Security Target Lite
for AQUARIUS

(Microcontroller AQUARIUS_BA_09 and AQUARIUS_CA_09)

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[1] Common Criteria for Information Technology Security Evaluation, Part 1: Introduction and General Model; April 2017, Version 3.1, Revision 5, CCMB-2017-04-001,

[2] Common Criteria for Information Technology Security Evaluation, Part 2: Security Functional Requirements; April 2017, Version 3.1, Revision 5, CCMB-2017-04-002

[3] Common Criteria for Information Technology Security Evaluation, Part 3: Security Assurance Requirements; April 2017, Version 3.1, Revision 5, CCMB-2017-04-003

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

[5] Security IC Platform Protection Profile, Version 1.0, Registered and Certified by Bundesamt für Sicherheit in der Informationstechnik (BSI) under the reference BSI-CC-PP-0084-2014.

[6] ISO/IEC 7816-3 Identification cards – Integrated circuit cards – Part 3: Cards with contacts – Electrical interface and transmission protocols.

[7] PP0084: Interpretations, reference: PP0084, version 03, 01/06/2016 from ANSSI.

[8] Smartcard Integrated Circuit Platform Augmentations, version 1.00, March 8, 2002, developed by Atmel, Hitachi Europe, Infineon Technologies, and Philips Semiconductors.

[9] Supporting Document: JIL Composite product evaluation for Smart Cards and similar devices, May 2018, Version 1.5.1.

[10] Supporting Document: JIL ETR template for composite evaluation, August 2015, Version 1.1.

[11] ISO/IEC FDIS 14443-2:2010, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 2: Radio frequency power and signal interface.

[12] ISO/IEC FDIS 14443-2:2011, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 2: Radio frequency power and signal interface – Amendment 1: Limits of electromagnetic disturbance levels parasitically generated by the PICC.

[13] ISO/IEC FDIS 14443-2:2012, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 2: Radio frequency power and signal interface – Amendment 3: Bits rates of fc/8, fc/4 and fc/2.

[14] ISO/IEC FDIS 14443-3:2011, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 3: Initialization and anti-collision.

[15] ISO/IEC FDIS 14443-3-a1:2011, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 3: Initialization and anti-collision – Amendment 1: Electromagnetic disturbance handling and single-size unique identifier.

[16] ISO/IEC FDIS 14443-a2:2012, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 3: Initialization and anti-collision – Amendment 2: Bit rates of fc/8, fc/4 and fc/2 frame size from 512 bytes to 4096 bytes and minimum TR0.

[17] ISO/IEC FDIS 14443-4:2008, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 4: Transmission protocol.

[18] ISO/IEC FDIS 14443-4-a2:2012, Identification cards – Contactless integrated circuit(s) cards – Proximity cards. Part 4: Transmission protocol – Amendment 2: Bit rates of fc/8, fc/4 and fc/2, protocol activation of PICC Type A and frame size from 512 bytes to 4096 bytes.

[19] AQUARIUS User Manual, version 1.5, 12/10/2022

[20] AQUARIUS Loader User Manual, version 10, 14/09/2022

[21] INVIA_Aquarius Security Guidance, version 0.7, 12/10/2022

[22] Secure 32 bits CPU Instruction Set Architecture, version 1.3rc, 01/10/2020

[23] Secure 32 bits CPU Embedded Application Binary Interface (EABI), version 0.6, March 2013.

[24] Aquarius – Assembly Instructions, version 0.4, 12/01/2020.

[25] Guidance – Secure Delivery, version 1.2, 30/11/2021.

[26] Security Target for AQUARIUS (Microcontroller AQUARIUS_ST), version 1.0, March 15, 2023

Acronyms

CC	Common Criteria
COS	Customer Operating System
DRNG	Digital Random Number Generator
E	Erase
EAL	Evaluation Assurance Level
IC	Integrated Circuit
IT	Information Technology
MBIST	Memory Built in Self-Test
MPU	Memory Protection Unit
NVM	Non-Volatile Memory
NVR	Non-Volatile Registers
PEOS	Product Engineering Operating System
PKI	Public Key Infrastructure
PP	Protection Profile
PTRNG	Pseudo True Random Number Generator
PUF	Physically Unclonable Function
R	Read
RNG	Random Number Generator
RTC	Real Time Clock
SAR	Security Assurance Requirement
SF	Security Functionality
SFP	Security Function Policy
SFR	Security Functional Requirement
ST	Security Target
TOE	Target Of Evaluation
TSF	TOE Security Functionality
W	Write
X	Execute

1. ST Introduction (ASE_INT)

This chapter contains the following sections:

ST Reference (1.1).

TOE Overview (1.2).

1.1. ST Reference

Title	Security Target Lite for AQUARIUS
Reference	AQUARIUS_ST_Lite
Version number	003
Date	02/06/2023
Provided by	THALES DIS FRANCE SAS, Arteparc – Bâtiment D, Route de la côte d'Azur, 13590 Meyreuil, FRANCE
Evaluator	CEA-LETI, MINATEC, 17 avenue des martyrs, 38054 Grenoble Cedex 9, FRANCE
Certification scheme	France – Agence Nationale de la Sécurité des Systèmes d'Information (ANSSI)

1.2. TOE Overview

1.2.1. TOE Identification

The Target of Evaluation (TOE) is a Secure Microcontroller (Secure IC) with a Dedicated Support Software.

The TOE is identified as below:

Product name	AQUARIUS_BA_09 & CA_09
TOE Reference	AQUARIUS_v2
Hardware Revision	B & C
Platform ROM Firmware Revision	A
Platform FLASH Firmware Revision • *BIOS* • *Loader*	09 *Version 1.0-911* *Version 2.2*
Crypto Support Library	None
Guidance	Aquarius User Manual [19]. Aquarius Loader User Manual [20]. Aquarius Security Guidance [21]. CPU Instruction Set Architecture [22].

	Secure 32 bits CPU Embedded Application Binary Interface (EABI) [23]. Aquarius – Assembly Instructions [24]. Guidance – Secure Delivery [25].

Four options for the MaskSet on the communication Pads (LA and LB pads) are possible for this product. They allow internal capacitance tuning (class 1 or class 2):

- High capacitance: 72 pF
- Mid capacitance: 54 pF
- Low capacitance: 26 pF

The security needs for the TOE can be summarized as being able to:

- Maintain the integrity and the confidentiality of the sensitive content of the TOE memories as required by the end application(s)
- Maintain the correct execution of the software residing on the TOE.

1.2.2. TOE Main Security Features

The main security features of the AQUARIUS integrated circuit are:

- An active shield;
- Security sensors;
- Memories and buses encryption mechanisms;
- A random number generator (PTRNG);
- A memory protection unit (MPU);
- An hardware cryptographic accelerator (providing acceleration instructions to support implementation of cryptographic algorithms TDES, AES)[1];
- A PKI Engine using MEXPA (providing acceleration instructions to support implementation of cryptographic algorithms RSA, ECDSA, ECDH)[2].

[1] The product does not implement any cryptographic algorithm so DES/TDES and AES are not part of the evaluation.

[2] The product does not implement any cryptographic algorithm so RSA, ECDSA and ECDH are not part of the evaluation.

1.2.3. TOE Definition

The TOE comprises:

- Hardware Secure chip.
- Associated IC Dedicated Support Software:
  - Bootloader to start the product.
  - Loader to load software in the IC by the customer.
- TOE User Guidance Documentation.

The Figure 1 provides an overview of the AQUARIUS product.

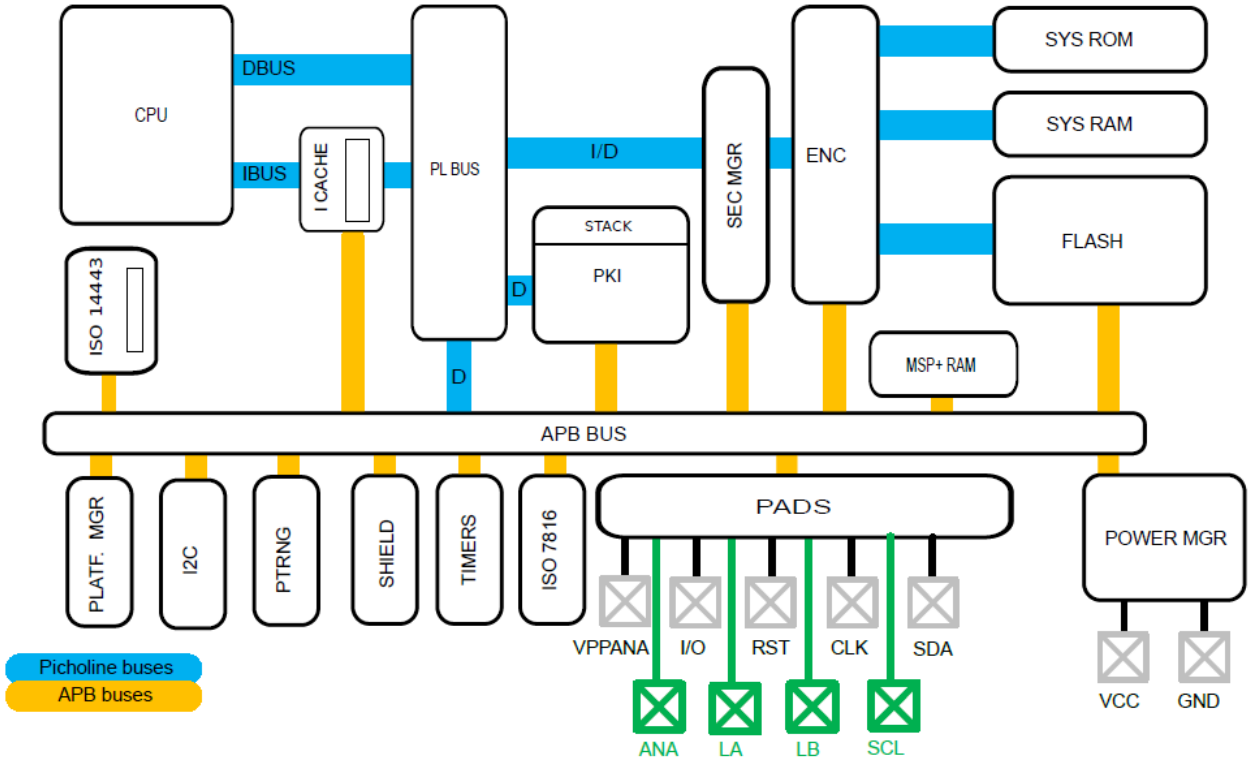


Figure 1: AQUARIUS Architecture

- Operating conditions:

Voltage	1,62 Volt < VCC < 5,5 Volt
Temperature	-25°C up to +85°C

Table 1: AQUARIUS operating conditions

- CPU Secure 32-bit

- Memories:

Memories
ROM
RAM (System RAM) (PKI RAM)
FLASH (NVM)

Table 2: Memories

- MPU (Memory Protection Unit) and Flash Protection Unit
  - Access Rights control, with interruption request if bad access.
- Interfaces
  - ISO 7816-3 (T=0 / T=1), compliant with ISO 7816-3 [6].
  - ISO 14443 (Type A / Type B), compliant with ISO 14443 ([11], [12], [13], [14], [15], [16], [17], [18]). NFC WI not supported.
  - I2C Master/ Slave mode.
- Crypto-coprocessors:
  - PKI Engine providing acceleration instructions to support implementation of cryptographic algorithms RSA, ECDSA, ECDH.
  - 16/32 bits CRC.
  - 2 Random Number Generators (RNG):
    - PTRNG: that meets PTG.2 class of BSI-AIS31 (German Scheme) and designed to be FIPS 140-2 compliant.
    - DRNG: designed to be FIPS 140-2 compliant.
- Internal clock and power consumption:
  - Standby mode for power saving.
  - Internal clocks.
  - No external clock mode.
- Resets:
  - Internal Power on Reset.
  - External reset indications to software (via communication interfaces).
  - Only software and alarms can generate a system reset.
- Environment Control:
  - Environment Sensors Monitoring:
    - External voltage class monitor.
    - Temperature sensor.
    - Low frequency monitor on internal clock.
    - Glitch detectors.
    - Laser detectors

- Active shield protection.

- Data integrity and redundancy mechanism.
- Timers:
  - Two internal clocks timers with autoreload:
    - One clocked by root clock (fixed).
    - One clocked by system clock (variable).
  - Two external clocks timers (ISO7816-3 and ISO14443).
- ESD protection.

The ROM of the TOE contains a Dedicated Software allowing to configure the product and start the product (boot/start-up) – the bootloader –, including a dedicated software which provides a very reduced set of commands for final test (Product Engineering Operating System for final test, called “PEOS”), not intended for the Security IC Embedded Software usage, and not available in User Mode.
As it is not available in User Mode, the PEOS is not included in the TOE.

The bootloader is in charge of loading information in the NVM on the chip.

The System ROM and NVM of the TOE contain a Dedicated Support Software called Loader, enabling to securely and efficiently download the Security IC Embedded Software into the NVM. It also allows the evaluator to load software into the TOE for test purpose. The Loader is available in User configuration but is erased after usage.

The cryptographic library is out of the scope of TOE at this stage.

Note that the Flash library (TDES and AES) is part of the TOE but out of TSF.

1.2.4. TOE Life Cycle

The complex development and manufacturing processes of a Composite Product can be separated into seven distinct phases. The phases 2 and 3 of the Composite Product life cycle cover the IC development and production:

- IC Development (Phase 2):
  - IC design,
  - IC Dedicated Software development,
- the IC Manufacturing (Phase 3):
  - integration and photomask fabrication,
  - IC production,
  - IC testing,
  - Initialisation, and
  - Pre-personalisation
  - Loading of Security IC Embedded Software if necessary

The Composite Product life cycle phase 4 can be included in the evaluation of the IC as an option:

- The IC Packaging (Phase 4):
  - Security IC packaging (and testing)

- Pre-personalisation if necessary.

In addition, four important stages have to be considered in the Composite Product life cycle:

- Security IC Embedded Software Development (Phase 1),
- the Composite Product Integration, Loading of Security IC Embedded Software if not done in phase 3, preparation and shipping to the personalization line for the Composite Product (Composite Product Integration Phase 5),
- the Composite Product personalisation and testing stage where the user data of the Composite TOE is loaded into the Security IC's memory (Personalisation Phase 6),
- the Composite Product usage by its issuers and consumers (Operational Usage Phase 7) which may include loading and other management of applications in the field.

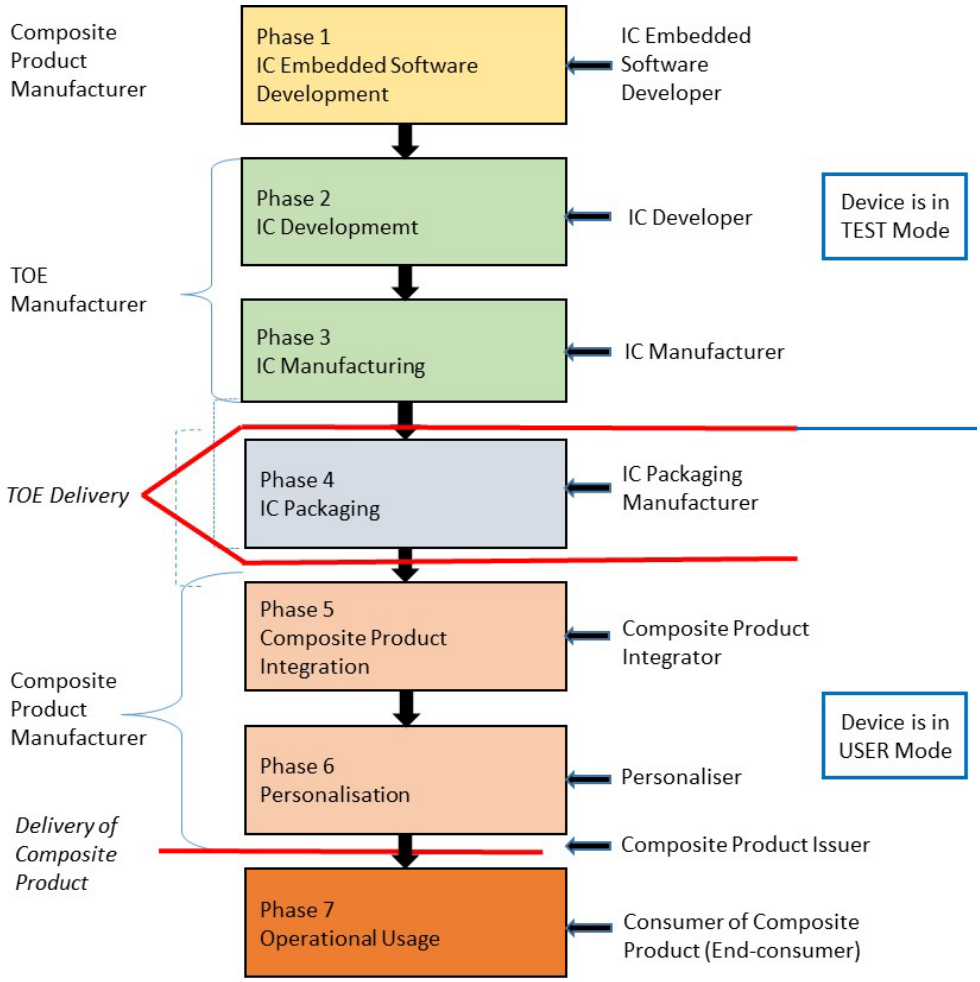


Figure 2: AQUARIUS Life Cycle

The Security IC Embedded Software is developed outside the TOE development in Phase 1. The TOE is developed in Phase 2 and produced in Phase 3. Then the TOE is delivered in form of wafers or sawn wafers (dies). The TOE can also be delivered in form of package products. In this case, the development and production of the TOE not only pertain to Phase 2 and 3 but to Phase 4 in addition.

In the following the term “TOE Delivery” (refer to Figure 2) is uniquely used to indicate:

- after Phase 3 (or before Phase 4) if the TOE is delivered in form of wafers or sawn wafers (dice) or
- after Phase 4 (or before Phase 5) if the TOE is delivered in form of packaged products.

In the following the term “TOE Manufacturer” (refer to Figure 2) includes the following roles:

- the IC Developer (Phase 2) and
- the IC Manufacturer (Phase 3)

if the TOE is delivered after Phase 3 in form of wafers or sawn wafers or

- the IC Developer (Phase 2),
- the IC Manufacturer (Phase 3) and
- the IC Packaging Manufacturer (Phase 4)

if the TOE is delivered after Phase 4 in form of packaged products.

Hence the “TOE Manufacturer” comprise all roles beginning with Phase 2 and before “TOE Delivery”. Starting with “TOE Delivery” another party takes over the control of the TOE.

In the following, the term “Composite Product Manufacturer” includes all roles (outside TOE development and manufacturing) except the End-consumer as user of the Composite Product (refer to Figure 2) which are the following:

- Security IC Embedded Software development (Phase 1)
- the IC Packaging Manufacturer (Phase 4) if the TOE is delivered after Phase 3 in form of wafers or sawn wafers (dice)
- the Composite Product Manufacturer (Phase 5) and
- the Personaliser (Phase 6).

During Phase 2, Phase 3 and Phase 4, the following sites are involved:

Function	Company
Phase 2: IC Development	
IC Design IC dedicated software development & tests	**Thales DIS France SAS** Arteparc – Bâtiment D, Route de la côte d’Azur 13590 Meyreuil FRANCE
Formal models and proof development	**THALES DIS France SAS** 6 rue de la Verrerie 92190 Meudon FRANCE
Validation	**MU-Electronics** 49 rue Jabal Tazekka, 1er étage, Agdal, 10000 Rabat MOROCCO
Loader Development and Test	**Thales Digital Identity and Security** 12 Ayer Rajat Crescent, 139941 SINGAPORE

Function	Company
Phase 3: IC Manufacturing	
Wafer fab / Warehouse	**UMC Fab12i** No.3, Pasir Ris Drive 12, Singapore 519528 SINGAPORE
Data Prep & Mask Shop	**PDMC** **Masks Manufacturing (1A)** 1stFloor, N°2, Li-Hsin Rd, Science Park, Hsinchu 30078 TAÏWAN **Masks Manufacturing (1B)** N°13, Tongshan Rd, Daya District, Taichung 42879 TAÏWAN **Masks Manufacturing (1D)** N°6, Li-Hsin 7th Rd, Science Park, Hsinchu 30078 TAÏWAN
IC Test Secure Embedded Software loading (optional)	**UTAC USG1** 5 Serangoon North Avenue 5, Singapore 554916 SINGAPORE
Phase 4: IC Packaging and delivery	
IC Packaging	**UTAC Thai Limited 1 (UTL1)** 237 Lasalle road, Bangna, Bangkok, 10260 THAILAND **UTAC Thai Limited 3 (UTL3)** 73 Moo5, Bangsamak, Chachoengsao, 24180 THAILAND
Delivery	**Thales Digital Identity and Security** 12 Ayer Rajat Crescent, 139941 SINGAPORE

Table 3: List of sites

1.2.5. Modes of operation and life cycle phases

The TOE has three modes of operation: Boot mode, Test mode and User mode.

Test mode is done in a secure environment during manufacturing and testing (Phase 3) and User Mode is the operational mode after delivery (after phase 3 from chip point of view).

Boot Mode — This mode is the first entry mode used at each start-up.

Test Mode — This mode is designed to allow test engineer to access to test feature of the TOE (Phase 3). This mode is disabled before delivery (at the end of Phase 3) and not accessible in operational Mode.

User Mode — This is the mode of operation that the end Secure IC user is intended to be used. This mode is available via the life cycle of the TOE (after Phase 3). It is not possible to come back to Test mode at this stage.

The Bootloader, including the Loader, is in the product in Phase 3. Loader will allow to load (in sense of Loader Package 1 and Package 2 of the BSI-CC-PP-0084-2014 [5] and ANSSI interpretation [7]) the Security IC Embedded Software in Phase 5. Loader is used in User mode and then blocked irreversibly in Phase 5.

As explain in previous chapter, Security IC Embedded Software can be also written in Phase 3. In this case, Loader is not loaded in the IC.

1.2.6. TOE Interfaces

In User Mode, the TOE has the following interfaces:

- Physical interface of the TOE with the external environment: the entire chip surface. This interface is taken into account as it contains sensors in order to prevent physical attacks.
- Electrical interfaces of the TOE with the external environment: the pads (the connected lines LA, LB, I/O, CLK, RST and the power supply lines VCC and GND). The LA and LB pads are connected to the antenna. The communication meets the ISO 7816-3, the I2C and the ISO 14443 standards.
- Software interfaces of the TOE with the hardware: registers and CPU instructions.
- Loader interfaces: commands to load the Operating System in phase 5. After the loading, Loader is blocked irreversibly.

1.2.7. TOE Intended usage

The Secure IC is a platform dedicated to secure applications running a Customer Operating System (COS).

The Secure IC could be used in contact or contactless mode for Payment applications or governmental applications.

1.2.8. Forms of delivery

Item Type	Item	Version	Date	Form of delivery
Hardware	AQUARIUS_BA_09 & CA_09microcontroller for Smart Card	BA_09 & CA_09	-	Wafer or dies or packaged dies
Software	BIOS	1.0-911	-	Included in AQUARIUS_BA_09 & CA_09
Software	Loader	2.2	-	Included in AQUARIUS_BA_09 & CA_09
Document	Aquarius User Manual [19]	1.5	12/10/2022	Electronic document
Document	Aquarius Loader User Manual [20]	10	14/09/2022	Electronic document
Document	Aquarius Security Guidance [21]	0.7	12/10/2022	Electronic document
Document	CPU Instruction Set Architecture [22]	1.3rc	01/10/2020	Electronic document
Document	Secure 32 bits CPU Embedded Application Binary Interface (EABI) [23]	0.6	March 2013	Electronic document
Document	Aquarius – Assembly Instructions [24]	0.4	12/01/2020	Electronic document
Document	Guidance – Secure Delivery [25]	1.2	30/11/2021	Electronic document

Table 4: Deliveries

The product can be delivered:
- In form of wafer.
- In form of sawn wafer (dice).
- In form of package products.

The product is sent by a standard transportation

Les TOE user guidance documents are delivered in electronic form via email. They are joined to email and encrypted via pgp or ACID or smart card encryption. The format of the user guidance documents is .pdf.

2. CC Conformance Claims (ASE_CCL)

This chapter contains the following sections:

CC Conformance Claim (2.1).

PP Claim (2.2).

Package Claim (2.3).

Conformance Claim Rationale (2.4).

2.1. CC Conformance Claim

This Security Target claims to be conformant to the Common Criteria version 3.1.

Furthermore it claims to be **CC Part 2 extended** and **CC Part 3 conformant**. The extended Security Functional Requirements are defined in chapter 5.

This Security IC Platform Security Target has been built with the Common Criteria for Information Technology Security Evaluation; **Version 3.1 Revision 5**

which comprises

[1] Common Criteria for Information Technology Security Evaluation, Part 1: Introduction and General Model; April 2017, Version 3.1, Revision 5, CCMB-2017-04-001.

[2] Common Criteria for Information Technology Security Evaluation, Part 2: Security Functional Requirements; April 2017, Version 3.1, Revision 5, CCMB-2017-04-002.

[3] Common Criteria for Information Technology Security Evaluation, Part 3: Security Assurance Requirements; April 2017, Version 3.1, Revision 5, CCMB-2017-04-003.

The

[4] Common Methodology for Information Technology Security Evaluation (CEM), Evaluation Methodology; April 2017, Version 3.1, Revision 5, CCMB-2017-04-004.

has been taken into account.

2.2. PP Claim

This Security Target is in strict conformance to the following protection profile:

[5] Security IC Platform Protection Profile, Version 1.0, Registered and Certified by Bundesamt für Sicherheit in der Informationstechnik (BSI) under the reference BSI-CC-PP-0084-2014

with additional packages from the BSI-CC-PP-0084-2014 [5] :

- Package “Authentication of the Security IC”.
- Package “Loader dedicated for usage in secured environment only” (Package 1).
- Package “Loader dedicated for usage by authorized users only” (Package 2).

This ST does not claim conformance to any other PP.

2.3. Package Claim

The assurance level for this Security Target is **EAL6** augmented with **ALC_FRL.2** and **ASE_TSS.2**.

2.4. Conformance Claim Rationale

This security target claims strict conformance only to one PP, the “Security IC Platform Protection Profile” BSI-CC-PP-0084-2014 [5].

The Evaluation Assurance Level (EAL) of the Protection Profile BSI-CC-PP-0084-2014 [5] is EAL4 augmented with ALC_DVS.2 and AVA_VAN.5. The Assurance Level required for this TOE is EAL6 augmented with ALC_FLR.2 and ASE_TSS.2. It is to be noted that the following assurance components are added to the assurance level required by the BSI-CC-PP-0084-2014 [5]: ADV_FSP.5, ADV_IMP.2, ADV_INT.3, ADV_SPM.1, ADV_TDS.5, ALC_CMC.5, ALC_CMS.5, ALC_TAT.3, ALC_FLR.2, ASE_TSS.2, ATE_COV.3, ATE_DPT.3 and ATE_FUN.2.

The TOE is an integrated circuit as defined in the protection profile BSI-CC-PP-0084-2014 [5]. So the TOE is consistent with the TOE type of the protection profile BSI-CC-PP-0084-2014 [5].

The security problem definition of this security target is consistent with the statement of the security problem definition in the protection profile BSI-CC-PP-0084-2014 [5], as the security target claims strict conformance to the protection profile BSI-CC-PP-0084-2014 [5]. Additional threats, organizational security policies and assumptions are introduced in this ST, according to the additional packages contained in the protection profile [5], to the ANSSI Interpretation [7] and to [8]:

- Package “Authentication of the Security IC”:
  - T.Masquerade_TOE Masquerade the TOE.
- Package “Loader dedicated for usage in secured environment only” (Package 1):
  - P.Lim_Block_Loader Limiting and Blocking the Loader Functionality.
- Package “Loader dedicated for usage by authorized users only” (Package 2):
  - P.Ctrl_Loader Controlled usage to Loader Functionality.
- Additional threats (from [7] and [8]):
  - T.open_Samples_Diffusion Diffusion of open samples.
  - T.Mem-Access Memory Access Violation.

The security objectives of this security target are consistent with the statement of the security objectives in the protection profile BSI-CC-PP-0084-2014 [5], as the security target claims strict conformance to the protection profile BSI-CC-PP-0084-2014 [5]. Additional security objectives are added in this ST, according to the additional packages contained in the protection profile [5], to the ANSSI Interpretation [7] and to [8]:

- Package “Authentication of the Security IC”:
  - O.Authentication Authentication of external entities.
  - OE.TOE_Auth External entities authenticating of the TOE.
- Package “Loader dedicated for usage in secured environment only” (Package 1):
  - O.Cap_Avail_Loader Capability and availability of the Loader.
  - OE.Lim_Block_Loader Limitation of capability and blocking the Loader.
- Package “Loader dedicated for usage by authorized users only” (Package 2):
  - O.Ctrl_Auth_Loader Access control and authenticity for the Loader.
  - OE.Loader_Usage Secure communication and usage of the Loader.

- Additional security objectives (from [7] and [8]):
    - O.Prot_TSF_Confidentiality Protection of the confidentiality of the TSF.
    - O.Mem-Access Area based Memory Access Control.

The security requirements of this security target are consistent with the statement of the security requirements in the protection profile BSI-CC-PP-0084-2014 [5], as the security target claims strict conformance to the protection profile BSI-CC-PP-0084-2014 [5]. Additional security requirements are added in this ST:

- Package “Authentication of the Security IC” (from the protection profile BSI-CC-PP-0084-2014 [5]):
    - FIA_API.1 Authentication Proof of Identity.
- Package “Loader dedicated for usage in secured environment only” (Package 1) (from the protection profile BSI-CC-PP-0084-2014 [5]):
    - FMT_LIM.1/Loader Limited capabilities – Loader.
    - FMT_LIM.2/Loader Limited availability – Loader.
- Package “Loader dedicated for usage by authorized users only” (Package 2) (from the protection profile BSI-CC-PP-0084-2014 [5]):
    - FTP_ITC.1 Inter-TSF trusted channel.
    - FDP_UCT.1 Basic data exchange confidentiality.
    - FDP_UIT.1 Data exchange integrity.
    - FDP_ACC.1/Loader Subset access control – Loader.
    - FDP_ACF.1/Loader Security attribute based access control – Loader.
- Security Functional Requirement for Memory Access Control:
    - FDP_ACC.1/Memory Subset access control – Memory.
    - FDP_ACF.1/Memory Security Attribute based access control – Memory.
    - FMT_MSA.1 Management of security attributes.
    - FMT_MSA.3 Static attribute initialisation.
    - FMT_SMF.1 Specification of Management Functions.

3. Security Problem Definition (ASE_SPD)

This chapter contains the following sections:

Description of Assets (3.1).

Threats (3.2).

Organisational Security Policies (3.3).

Assumptions (3.4).

3.1. Description of Assets

The assets (related to standard functionality) to be protected are

- the user data of the Composite TOE,
- the Security IC Embedded Software, stored and in operation,
- the security services provided by the TOE for the Security IC Embedded Software.

The user (consumer) of the TOE places value upon the assets related to high-level security concerns:

SC1 integrity of user data of the Composite TOE,

SC2 confidentiality of user data of the Composite TOE being stored in the TOE's protected memory areas,

SC3 correct operation of the security services provided by the TOE for the Security IC Embedded Software.

Note the Security IC Embedded Software is user data and shall be protected while being executed/processed and while being stored in the TOE's protected memories.

The Security IC may not distinguish between user data which is public knowledge or kept confidential. Therefore the security IC shall protect the user data of the Composite TOE in integrity and in confidentiality if stored in protected memory areas, unless the Security IC Embedded Software chooses to disclose or modify it.

In particular integrity of the Security IC Embedded Software means that it is correctly being executed which includes the correct operation of the TOE's functionality. Parts of the Security IC Embedded Software which do not contain secret data or security critical source code, may not require protection from being disclosed. Other parts of the Security IC Embedded Software may need to be kept confidential since specific implementation details may assist an attacker.

The Protection Profile requires the TOE to provide at least one security service: the generation of random numbers by means of a physical Random Number Generator. The Security Target may require additional security services. It is essential that the TOE ensures the correct operation of all security services provided by the TOE for the Security IC Embedded Software.

According to the Protection Profile there is the following high-level security concern related to security service:

SC4 deficiency of random numbers.

To be able to protect these assets (SC1 to SC4) the TOE shall self-protect its TSF. Critical information about the TSF shall be protected by the development environment and the operational environment. Critical information may include:

- logical design data, physical design data, IC Dedicated Software, and configuration data,

- Initialisation Data and Pre-personalisation Data, specific development aids, test and characterisation related data, material for software development support, and photomasks.

Such information and the ability to perform manipulations assist in threatening the above assets.

Note that there are many ways to manipulate or disclose the user data of the Composite TOE: (i) An attacker may manipulate the Security IC Embedded Software or the TOE. (ii) An attacker may cause malfunctions of the TOE or abuse Test Features provided by the TOE. Such attacks usually require design information of the TOE to be obtained. They pertain to all information about (i) the circuitry of the IC (hardware including the physical memories), (ii) the IC Dedicated Software with the parts IC Dedicated Test Software (if any) and IC Dedicated Support Software (if any), and (iii) the configuration data for the TSF. The knowledge of this information may enable or support attacks on the assets. Therefore the TOE Manufacturer must ensure that the development and production of the TOE is secure so that no restricted, sensitive, critical or very critical information is unintentionally made available for attacks in the operational phase of the TOE.

The TOE Manufacturer must apply protection to support the security of the TOE. This not only pertains to the TOE but also to all information and material exchanged with the developer of the Security IC Embedded Software. This covers the Security IC Embedded Software itself if provided by the developer of the Security IC Embedded Software or any authentication data required to enable the download of software. This includes the delivery (exchange) procedures for Phase 1 and the Phases after TOE Delivery as far as they can be controlled by the TOE Manufacturer. These aspects enforce the usage of the supporting documents and the refinements of SAR defined in the Protection Profile.

The information and material produced and/or processed by the TOE Manufacturer in the TOE development and production environment (Phases 2 up to TOE Delivery) can be grouped as follows:

- logical design data,
- physical design data,
- IC Dedicated Software, Initialisation Data and Pre-personalisation Data,
- Security IC Embedded Software, provided by the Security IC Embedded Software developer and implemented by the IC manufacturer,
- specific development aids,
- test and characterisation related data,
- material for software development support, and
- photomasks and products in any form

as long as they are generated, stored, or processed by the TOE Manufacturer.

3.2. Threats

The threats are directed against the assets and/or the security functions of the TOE. An overview on attacks is given in BSI-CC-PP-0084-2014 [5] section 3.2.

The high-level security concerns are refined below by defining threats as required by the Common Criteria (refer to Figure 3). Note that manipulation of the TOE is only a means to threaten user data and is not a success for the attacker in itself.

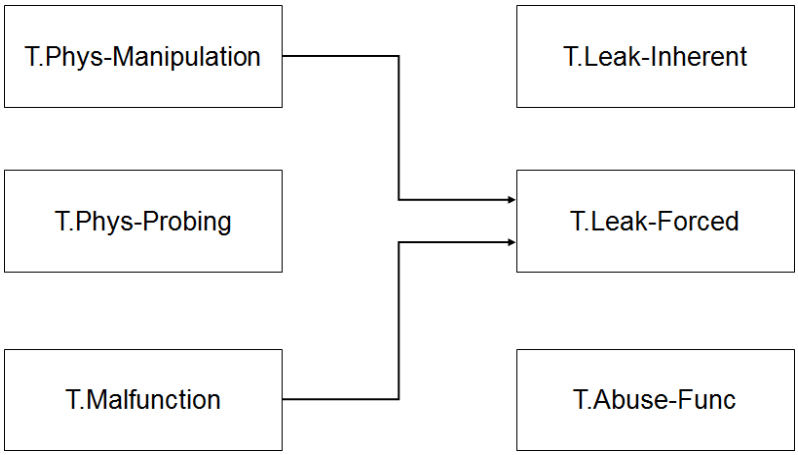


Figure 3: Standard Threats

The high-level security concern related to security service is refined below by defining threats as required by the Common Criteria (refer to Figure 4).

Figure 4: Threats related to security services

Standard Threats

T.Leak-Inherent — Inherent Information Leakage

An attacker may exploit information which is leaked from the TOE during usage of the Security IC in order to disclose confidential user data as part of the assets.

T.Phys-Probing — Physical Probing

An attacker may perform physical probing of the TOE in order (i) to disclose user data while stored in protected memory areas, (ii) to disclose/reconstruct the user data while processed or (iii) to disclose other critical information about the operation of the TOE to enable attacks disclosing or manipulating the user data of the Composite TOE or the Security IC Embedded Software.

T.Malfunction — Malfunction due to Environmental Stress

An attacker may cause a malfunction of TSF or of the Security IC Embedded Software by applying environmental stress in order to (i) modify security services of the TOE or (ii) modify functions of the Security IC Embedded Software (iii) deactivate or affect security mechanisms of the TOE to enable attacks disclosing or manipulating the user data of the Composite TOE or the Security IC Embedded Software. This may be achieved by operating the Security IC outside the normal operating conditions.

T.Phys-Manipulation	Physical Manipulation An attacker may physically modify the Security IC in order to (i) modify user data of the Composite TOE, (ii) modify the Security IC Embedded Software, (iii) modify or deactivate security services of the TOE, or (iv) modify security mechanisms of the TOE to enable attacks disclosing or manipulating the user data of the Composite TOE or the Security IC Embedded Software.
T.Leak-Forced	Forced Information Leakage An attacker may exploit information which is leaked from the TOE during usage of the Security IC in order to disclose confidential user data of the Composite TOE as part of the assets even if the information leakage is not inherent but caused by the attacker.
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 (i) disclose or manipulate user data of the Composite TOE, (ii) manipulate (explore, bypass, deactivate or change) security services of the TOE or (iii) manipulate (explore, bypass, deactivate or change) functions of the Security IC Embedded Software or (iv) enable an attack disclosing or manipulating the user data of the Composite TOE or the Security IC Embedded Software.

Threats related to security services

T.RND	Deficiency of Random Numbers An attacker may predict or obtain information about random numbers generated by the TOE security service for instance because of a lack of entropy of the random numbers provided.

Package “Authentication of the Security IC”

T.Masquerade_TOE	Masquerade the TOE An attacker may threaten the property being a genuine TOE by producing an IC which is not a genuine TOE but wrongly identifying itself as genuine TOE sample.

Additional threats (provided by [7] and [8])

T.Open_Samples_Diffusion	Diffusion of open samples An attacker may get access to open samples of the TOE and use them to gain information about the TSF (loader, memory management unit, ROM code…). He may also use the open samples to characterize the behavior of the IC and its security functionalities (for example: characterization of side channel profiles, perturbation cartography…). The execution of a dedicated security features (for example: execution of a DES computation without countermeasures or by de-activating countermeasures) through the loading of an adequate code would allow this kind of characterization and the execution of enhanced attacks on the IC.

T.Mem-Access	Memory Access Violation
	Parts of the Smartcard Embedded Software may cause security violations by accidentally or deliberately accessing restricted data (which may include code). Any restrictions are defined by the security policy of the specific application context and must be implemented by the Smartcard Embedded Software.

3.3. Organisational Security Policies

The following Figure 5 shows the policies applied in this security target.

Figure 5: Organisational Security Policies

Core PP

The IC Developer / Manufacturer must apply the policy “Identification during TOE Development and Production (P.Process-TOE)” as specified below.

P.Process-TOE	Identification during TOE Development and Production
	An accurate identification must be established for the TOE. This requires that each instantiation of the TOE carries this unique identification.

The accurate identification is introduced at the end of the production test in phase 3. Therefore the production environment must support this unique identification.

Package 1: Loader dedicated for usage in secured environment only

The organisational security policy “Limiting and Blocking the Loader Functionality (P.Lim_Block_Loader)” applies to Loader dedicated for usage in secured environment.

P.Lim_Block_Loader	Limiting and Blocking the Loader Functionality
	The composite manufacturer uses the Loader for loading of Security IC Embedded Software, user data of the Composite Product or IC Dedicated Support Software in charge of the IC Manufacturer. He limits the capability and blocks the availability of the Loader in order to protect stored data from disclosure and manipulation.

Package 2: Loader dedicated for usage by authorized users only

The organisational security policy “Controlled usage to Loader Functionality (P.Ctrl_Loader)” applies to Loader dedicated for usage by authorized users only.

P.Ctrl_Loader	Controlled usage to Loader Functionality Authorized user controls the usage of the Loader functionality in order to protect stored and loaded user data from disclosure and manipulation.

3.4. Assumptions

The following Figure 6 shows the assumptions applied in this security target.

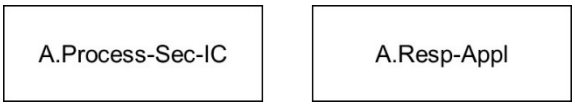


Figure 6: Assumptions

Core PP

Before being delivered to the consumer the TOE is packaged. Many attacks require the TOE to be removed from the carrier. Though this extra step adds difficulties for the attacker no specific assumptions are made here regarding the package.

Appropriate “Protection during Packaging, Finishing and Personalisation (A.Process-Sec-IC)” must be ensured after TOE Delivery up to the end of Phase 6, as well as during the delivery to Phase 7 as specified below.

A.Process-Sec-IC	Protection during Packaging, Finishing and Personalisation It is assumed that security procedures are used after delivery of the TOE by the TOE Manufacturer up to delivery to the end-consumer to maintain confidentiality and integrity of the TOE and of its manufacturing and test data (to prevent any possible copy, modification, retention, theft or unauthorised use). This means that the Phases after TOE Delivery are assumed to be protected appropriately.

The information and material produced and/or processed by the Security IC Embedded Software Developer in Phase 1 and by the Composite Product Manufacturer can be grouped as follows:

- the Security IC Embedded Software including specifications, implementation and related documentation,
- Pre-personalisation Data and Personalisation Data including specifications of formats and memory areas, test related data,
- the user data of the Composite TOE and related documentation, and
- material for software development support

as long as they are not under the control of the TOE Manufacturer. Details must be defined in the Protection Profile or Security Target for the evaluation of the Security IC Embedded Software and/or Security IC.

The developer of the Security IC Embedded Software must ensure the appropriate usage of Security IC while developing this software in Phase 1 as described in the (i) TOE guidance documents (refer to the Common Criteria assurance class AGD) such as the hardware data sheet, and the hardware application notes, and (ii) findings of the TOE evaluation reports relevant for the Security IC Embedded Software as documented in the certification report.

Note that particular requirements for the Security IC Embedded Software are often not clear before considering a specific attack scenario during vulnerability analysis of the Security IC (AVA_VAN). A summary of such results is provided in the document "ETR for composite evaluation" (ETR-COMP), see [10]. This document will be provided for the evaluation of the composite product (see [9]). The ETR-COMP may also include guidance for additional tests being required for the combination of hardware and software. The TOE evaluation must be completed before evaluation of the Security IC Embedded Software can be completed. The TOE evaluation can be conducted before and independently from the evaluation of the Security IC Embedded Software.

The Security IC Embedded Software must ensure the appropriate “Treatment of user data of the Composite TOE (A.Resp-Appl)” as specified below.

A.Resp-Appl	Treatment of user data of the Composite TOE All user data of the Composite TOE are owned by Security IC Embedded Software. Therefore, it must be assumed that security relevant user data of the Composite TOE (especially cryptographic keys) are treated by the Security IC Embedded Software as defined for its specific application context.

The application context specifies how the user data of the Composite TOE shall be handled and protected. The evaluation of the Security IC according to this Security Target is conducted on generalized application context. The concrete requirements for the Security IC Embedded Software shall be defined in the Protection Profile respective Security Target for the Security IC Embedded Software. The Security IC cannot prevent any compromise or modification of user data of the Composite TOE by malicious Security IC Embedded Software.

4. Security Objectives (ASE_OBJ)

This chapter contains the following sections:

Security Objectives for the TOE (4.1).

Security Objectives for the Security IC Embedded Software (4.2).

Security Objectives for the Operational Environment (4.3).

Security Objectives Rationale (4.4).

4.1. Security Objectives for the TOE

The user have the following standard high-level security goals related to the assets:

SG1 maintain the integrity of user data (when being executed/processed and when being stored in the TOE's memories) as well as

SG2 maintain the confidentiality of user data (when being processed and when being stored in the TOE's protected memories).

SG3 maintain the correct operation of the security services provided by the TOE for the Security IC Embedded Software.

Note, the Security IC may not distinguish between user data which are public known or kept confidential. Therefore the security IC shall protect the user data in integrity and in confidentiality if stored in protected memory areas, unless the Security IC Embedded Software chooses to disclose or modify it. Parts of the Security IC Embedded Software which do not contain secret data or security critical source code, may not require protection from being disclosed. Other parts of the Security IC Embedded Software may need kept confidential since specific implementation details may assist an attacker.

These standard high-level security goals in the context of the security problem definition build the starting point for the definition of security objectives as required by the Common Criteria (refer to Figure 7). Note that the integrity of the TOE is a means to reach these objectives.

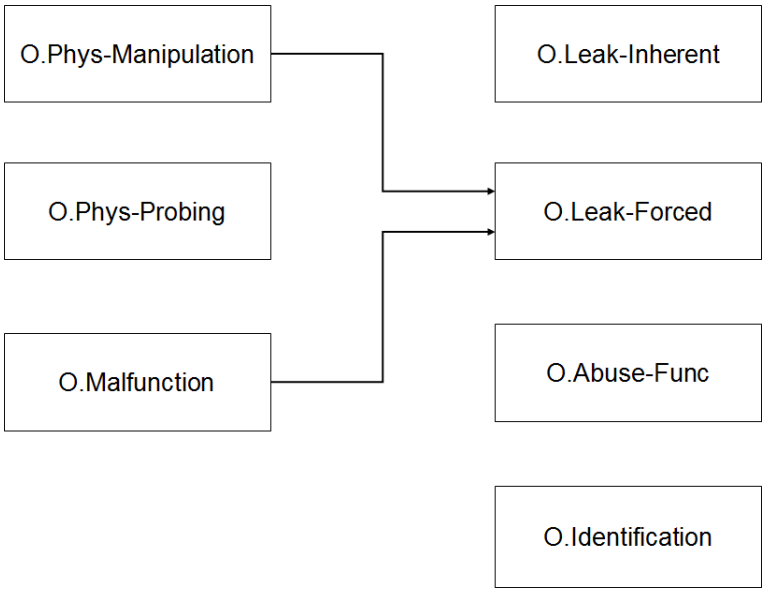


Figure 7: Standard Security Objectives

According to the Protection Profile there is the following high-level security goal related to specific functionality:

SG4 provide true random numbers.

The additional high-level security considerations are refined below by defining security objectives as required by the Common Criteria (refer to Figure 8).

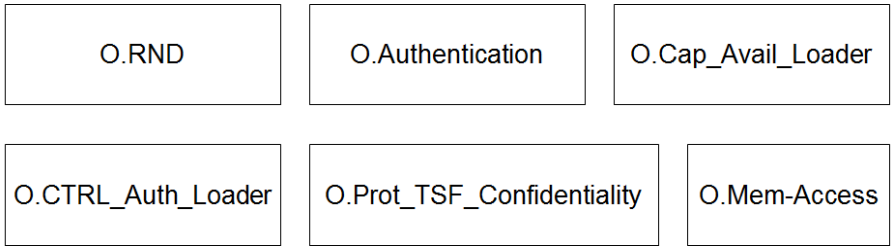


Figure 8: Security Objectives related to Specific Functionality

Standard Security Objectives

The TOE shall provide “Protection against Inherent Information Leakage (O.Leak-Inherent)” as specified below.

O.Leak-Inherent — Protection against Inherent Information Leakage

The TOE must provide protection against disclosure of confidential data stored and/or processed in the Security IC

- 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).

This objective pertains to measurements with subsequent complex signal processing whereas O.Phys-Probing is about direct measurements on elements on the chip surface. Details correspond to an analysis of attack scenarios which is not given here.

The TOE shall provide “Protection against Physical Probing (O.Phys-Probing)” as specified below.

O.Phys-Probing — Protection against Physical Probing

The TOE must provide protection against disclosure/reconstruction of user data while stored in protected memory areas and processed or against the disclosure of other critical information about the operation of the TOE.

This includes protection against

- 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
- 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.

The TOE shall provide “Protection against Malfunction due to environmental stress (O.Malfunction)” as specified below.

O.Malfunction — Protection against Malfunction due to environmental stress

The TOE must ensure its correct operation.

The TOE must indicate or 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, clock frequency, temperature, or external energy fields.

Remark: A malfunction of the TOE may also be caused using a direct interaction with elements on the chip surface. This is considered as being a manipulation (refer to the objective O.Phys-Manipulation) provided that detailed knowledge about the TOE´s internal construction is required and the attack is performed in a controlled manner.

The TOE shall provide “Protection against Physical Manipulation (O.Phys-Manipulation)” as specified below.

O.Phys-Manipulation Protection against Physical Manipulation

The TOE must provide protection against manipulation of the TOE (including its software and TSF data), the Security IC Embedded Software and the user data of the Composite TOE. This includes protection against

- reverse-engineering (understanding the design and its properties and functions),
- manipulation of the hardware and any data, as well as
- undetected manipulation of memory contents.

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.

The TOE shall provide “Protection against Forced Information Leakage (O.Leak-Forced)“ as specified below:

O.Leak-Forced Protection against Forced Information Leakage

The Security IC must be protected against disclosure of confidential data processed in the Security IC (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.

The TOE shall provide “Protection against Abuse of Functionality (O.Abuse-Func)” as specified below.

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 critical user data of the Composite TOE, (ii) manipulate critical user data of the Composite TOE, (iii) manipulate Security IC Embedded Software or (iv) bypass, deactivate, change or explore security features or security services of the TOE. Details depend, for instance, on the capabilities of the Test Features provided by the IC Dedicated Test Software which are not specified here.

The TOE shall provide “TOE Identification (O.Identification)“ as specified below:

O.Identification TOE Identification

The TOE must provide means to store Initialisation Data and Pre-personalisation Data in its non-volatile memory. The Initialisation Data (or parts of them) are used for TOE identification.

Security Objectives related to Specific Functionality (referring to SG4)

The TOE shall provide “Random Numbers (O.RND)” as specified below.

O.RND	Random Numbers The TOE will ensure the cryptographic quality of random number generation. For instance random numbers shall not be predictable and shall have a sufficient entropy. The TOE will ensure that no information about the produced random numbers is available to an attacker since they might be used for instance to generate cryptographic keys.

Package “Authentication of the Security IC”

The TOE shall provide “Authentication to external entities (O.Authentication)” as specified below.

O.Authentication	Authentication to external entities The TOE shall be able to authenticate itself to external entities. The Initialisation Data (or parts of them) are used for TOE authentication verification data.

Package 1: Loader dedicated for usage in secured environment only

The TOE shall provide “Capability and availability of the Loader (O.Cap_Avail_Loader)” as specified below.

O.Cap_Avail_Loader	Capability and availability of the Loader The TSF provides limited capability of the Loader functionality and irreversible termination of the Loader in order to protect stored user data from disclosure and manipulation.

Package 2: Loader dedicated for usage by authorized users only

The TOE shall provide “Access control and authenticity for the Loader (O.Ctrl_Auth_Loader)” as specified below.

O.Ctrl_Auth_Loader	Access control and authenticity for the Loader The TSF provides trusted communication channel with authorized user, supports authentication of the user data to be loaded and access control for usage of the Loader functionality.

Additional security objectives for the TOE (provided by [7] and [8]):

The TOE shall provide “Protection of the confidentiality of the TSF (O.Prot_TSF_Confidentiality)” as specified below:

O.Prot_TSF_Confidentiality	Protection of the confidentiality of the TSF The TOE must provide protection against disclosure of confidential operations of the Security IC (loader, memory management unit…) through the use of a dedicated code loaded on open samples.

The TOE shall provide “Area based Memory Access Control (O.Mem-Access)” as specified below:

O.Mem-Access	Area based Memory Access Control The TOE must provide the Smartcard Embedded Software with the capability to define restricted access memory areas. The TOE must then enforce the partitioning of such memory areas so that access of software to memory areas is controlled as required, for example, in a multi-application environment.

4.2. Security Objectives for the Security IC Embedded Software

The development of the Security IC Embedded Software is outside the development and manufacturing of the TOE (cf. section 1.2.4). The Security IC Embedded Software defines the operational use of the TOE. This section describes the security objective for the Security IC Embedded Software.

Note, in order to ensure that the TOE is used in a secure manner the Security IC Embedded Software shall be designed so that the requirements from the following documents are met: (i) hardware data sheet for the TOE, (ii) data sheet of the IC Dedicated Software of the TOE, (iii) TOE application notes, other guidance documents, and (iv) findings of the TOE evaluation reports relevant for the Security IC Embedded Software as referenced in the certification report.

Core PP

The Security IC Embedded Software shall provide “Treatment of user data of the Composite TOE (OE.Resp-Appl)” as specified below.

OE.Resp-Appl	Treatment of user data of the Composite TOE Security relevant user data of the Composite TOE (especially cryptographic keys) are treated by the Security IC Embedded Software as required by the security needs of the specific application context.

For example the Security IC Embedded Software will not disclose security relevant user data of the Composite TOE to unauthorised users or processes when communicating with a terminal.

4.3. Security Objectives for the Operational Environment

TOE Delivery up to the end of Phase 6

Appropriate “Protection during Packaging, Finishing and Personalisation (OE.Process-Sec-IC)” must be ensured after TOE Delivery up to the end of Phases 6, as well as during the delivery to Phase 7 as specified below.

OE.Process-Sec-IC	Protection during composite product manufacturing Security procedures shall be used after TOE Delivery up to delivery to the end-consumer to maintain confidentiality and integrity of the TOE and of its manufacturing and test data (to prevent any possible copy, modification, retention, theft or unauthorised use). This means that Phases after TOE Delivery up to the end of Phase 6 (refer to Section 1.2.4) must be protected appropriately.

Package "Authentication of the Security IC"

The operational environment shall provide "External entities authenticating of the TOE (OE.TOE_Auth)".

OE.TOE_Auth	External entities authenticating of the TOE The operational environment shall support the authentication verification mechanism and know authentication reference data of the TOE.

Package 1: Loader dedicated for usage in secured environment only

The operational environment of the TOE shall provide "Limitation of capability and blocking the Loader (OE.Lim_Block_Loader)" as specified below.

OE.Lim_Block_Loader	Limitation of capability and blocking the Loader The Composite Product Manufacturer will protect the Loader functionality against misuse, limit the capability of the Loader and terminate irreversibly the Loader after intended usage of the Loader.

Package 2: Loader dedicated for usage by authorized users only

The operational environment of the TOE shall provide "Secure communication and usage of the Loader (OE.Loader_Usage)" as specified below.

OE.Loader_Usage	Secure communication and usage of the Loader The authorized user must fulfil the access conditions required by the Loader.

4.4. Security Objectives Rationale

Table 5 below gives an overview, how the assumptions, threats, and organisational security policies are addressed by the objectives. The text following after the table justifies this in detail.

Assumption, Threat or Organisational Security Policy	Security Objectives	Notes
Core PP		
A.Process-Sec-IC	OE.Process-Sec-IC	Phase 5 – 6. Optional Phase 4.
A.Resp-Appl	OE.Resp-Appl	
P.Process-TOE	O.Identification	Phase 2 – 3. Optional Phase 4.
T.Phys-Manipulation	O.Phys-Manipulation	
T.Phys-Probing	O.Phys-Probing	
T.Malfunction	O.Malfunction	
T.Leak-Inherent	O.Leak-Inherent	
T.Leak-Forced	O.Leak-Forced	

Assumption, Threat or Organisational Security Policy	Security Objectives	Notes
T.Abuse-Func	O.Abuse-Func O.CAP_Avail_Loader	
T.RND	O.RND	
Package "Authentication of the Security IC"		
T.Masquerade_TOE	O.Authentication OE.TOE_Auth	
Additional threats (provided by [7] and [8])		
T.Open_Samples_Diffusion	O.Prot_TSF_Confidentiality O.Leak-Inherent O.Leak-Forced	
T.Mem-Access	O.Mem-Access	
Package 1: Loader dedicated for usage in secured environment only		
P.Lim_Block_Loader	O.Cap_Avail_Loader OE.Lim_Block_Loader	Phase 3 to phase 5.
Package 2: Loader dedicated for usage by authorized users only		
P.Ctrl_Loader	O.Ctrl_Auth_Loader OE.Loader_Usage	Phase 3 to phase 5.

Table 5: Security Objectives versus Assumptions, Threats or Policy

	O.Leak_Inherent	O.Phys-Probing	O.Malfunction	O.Phys-Manipulation	O.Leak-Forced	O.Abuse-Func	O.Identification	O.RND	O.Authentication	O.Cap_Avail_Loader	O.Ctrl_Auth_Loader	O.Prot_TSF_Confidentiality	O.Mem-Access	OE.Resp-Appl	OE.Process-Sec-IC	OE.TOE_Auth	OE.Lim_Block_Loader	OE.Loader_Usage
T.Leak-Inherent	X																	
T.Phys-Probing		X																
T.Malfunction			X															
T.Phys-Manipulation				X														
T.Leak-Forced					X													
T.Abuse-Func						X				X								
T.RND								X										
T.Masquerade_TOE									X							X		

	O.Leak_Inherent	O.Phys-Probing	O.Malfunction	O.Phys-Manipulation	O.Leak-Forced	O.Abuse-Func	O.Identification	O.RND	O.Authentication	O.Cap_Avail_Loader	O.Ctrl_Auth_Loader	O.Prot_TSF_Confidentiality	O.Mem-Access	OE.Resp-Appl	OE.Process-Sec-IC	OE.TOE_Auth	OE.Lim_Block_Loader	OE.Loader_Usage
T.Open_Samples_Diffusion	X				X							X						
T.Mem-Access													X					
P.Process-TOE							X											
P.Lim_Block_Loader										X							X	
P.Ctrl_Loader											X							X
A.Process-Sec-IC															X			
A.Resp-Appl														X				

Table 6: Mapping Security Problem vs Security Objectives

Core PP

The justification related to the assumption “Treatment of user data of the Composite TOE (**A.Resp-Appl**)” is as follows:

Since OE.Resp-Appl requires the Security IC Embedded Software to implement measures as assumed in A.Resp-Appl, the assumption is covered by the objective.

The justification related to the organisational security policy “Protection during TOE Development and Production (**P.Process-TOE**)” is as follows:

O.Identification requires that the TOE has to support the possibility of a unique identification. The unique identification can be stored on the TOE. Since the unique identification is generated by the production environment the production environment must support the integrity of the generated unique identification. The technical and organisational security measures that ensure the security of the development environment and production environment are evaluated based on the assurance measures that are part of the evaluation. For a list of material produced and processed by the TOE Manufacturer refer to section 3.1 page 23 (paragraph 69, page 21 in the BSI-CC-PP-0084-2014 [5]). All listed items and the associated development and production environments are subject of the evaluation. Therefore, the organisational security policy P.Process-TOE is covered by this objective, as far as organisational measures are concerned.

The justification related to the assumption “Protection during Packaging, Finishing and Personalisation (**A.Process-Sec-IC**)” is as follows:

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

The justification related to the threats “Inherent Information Leakage (**T.Leak-Inherent**)”, “Physical Probing (**T.Phys-Probing**)”, “Malfunction due to Environmental Stress (**T.Malfunction**)”, “Physical Manipulation

(**T.Phys-Manipulation**)", "Forced Information Leakage (**T.Leak-Forced**)", "Abuse of Functionality (**T.Abuse-Func**)" and "Deficiency of Random Numbers (**T.RND**)" is as follows:

For all threats the corresponding objectives (refer to Table 5) are stated in a way, which directly corresponds to the description of the threat (refer to Section 3.2). It is clear from the description of each objective (refer to Section 4.1), that the corresponding threat is removed if the objective is valid. More specifically, in every case the ability to use the attack method successfully is countered, if the objective holds.

Package "Authentication of the Security IC"

The threat "Masquerade the TOE (**T.Masquerade_TOE**)" is directly covered by the TOE security objective "Authentication to external entities (O.Authentication)" describing the proving part of the authentication and the security objective for the operational environment of the TOE "External entities authenticating of the TOE (OE.TOE_Auth)" the verifying part of the authentication.

Package 1: Loader dedicated for usage in secured environment only

The organisational security policy Limitation of capability and blocking the Loader (**P.Lim_Block_Loader**) is directly implemented by the security objective for the TOE "Capability and availability of the Loader (O.Cap_Avail_Loader)" and the security objective for the TOE environment "Limitation of capability and blocking the Loader (OE.Lim_Block_Loader)".

The TOE security objective "Capability and availability of the Loader" (O.Cap_Avail_Loader) mitigates also the threat "Abuse of Functionality "(**T.Abuse-Func**) if attacker tries to misuse the Loader functionality in order to manipulate security services of the TOE provided or depending on IC Dedicated Support Software or user data of the TOE as IC Embedded Software, TSF data or user data of the smartcard product.

Additional threats (provided by [7] and [8])

The threat "Diffusion of open samples" (**T.Open_Samples_Diffusion**) is directly covered by the TOE security objective "Protection of the confidentiality of the TSF" (O.Prot_TSF_Confidentiality) based on the self-protection of the TOE and the authentication mechanism of the Loader.
Additionally, **T.Open_Samples_Diffusion** threat is countered by "Protection against Inherent Information Leakage" (O.Leak-Inherent) and "Protection against Forced Information Leakage" (O.Leak-Forced) from the PP.

The TOE security objective "Area based Memory Access Control" (O.Mem-Access) counters the threats "Memory Access Violation" (**T.Mem-Access**). According to O.Mem-Access the TOE must enforce the partitioning of memory areas so that access of software to memory areas is controlled. Any restrictions are to be defined by the Smartcard Embedded Software. Thereby security violations caused by accidental or deliberate access to restricted data (which may include code) can be prevented. The threat T.Mem-Access is therefore removed if the objective is met.

The TOE shall provide access control functions as a means to be used by the Smartcard Embedded Software. This is further emphasised by the clarification of "Treatment of User Data (OE.Resp-Appl)" which reminds that the Smartcard Embedded Software must not undermine the restrictions.

Package 2: Loader dedicated for usage by authorized users only

The organisational security policy "Controlled usage to Loader Functionality (**P.Ctrl_Loader**) is directly implemented by the security objective for the TOE "Access control and authenticity for the Loader (O.Ctrl_Auth_Loader)" and the security objective for the TOE environment "Secure communication and usage of the Loader (OE.Loader_Usage)".

5. Extended Components Definition (ASE_ECD)

This chapter contains the following sections:

Definition of the Family FCS_RNG (5.1).

Definition of the Family FMT_LIM (5.2).

Definition of the Family FAU_SAS (5.3).

Definition of the Family FDP_SDC (5.4).

Definition of the Family FIA_API (5.5).

5.1. Definition of the Family FCS_RNG

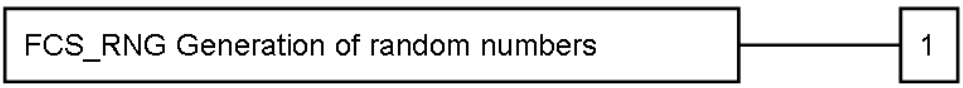
To define the IT Security Functional Requirements of the TOE an additional family (FCS_RNG) of the Class FCS (cryptographic support) is defined here. This family describes the functional requirements for random number generation used for cryptographic purposes.

FCS_RNG Generation of random numbers

Family behavior:

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

Component levelling:



FCS_RNG.1 Generation of random numbers requires that random numbers meet a defined quality metric.

Management: FCS_RNG.1

There are no management activities foreseen.

Audit: FCS_RNG.1

There are no actions defined to be auditable.

FCS_RNG.1 Random number generation

Hierarchical to: No other components.

Dependencies: No dependencies.

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

FCS_RNG.1.2 The TSF shall provide [selection: *bits, octets of bits, numbers [assignment: format of the numbers]*] that meet [assignment: *a defined quality metric*].

5.2. Definition of the Family FMT_LIM

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 6.1) 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 behavior:

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.

The TOE Functional Requirement “Limited capabilities (FMT_LIM.1)” is specified as follows:

FMT_LIM.1 Limited capabilities

Hierarchical to: No other components.

Dependencies: FMT_LIM.2 Limited availability.

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 TOE Functional Requirement “Limited availability (FMT_LIM.2)” is specified as follows:

FMT_LIM.2 Limited availability

Hierarchical to: No other components.

Dependencies: FMT_LIM.1 Limited capabilities.

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*].

5.3. Definition of the Family FAU_SAS

To define the Security Functional Requirements of the TOE an additional family (FAU_SAS) of the Class FAU (Security Audit) is defined here. This family describes the functional requirements for the storage of audit data. It has a more general approach than FAU_GEN, because it does not necessarily require the data to be generated by the TOE itself and because it does not give specific details of the content of the audit records.

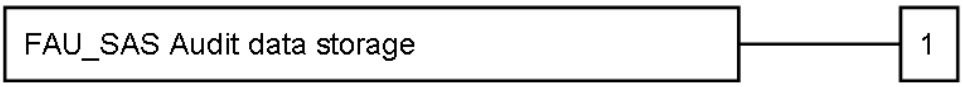
The family “Audit data storage (FAU_SAS)” is specified as follows.

FAU_SAS Audit data storage

Family behavior:

This family defines functional requirements for the storage of audit data.

Component levelling:



FAU_SAS.1 Requires the TOE to provide the possibility to store audit data.

Management: FAU_SAS.1

There are no management activities foreseen.

Audit: FAU_SAS.1

There are no actions defined to be auditable.

FAU_SAS.1 Audit storage

Hierarchical to: No other components.

Dependencies: No dependencies.

FAU_SAS.1.1 The TSF shall provide [assignment: *list of subjects*] with the capability to store [assignment: list of audit information] in the [assignment: *type of persistent memory*].

5.4. Definition of the Family FDP_SDC

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 behavior:

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.

FDP_SDC.1 Stored data confidentiality

Hierarchical to: No other components.

Dependencies: No dependencies.

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 area*].

5.5. Definition of the Family FIA_API

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

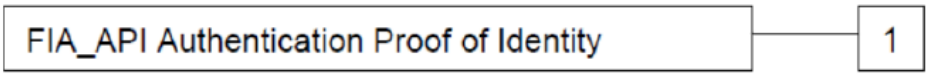
The other families of the Class FIA describe only the authentication verification of users' identity performed by the TOE and do not describe the functionality of the user to prove their identity. The following paragraph defines the family FIA_API in the style of the Common Criteria part 2 (see [3], chapter "Extended components definition (APE_ECD)") from a TOE point of view.

FIA_API Authentication Proof of Identity

Family behavior:

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

Component levelling:



FIA_API.1 Authentication Proof of Identity, provides proof of the identity of the TOE, an object or an authorized user or role to an external entity.

Management: FIA_API.1

The following actions could be considered for the management functions in FMT: Management of authentication information used to prove the claimed identity.

Audit: FIA_API.1

There are no actions defined to be auditable.

FIA_API.1 Authentication Proof of Identity

Hierarchical to: No other components.

Dependencies: No dependencies.

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

6. IT Security Requirements (ASE_REQ)

This chapter contains the following sections:

Security Functional Requirements for the TOE (6.1).

Security Assurance Requirements for the TOE (6.2).

Security Requirements Rationale (6.3).

6.1. Security Functional Requirements for the TOE

6.1.1. Convention

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. When an interpretation refinement is given, an extra paragraph starting with “Refinement” is 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 BSI-CC-PP-0084-2014 author are denoted as underlined text. Selections fill in by this ST author appear underlined and *italicised*, like this.

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 BSI-CC-PP-0084-2014 author are denoted as underlined text. Assignments fill in by this ST author appear underlined and *italicised*, like this.

The **iteration** operation is used when a component is repeated with varying operations. Iteration is denoted by showing a slash “/”, and the iteration indicator after the component identifier.

6.1.2. Malfunction

The TOE shall meet the requirement “Limited fault tolerance (FRU_FLT.2)” as specified below.

FRU_FLT.2	**Limited fault tolerance**
Hierarchical to:	FRU_FLT.1 Degraded fault tolerance
Dependencies:	FPT_FLS.1 Failure with preservation of secure state.
FRU_FLT.2.1	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).
Refinement:	**The term “failure” above means “circumstances”. The TOE prevents failures for the “circumstances” defined above.**

The TOE shall meet the requirement “Failure with preservation of secure state (FPT_FLS.1)” as specified below.

FPT_FLS.1	**Failure with preservation of secure state**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_FLS.1.1	The TSF shall preserve a secure state when the following types of failures occur: exposure to operating conditions which may not be tolerated according to the requirement Limited fault tolerance (FRU_FLT.2) and where therefore a malfunction could occur.
Refinement:	**The term “failure” above also covers “circumstances”. The TOE prevents failures for the “circumstances” defined above.**

6.1.3. Abuse of Functionality

The TOE shall meet the requirement “Limited capabilities (FMT_LIM.1)” as specified below (Common Criteria Part 2 extended).

FMT_LIM.1	**Limited capabilities**
Hierarchical to:	No other components.
Dependencies:	FMT_LIM.2 Limited availability.
FMT_LIM.1.1	The TSF shall be designed and implemented in a manner that limits their 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 of the Composite TOE to be disclosed or manipulated, TSF data to be disclosed or manipulated, software to be reconstructed and no substantial information about construction of TSF to be gathered which may enable other attacks.

The TOE shall meet the requirement “Limited availability (FMT_LIM.2)” as specified below (Common Criteria Part 2 extended).

FMT_LIM.2	**Limited availability**
Hierarchical to:	No other components.
Dependencies:	FMT_LIM.1 Limited capabilities.
FMT_LIM.2.1	The TSF shall be designed and implemented in a manner that limits their 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 of the Composite TOE to be disclosed or manipulated, TSF data to be disclosed or manipulated, software to be reconstructed and no substantial information about construction of TSF to be gathered which may enable other attacks.

The TOE shall meet the requirement “Audit storage (FAU_SAS.1)” as specified below (Common Criteria Part 2 extended).

FAU_SAS.1	**Audit storage**
Hierarchical to:	No other components.
Dependencies:	No dependencies.

FAU_SAS.1.1	The TSF shall provide the test process before TOE Delivery with the capability to store *the Initialisation Data and/or Pre-personalisation Data and/or supplements of the Security IC Embedded Software* in the *Non-Volatile Memory*.

6.1.4. Physical Manipulation and Probing

The TOE shall meet the requirement "Stored data confidentiality (FDP_SDC.1)" as specified below.

FDP_SDC.1	**Stored data confidentiality**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FDP_SDC.1.1	The TSF shall ensure the confidentiality of the information of the user data while it is stored in the *RAM, NVM or ROM*.

The TOE shall meet the requirement "Stored data integrity monitoring and action (FDP_SDI.2)" as specified below.

FDP_SDI.2	**Stored data integrity monitoring and action**
Hierarchical to:	FDP_SDI.1 Stored data integrity monitoring
Dependencies:	No dependencies.
FDP_SDI.2.1	The TSF shall monitor user data stored in containers controlled by the TSF for *integrity errors* on all objects, based on the following attributes: *RAMs, NVM, Registers and Buses*.
FDP_SDI.2.2	Upon detection of a data integrity error, the TSF shall *send an alarm to trig either an interrupt or a hardware reset*.

The TOE shall meet the requirement "Resistance to physical attack (FPT_PHP.3)" as specified below.

FPT_PHP.3	**Resistance to physical attack**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_PHP.3.1	The TSF shall resist physical manipulation and physical probing to the TSF by responding automatically such that the SFRs are always enforced.
Refinement:	**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.**

6.1.5. Leakage

The TOE shall meet the requirement “Basic internal transfer protection (FDP_ITT.1)” as specified below.

FDP_ITT.1	**Basic internal transfer protection**
Hierarchical to:	No other components.
Dependencies:	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]
FDP_ITT.1.1	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.
Refinement:	**The different memories, the CPU and other functional units of the TOE (e.g. a cryptographic co-processor) are seen as physically-separated parts of the TOE.**

The TOE shall meet the requirement “Basic internal TSF data transfer protection (FPT_ITT.1)” as specified below.

FPT_ITT.1	**Basic internal TSF data transfer protection**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_ITT.1.1	The TSF shall protect TSF data from disclosure when it is transmitted between separate parts of the TOE.
Refinement:	**The different memories, the CPU and other functional units of the TOE (e.g. a cryptographic co-processor) are seen as separated parts of the TOE.**

The TOE shall meet the requirement “Subset information flow control (FDP_IFC.1)” as specified below:

FDP_IFC.1	**Subset information flow control**
Hierarchical to:	No other components.
Dependencies:	FDP_IFF.1 Simple security attributes
FDP_IFC.1.1	The TSF shall enforce the Data Processing Policy on all confidential data when they are processed or transferred by the TOE or by the Security IC Embedded Software.

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

“User data of the Composite TOE and TSF data shall not be accessible from the TOE except when the Security IC Embedded Software decides to communicate the user data of the Composite TOE via an external interface. The protection shall be applied to confidential data only but without the distinction of attributes controlled by the Security IC Embedded Software.”

6.1.6. Random Number

The TOE shall meet the requirement “Quality metric for random numbers (FCS_RNG.1)” as specified below (Common Criteria Part 2 extended).

FCS_RNG.1/PTG.2	**Random number generation – PTG.2**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FCS_RNG.1.1/PTG.2	The TSF shall provide a physical random number generator that implements:

(PTG.2.1) A total failure test detects a total failure of entropy source immediately when the RNG has started. When a total failure is detected, no random numbers will be output.

(PTG.2.2) If a total failure of the entropy source occurs while the RNG is being operated, the RNG *prevents the output of any internal random number that depends on some raw random numbers that have been generated after the total failure of the entropy source*.

(PTG.2.3) The online test shall detect non-tolerable statistical defects of the raw random number sequence (i) immediately when the RNG has started, and (ii) while the RNG is being operated. The TSF must not output any random numbers before the power-up online test has finished successfully or when a defect has been detected.

(PTG.2.4) The online test procedure shall be effective to detect non-tolerable weaknesses of the random numbers soon.

(PTG.2.5) The online test procedure checks the quality of the raw random number sequence. It is triggered *applied upon specified internal events*. The online test is suitable for detecting non-tolerable statistical defects of the statistical properties of the raw random numbers within an acceptable period of time.

FCS_RNG.1.2 /PTG.2 The TSF shall provide *32-bit numbers* that meet

(PTG.2.6) Test procedure A does not distinguish the internal random numbers from output sequences of an ideal RNG.

(PTG.2.7) The average Shannon entropy per internal random bit exceeds 0.997.

6.1.7. Security Functional Requirement for Authentication of the TOE

The TOE shall meet the requirement “Authentication Proof of Identity (FIA_API.1)” as specified below.

FIA_API.1	**Authentication Proof of Identity**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FIA_API.1.1	The TSF shall provide a *mutual authentication mechanism* to prove the identity of the TOE to an external entity.

6.1.8. Security Functional Requirement for the Loader dedicated for usage in secured environment only (Package 1)

The TOE Functional Requirement “Limited capabilities – Loader (FMT_LIM.1/Loader)” is specified as follows.

FMT_LIM.1/Loader	**Limited capabilities – Loader**
Hierarchical to:	No other components.
Dependencies:	FMT_LIM.2 Limited availability.
FMT_LIM.1.1/Loader	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 Loader functionality after *full loading of Embedded Software and locking of the Loader* does not allow stored user data to be disclosed or manipulated by unauthorized user.

The TOE Functional Requirement “Limited availability – Loader (FMT_LIM.2/Loader)” is specified as follows.

FMT_LIM.2/Loader	**Limited availability – Loader**
Hierarchical to:	No other components.
Dependencies:	FMT_LIM.1 Limited capabilities.
FMT_LIM.2.1/Loader	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: The TSF prevents deploying the Loader functionality after *full loading of Embedded Software and locking of the Loader*.

6.1.9. Security Functional Requirement for the Loader dedicated for usage by authorized users only (Package 2)

The TOE Functional Requirement “Inter-TSF trusted channel (FTP_ITC.1)” is specified as follows.

FTP_ITC.1	**Inter-TSF trusted channel**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FTP_ITC.1.1	The TSF shall provide a communication channel between itself and *users authorized for using the Loader* that is logically distinct from other communication channels and provides assured identification of its end points and protection of the channel data from modification or disclosure. *The above restrictions are granted by the use of a cryptographic key dedicated to Loader operation.*
FTP_ITC.1.2	The TSF shall permit another trusted IT product to initiate communication via the trusted channel.
FTP_ITC.1.3	The TSF shall initiate communication via the trusted channel for deploying Loader *mutual authentication*.

The TOE Functional Requirement “Basic data exchange confidentiality (FDP_UCT.1)” is specified as follows.

FDP_UCT.1	**Basic data exchange confidentiality**
Hierarchical to:	No other components.
Dependencies:	[FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] [FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]
FDP_UCT.1.1	The TSF shall enforce the Loader SFP to receive user data in a manner protected from unauthorized disclosure. *User data are encrypted using the key dedicated to Loader operation.*

The TOE Functional Requirement “Data exchange integrity (FDP_UIT.1)” is specified as follows.

FDP_UIT.1	**Data exchange integrity**
Hierarchical to:	No other components.
Dependencies:	[FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] [FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control]
FDP_UIT.1.1	The TSF shall enforce the Loader SFP to receive user data in a manner protected from modification, deletion, insertion errors.
FDP_UIT.1.2	The TSF shall be able to determine on receipt of user data, whether modification, deletion, insertion has occurred. *User data integrity is granted by a signature using the key dedicated to Loader operation.*

The TOE Functional Requirement “Subset access control - Loader (FDP_ACC.1/Loader)” is specified as follows.

FDP_ACC.1/Loader	**Subset access control - Loader**
Hierarchical to:	No other components.
Dependencies:	FDP_ACF.1 Security attribute based access control.
FDP_ACC.1.1/Loader	The TSF shall enforce the Loader SFP on (1) the subjects *Loader authorized users*, (2) the objects user data in *Non-Volatile Memory (FLASH)*, (3) the operation deployment of Loader

The TOE Functional Requirement “Security attribute based access control - Loader (FDP_ACF.1/Loader)” is specified as follows.

FDP_ACF.1/Loader	**Security attribute based access control - Loader**
Hierarchical to:	No other components.
Dependencies:	FMT_MSA.3 Static attribute initialisation
FDP_ACF.1.1/Loader	The TSF shall enforce the Loader SFP to objects based on the following: (1) the subjects *Loader authorized users* with security attributes *controlling the right address range access* (2) the objects user data in *Non-Volatile Memory (FLASH)* with security attributes *controlling the right address range access*.

FDP_ACF.1.2/Loader	The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed: *the loading operation is allowed if and only if the subject has been successfully authenticated to the TSF by mutual authentication and by verification of the signature of the loading operation*.
FDP_ACF.1.3/Loader	The TSF shall explicitly authorise access of subjects to objects based on the following additional rules: *None*.
FDP_ACF.1.4/Loader	The TSF shall explicitly deny access of subjects to objects based on the following additional rules: *locking of the Loader*.

6.1.10. Memory access control

The TOE Functional Requirement “Subset access control” (FDP_ACC.1) is specified as follows.

FDP_ACC.1/Memory	**Subset access control – Memory**
Hierarchical to:	No other components.
Dependencies:	FDP_ACF.1 Security attribute based access control
FDP_ACC.1.1/Memory	The TSF shall enforce the Memory Access Control Policy on *all subjects (i.e. software in Test mode, Boot mode and User mode), all objects (user data stored in memories or NVR) and all operations (i.e. Read, Write, Execute and Erase) defined in the Memory Access Control Policy*.

The TOE Functional Requirement “Security attribute based access control” (FDP_ACF.1) is specified as follows.

FDP_ACF.1/Memory	**Security attribute based access control – Memory** The attributes are object’s address, memory kind (RAM, ROM or Flash), start address, end address and rights of the memory windows, product mode (Test mode, Boot mode or User mode).
Hierarchical to:	No other components.
Dependencies:	FDP_ACC.1 Subset access control FMT_MSA.3 Static attribute initialisation
FDP_ACF.1.1/Memory	The TSF shall enforce the Memory Access Control Policy to objects based on the following: *memory windows and NVR locations*.
FDP_ACF.1.2/Memory	The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed: *control the access conditions so that all unauthorized accesses are detected.* The rules are listed in the table below. Note that operations between parentheses are allowed by the security policy but correspond to operations with no effect on the object (memory kind).
FDP_ACF.1.3/Memory	The TSF shall explicitly authorise access of subjects to objects based on the following additional rules: *None*.
FDP_ACF.1.4/Memory	The TSF shall explicitly deny access of subjects to objects based on the following additional rules: *None*.

The TOE Functional Requirement “Static attribute initialisation” (FMT_MSA.3) is specified as follows.

FMT_MSA.3	**Static attribute initialisation**
Hierarchical to:	No other components.
Dependencies:	FMT_MSA.1 Management of security attributes, FMT_SMR.1 Security roles
FMT_MSA.3.1	The TSF shall enforce the Memory Access Control Policy to provide *well defined* default values for security attributes that are used to enforce the SFP.
FMT_MSA.3.2	The TSF shall allow the *None* to specify alternative initial values to override the default values when an object or information is created.

The TOE Functional Requirement “Management of security attributes” (FMT_MSA.1) is specified as follows.

FMT_MSA.1	**Management of security attributes**
Hierarchical to:	No other components.
Dependencies:	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control], FMT_SMR.1 Security roles, FMT_SMF.1 Specification of Management Functions
FMT_MSA.1.1	The TSF shall enforce the Memory Access Control Policy to restrict the ability to *change_default, modify or delete* the security attribute *start address, end address and rights of the memory windows* to *the software running in User mode*. The security attributes that can be set via Memory Protection Unit and Flash Protection Unit registers is summarized in the table below:

The TOE Functional Requirement “Specification of Management Functions” (FMT_SMF.1) is specified as follows.

FMT_SMF.1	**Specification of Management Functions**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FMT_SMF.1.1	The TSF shall be capable of performing the following management functions: *access to the registers of the Memory Protection Unit and of the Flash Protection Unit*.

6.2. Security Assurance Requirements for the TOE

The Security Assurance Requirements for the TOE and its development and operating environment are those taken from EAL6 augmented with ALC_FLR.2 and ASE_TSS.2.

Class	Family	Title
ADV Development	ADV_ARC.1	Security architecture description.
	ADV_FSP.5	Complete semi-formal functional specification with additional error information.
	ADV_IMP.2	Complete mapping of the implementation representation of the TSF.
	ADV_INT.3	Minimally complex internals.
	ADV_SPM.1	Formal TOE security policy model.
	ADV_TDS.5	Complete semi-formal modular design.
AGD Guidance documents	AGD_OPE.1	Operational user guidance.
	AGD_PRE.1	Preparative procedures.
ALC Life-cycle support	ALC_CMC.5	Advanced support.
	ALC_CMS.5	Development tools CM coverage.
	ALC_DEL.1	Delivery procedures.
	ALC_DVS.2	Sufficiency of security measures.
	ALC_FLR.2	Flaw reporting procedures
	ALC_LCD.1	Developer defined life-cycle model.
	ALC_TAT.3	Compliance with implementation standards – all parts.
ASE Security Target Evaluation	ASE_INT.1	Security target introduction.
	ASE_CCL.1	Conformance claims.
	ASE_SPD.1	Security problem definition.
	ASE_OBJ.2	Security objectives.
	ASE_ECD.1	Extended components definition.
	ASE_REQ.2	Derived security requirements.
	ASE_TSS.2	TOE summary specification with architectural design summary.
ATE Tests	ATE_COV.3	Rigorous analysis of coverage.
	ATE_DPT.3	Testing: modular design.
	ATE_FUN.2	Ordered functional testing.
	ATE_IND.2	Independent testing – sample.
AVA Vulnerability assessment	AVA_VAN.5	Advanced methodical vulnerability analysis.

The Protection Profile BSI-CC-PP-0084-2014 [5] gives refinements of the Security Assurance Requirements at EAL4+ level. To maintain the conformance claim to the PP, the refinements stated in the Protection Profile BSI-CC-PP-0084-2014 section 6.2.1 have to be taken into account by the higher level assurance components defined in the EAL6 package.

6.3. Security Requirements Rationale

6.3.1. Rationale for the Security Functional Requirements

Table 7 below gives an overview, how the security functional requirements are combined to meet the security objectives. The detailed justification follows after the table.

Objective	TOE Security Functional and Assurance Requirements
Core PP	
O.Leak-Inherent	- FDP_ITT.1 “Basic internal transfer protection” - FPT_ITT.1 “Basic internal TSF data transfer protection” - FDP_IFC.1 “Subset information flow control”
O.Phys-Probing	- FDP_SDC.1 “Stored data confidentiality” - FPT_PHP.3 “Resistance to physical attack”
O.Malfunction	- FRU_FLT.2 “Limited fault tolerance - FPT_FLS.1 “Failure with preservation of secure state”
O.Phys-Manipulation	- FDP_SDI.2 “Stored data integrity monitoring and action” - FPT_PHP.3 “Resistance to physical attack”
O.Leak-Forced	All requirements listed for O.Leak-Inherent: - FDP_ITT.1, FPT_ITT.1, FDP_IFC.1 plus those listed for O.Malfunction and O.Phys-Manipulation: - FRU_FLT.2, FPT_FLS.1, FPT_PHP.3
O.Abuse-Func	- FMT_LIM.1 “Limited capabilities” - FMT_LIM.2 “Limited availability” plus those for O.Leak-Inherent, O.Phys-Probing, O.Malfunction, O.Phys-Manipulation, O.Leak-Forced: - FDP_ITT.1, FPT_ITT.1, FDP_IFC.1, FPT_PHP.3, FRU_FLT.2, FPT_FLS.1
O.Identification	- FAU_SAS.1 “Audit storage”
O.RND	- FCS_RNG.1/PTG.2 “Quality metric for random numbers” plus those for O.Leak-Inherent, O.Phys-Probing, O.Malfunction, O.Phys-Manipulation, O.Leak-Forced: - FDP_ITT.1, FPT_ITT.1, FDP_IFC.1, FPT_PHP.3, FRU_FLT.2, FPT_FLS.1
Package “Authentication of the Security IC”	
O.Authentication	- FIA_API.1 “Authentication Proof of Identity”
Package 1: Loader dedicated for usage in secured environment only	
O.Cap_Avail_Loader	- FMT_LIM.1/Loader “Limited Capabilities” - FMT_LIM.2/Loader “Limited Availability”

Objective	TOE Security Functional and Assurance Requirements
Package 2: Loader dedicated for usage by authorized users only	
O.Ctrl_Auth_Loader	- FTP_ITC.1 “Inter-TSF trusted channel” - FDP_UCT.1 “Basic data exchange confidentiality” - FDP_UIT.1 “Data exchange integrity” - FDP_ACC.1/Loader “Subset access control – Loader” - FDP_ACF.1/Loader “Security attribute based access control – Loader”
Additional security objectives for the TOE (provided by [7] and [8])	
O.Prot_TSF_Confidentiality	- FDP_ACC.1/Loader “Subset access control – Loader” - FDP_ACF.1/Loader “Security attribute based access control – Loader”
O.Mem-Access	- FDP_ACC.1/Memory “Subset access control – Memory” - FDP_ACF.1/Memory “Security attribute based access control – Memory” - FMT_MSA.3 “Static attribute initialisation” - FMT_MSA.1 “Management of security attributes” - FMT_SMF.1 “Specification of Management Functions”
Security objective for the Security IC Embedded Software	
OE.Resp-Appl	Not Applicable.
Security objectives for the Operational Environment	
OE.Process-Sec-IC	Not Applicable.
OE.Lim-Block-Loader	Not Applicable.
OE.TOE_Auth	Not Applicable.
OE.Loader_Usage	Not Applicable.

Table 7: Security Requirements versus Security Objectives

Core PP

The justification related to the security objective “Protection against Inherent Information Leakage (**O.Leak-Inherent**)” is as follows:

The refinements of 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 transmitted between separate parts of the TOE or 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 are transmitted between or processed by TOE parts.

It is possible that the TOE needs additional support by the Security IC Embedded Software (e.g. timing attacks are possible if the processing time of algorithms implemented in the software depends on the content of secret). This support must be addressed in the Guidance Documentation. Together with this **FPT_ITT.1**, **FDP_ITT.1** and **FDP_IFC.1** are suitable to meet the objective.

The justification related to the security objective “Protection against Physical Probing (**O.Phys-Probing**)” is as follows:

The SFR **FDP_SDC.1** requires the TSF to protect the confidentiality of the information 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.

It is possible that the TOE needs additional support by the Security IC Embedded Software (e.g. to send data over certain buses only with appropriate precautions). This support must be addressed in the Guidance Documentation. Together with this **FPT_PHP.3** is suitable to meet the objective.

The justification related to the security objective “Protection against Malfunction due to environmental stress (**O.Malfunction**)” is as follows:

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**, 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. The functions implementing **FRU_FLT.2** and **FPT_FLS.1** must work independently so that their operation cannot affected by the Security IC Embedded Software (refer to the refinement). Therefore, there is no possible instance of conditions under O.Malfunction, which is not covered.

The justification related to the security objective “Protection against Physical Manipulation (**O.Phys-Manipulation**)” is as follows:

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. 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.

The justification related to the security objective “Protection against Forced Information Leakage (**O.Leak-Forced**)“ is as follows:

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** and **O.Phys-Manipulation**, respectively. The requirements covering **O.Leak-Inherent** also support O.Leak-Forced because they prevent the attacker from being successful if he tries the second step directly.

The justification related to the security objective “Protection against Abuse of Functionality (**O.Abuse-Func**)” is as follows:

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 in Phase 7 of the life-cycle. 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 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 also listed in Table 7.

It was chosen to define **FMT_LIM.1** and **FMT_LIM.2** explicitly (not using Part 2 of the Common Criteria) for the following reason: Though taking components from the Common Criteria catalogue makes it easier to recognise functions, any selection from Part 2 of the Common Criteria would have made it harder for the reader to understand the special situation meant here. As a consequence, the statement of explicit security functional requirements was chosen to provide more clarity.

The justification related to the security objective “TOE Identification (**O.Identification**)“ is as follows:

Obviously the operations for **FAU_SAS.1** are chosen in a way that they require the TOE to provide the functionality needed for O.Identification. The Initialisation Data (or parts of them) are used for TOE identification. The technical capability of the TOE to store Initialisation Data and/or Pre-personalisation Data is provided according to FAU_SAS.1.

It was chosen to define **FAU_SAS.1** explicitly (not using a given security functional requirement from Part 2 of the Common Criteria) for the following reason: The security functional requirement FAU_GEN.1 in Part 2 of the CC [2] requires the TOE to generate the audit data and gives details on the content of the audit records (for instance data and time). The possibility to use the functions in order to store security relevant data which are generated outside of the TOE, is not covered by the family FAU_GEN or by other families in Part 2. Moreover, the TOE cannot add time information to the records, because it has no real time clock. Therefore, the new family FAU_SAS was defined for this situation.

The justification related to the security objective “Random Numbers (**O.RND**)” is as follows:

FCS_RNG.1/PTG.2 requires the TOE to provide random numbers of good quality. To specify the exact metric is left to the individual Security Target for a specific TOE.

Other security functional requirements, which prevent physical manipulation and malfunction of the TOE (see the corresponding objectives listed in the Table 7) support this objective because they prevent attackers from manipulating or otherwise affecting the random number generator.

Random numbers are often used by the Security IC Embedded Software to generate cryptographic keys for internal use. Therefore, the TOE must prevent the unauthorised disclosure of random numbers. Other security functional requirements which prevent inherent leakage attacks, probing and forced leakage attacks ensure the confidentiality of the random numbers provided by the TOE.

Depending on the functionality of specific TOEs the Security IC Embedded Software will have to support the objective by providing runtime-tests of the random number generator. Together, these requirements allow the TOE to provide cryptographically good random numbers and to ensure that no information about the produced random numbers is available to an attacker.

It was chosen to define **FCS_RNG.1** explicitly, because Part 2 of the Common Criteria do not contain generic security functional requirements for Random Number generation. (Note, that there are security functional requirements in Part 2 of the Common Criteria, which refer to random numbers. However, they define requirements only for the authentication context, which is only one of the possible applications of random numbers.)

Package “Authentication of the Security IC”

The justification related to the security objective “Authentication to external entities (**O.Authentication**)” is as follows:

The security objective “Authentication to external entities (O.Authentication) is directly covered by the SFR **FIA_API.1**.

Package 1: Loader dedicated for usage in secured environment only

The security objective “Capability and availability of the Loader (**O.Cap_Avail_Loader**) is directly covered by the SFR **FMT_LIM.1/Loader** and **FMT_LIM.2/Loader**.

Package 2: Loader dedicated for usage by authorized users only

The security objective “Access control and authenticity for the Loader” (**O.Ctrl_Auth_Loader**) is covered by the SFR as follows:

- The SFR **FDP_ACC.1/Loader** defines the subjects, objects and operations of the Loader SFP enforced by the SFR **FTP_ITC.1**, **FDP_UCT.1**, **FDP_UIT.1** and **FDP_ACF.1/Loader**.
- The SFR **FDP_UIT.1** requires the TSF to verify the integrity of the received user data.
- The SFR **FDP_ACF.1/Loader** requires the TSF to implement access control for the Loader functionality.

Additional security objectives for the TOE (provided by [7] and [8])

The security objective “Protection of the confidentiality of the TSF” (**O.Prot_TSF_Confidentiality**) is directly covered by the SFR **FDP_ACC.1/Loader** and **FDP_ACF.1/Loader** which requires the TSF to implement access control for the Loader functionality. The user must be successfully authenticated before having access to the TOE.

The justification related to the security objective “Area based Memory Access Control (**O.Mem-Access**)” is as follows:

The security functional requirement “Subset access control – Memory (**FDP_ACC.1/Memory**)” with the related Security Function Policy (SFP) “Memory Access Control Policy” exactly require to implement an area based memory access control as demanded by O.Mem-Access. Therefore, FDP_ACC.1/Memory with its SFP is suitable to meet the security objective.

Nevertheless, the developer of the Smartcard Embedded Software must ensure that the additional functions are used as specified and that the User Data processed by these functions are protected as defined for the application context.

The security functional requirement “Security Attribute based access control – Memory (**FDP_ACF.1/Memory**) with the related Security Function Policy (SFP) “Memory Access Control Policy” addresses security attributes usage and characteristics of policies. It describes the rules for the function that implements the Security Function Policy (SFP) as identified in FDP_ACC.1/Memory. Therefore, FDP_ACF.1/Memory with its SFP is suitable to meet the security objective.

The security functional requirement “Static attribute initialisation (**FMT_MSA.3**)” requires that the TOE provides default values for security attributes. Since the TOE is a hardware platform these default values are generated by the reset procedure. Therefore FMT_MSA.3 is suitable to meet the security objective O.Mem-Access.

The security functional requirement “Management of security attributes **(FMT_MSA.1**)” requires that the ability to change the security attributes is restricted to privileged subject(s). It ensures that the access control required by O.Mem-Access can be realized using the functions provided by the TOE. Therefore FMT_MSA.1 is suitable to meet the security objective O.Mem-Access.

Finally, the security functional requirement “Specification of Management Functions (**FMT_SMF.1**)” is used for the specification of the management functions to be provided by the TOE as required by O.Mem_Access. Therefore, FMT_SMF.1 is suitable to meet the security objective O.Mem-Access.

6.3.2. Dependencies of Security Functional Requirements

Table 8 below lists the security functional requirements defined in this Security Target, their dependencies and whether they are satisfied by other security requirements defined in this Security Target. The text following the table discusses the remaining cases.

Security Functional Requirement	Dependencies	Fulfilled by security requirement in this ST
Core PP		
FRU_FLT.2	FPT_FLS.1	Yes
FPT_FLS.1	None	No dependency
FMT_LIM.1	FMT_LIM.2	Yes
FMT_LIM.2	FMT_LIM.1	Yes
FAU_SAS.1	None	No dependency
FDP_SDC.1	None	No dependency
FDP_SDI.2	None	No dependency
FPT_PHP.3	None	No dependency
FDP_ITT.1	[FDP_ACC.1 or FDP_IFC.1]	FDP_IFC.1
FPT_ITT.1	None	No dependency
FDP_IFC.1	FDP_IFF.1	See discussion below
FCS_RNG.1/PTG.2	None	No dependency
Package “Authentication of the Security IC”		
FIA_API.1	None	No dependency
Package 1: Loader dedicated for usage in secured environment only		
FMT_LIM.1/Loader	FMT_LIM.2	FMT_LIM.2/Loader
FMT_LIM.2/Loader	FMT_LIM.1	FMT_LIM.1/Loader
Package 2: Loader dedicated for usage by authorized users only		
FTP_ITC.1	None	No dependency
FDP_UCT.1	[FTP_ITC.1 or FTP_TRP.1] [FDP_ACC.1 or FDP_IFC.1]	FTP_ITC.1 FDP_ACC.1/Loader
FDP_UIT.1	[FTP_ITC.1 or FTP_TRP.1] [FDP_ACC.1 or FDP_IFC.1]	FTP_ITC.1 FDP_ACC.1/Loader
FDP_ACC.1/Loader	FDP_ACF.1	FDP_ACF.1/Loader
FDP_ACF.1/Loader	FMT_MSA.3	See discussion below
Memory Access Control		
FDP_ACC.1/Memory	FDP_ACF.1	FDP_ACF.1/Memory
FDP_ACF.1/Memory	FDP_ACC.1 FMT_MSA.3	FDP_ACC.1/Memory. Yes.

Security Functional Requirement	Dependencies	Fulfilled by security requirement in this ST
FMT_MSA.1	[FDP_ACC.1 or FDP_ITC.1] FMT_SMR.1 FMT_SMF.1	FDP_ACC.1/Memory. See discussion bellow. Yes.
FMT_MSA.3	FMT_MSA.1 FMT_SMR.1	Yes. See discussion bellow.
FMT_SMF.1	None	No dependency

Table 8: Dependencies of the Security Functional Requirements

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).

As Table 8 shows, all other dependencies of functional requirements are fulfilled by security requirements defined in this Security Target.

The discussion in Section 6.3.1 has shown, how the security functional requirements support each other in meeting the security objectives of this Security Target. In particular the security functional requirements providing resistance of the hardware against manipulations (e. g. FPT_PHP.3) support all other more specific security functional requirements (e. g. FCS_RNG.1) because they prevent an attacker from disabling or circumventing the latter.

The dependency of **FDP_ACF.1/Loader** on FMT_MSA.3 isn't necessary because the security attributes used to enforce the Loader SFP are fixed by the IC manufacturer and no new objects under control of the Loader SFP are created.

The dependency FMT_SMR.1 introduced by the two components **FMT_MSA.1** and **FMT_MSA.3** is considered to be satisfied because the access control specified for the intended TOE is not role-based but enforced for each subject. Therefore, there is no need to identify roles in form of a security functional requirement FMT_SMR.1.

6.3.3. Rationale for the Assurance Requirements

The assurance level EAL6 and the augmentation ALC_FLR.2 and ASE_TSS.2 were chosen in order to meet assurance expectations explained in the following paragraphs.

EAL6

An assurance level of EAL6 is required for this type of TOE since it is intended to defend against sophisticated attacks.

The EAL6 assurance package was selected to permit a developer to gain high assurance from application of security engineering techniques to a rigorous development environment in order to produce a premium TOE for protecting high value assets against significant risks.

ASE_TSS.2 TOE summary specification

This component is chosen to give architectural information on the security functionality of the TOE. The TOE summary specification describes how the TOE protects itself against interference, logical tampering and bypass.

This assurance component is a higher hierarchical component to EAL6 (which only requires ASE_TSS.1). ASE_TSS.2 has three dependencies (ASE_INT.1, ASE_REQ.1 and ADV_ARC.1) that are all satisfied by this TOE.

ALC_FLR.2 Flaw Reporting Procedure

This component is added to cover policies and procedure that are applied to track and correct flaws and to support surveillance of the TOE. No dependencies of ALC_FLR.2.

6.3.4. Definition of ADV_SPM.1

ADV_SPM.1	**Formal TOE security policy model**
Dependencies:	ADV_FSP.4 Complete function description
ADV_SPM.1.1D	The developer shall provide a formal security policy model for the *Memory Access Control Policy, the Loader SFP and the corresponding SFRs:*

- *FIA_API.1 Authentication Proof of Identity*
- *FDP_ACC.1/Memory Subset access control – Memory*
- *FDP_ACF.1/Memory Security attribute based access control – Memory*
- *FMT_MSA.3 Static attribute initialization*
- *FMT_MSA.1 Management of security attributes*
- *FMT_SMF.1 Specification of Management Functions.*
- *FMT_LIM.1/Loader Limited capabilities – Loader*
- *FMT_LIM.2/Loader Limited availability – Loader*
- *FTP_ITC.1 Inter-TSF trusted channel*
- *FDP_UCT.1 Basic data exchange confidentiality*
- *FDP_UIT.1 Data exchange integrity*
- *FDP_ACC.1/Loader Subset access control – Loader*
- *FDP_ACF.1/Loader Security attribute based access control – Loader*

ADV_SPM.1.2D	For each policy covered by the formal security policy model, the model shall identify the relevant portions of the statement of SFRs that make up that policy.

ADV_SPM.1.3D The developer shall provide a formal proof of correspondence between the model and any formal functional specification.

ADV_SPM.1.4D The developer shall provide a demonstration of correspondence between the model and the functional specification.

6.3.5. Security Requirements are Internally Consistent

The discussion of security functional requirements and assurance components in the preceding sections has shown that consistency are given for both groups of requirements. The arguments given for the fact that the assurance components are adequate for the functionality of the TOE also shows that the security functional requirements and assurance requirements support each other and that there are no inconsistencies between these groups.

The security functional requirements FDP_SDC.1 and FDP_SDI.2 address the protection of user data in the specified memory areas against compromise and manipulation. The security functional requirement FPT_PHP.3 makes it harder to manipulate data. This protects the primary assets identified in Section 3.1 and other security features or functionality which use these data.

Though a manipulation of the TOE (refer to FPT_PHP.3) is not of great value for an attacker in itself, it can be an important step in order to threaten the primary assets identified in Section 3.1. Therefore, the security functional requirement FPT_PHP.3 is not only required to meet the security objective O.Phys-Manipulation. Instead it protects other security features or functions of both the TOE and the Security IC Embedded Software from being bypassed, deactivated or changed. In particular this may pertain to the security features or functions being specified using FDP_ITT.1, FPT_ITT.1, FPT_FLS.1, FMT_LIM.2, FCS_RNG.1/PTG.2, and those implemented in the Security IC Embedded Software.

A malfunction of TSF (refer to FRU_FLT.2 and FPT_FLS.1) can be an important step in order to threaten the primary assets identified in Section 3.1. Therefore, the security functional requirements FRU_FLT.2 and FPT_FLS.1 are not only required to meet the security objective O.Malfunction. Instead they protect other security features or functions of both the TOE and the Security IC Embedded Software from being bypassed, deactivated or changed. In particular this pertains to the security features or functions being specified using FDP_ITT.1, FPT_ITT.1, FMT_LIM.1, FMT_LIM.2, FCS_RNG.1/PTG.2, and those implemented in the Security IC Embedded Software.

In a forced leakage attack the methods described in “Malfunction due to Environmental Stress” (refer to T.Malfunction) and/or “Physical Manipulation” (refer to T.Phys-Manipulation) are used to cause leakage from signals which normally do not contain significant information about secrets. Therefore, in order to avert the disclosure of primary assets identified in Section 3.1 it is important that the security functional requirements averting leakage (FDP_ITT.1, FPT_ITT.1) and those against malfunction (FRU_FLT.2 and FPT_FLS.1) and physical manipulation (FPT_PHP.3) are effective and bind well. The security features and functions against malfunction ensure correct operation of other security functions (refer to above) and help to avert forced leakage themselves in other attack scenarios. The security features and functions against physical manipulation make it harder to manipulate the other security functions (refer to above).

Physical probing (refer to FPT_PHP.3) shall directly avert the disclosure of primary assets identified in Section 3.1. In addition, physical probing can be an important step in other attack scenarios if the corresponding security features or functions use secret data. For instance the security functional requirement FMT_LIM.2 may use passwords. Therefore, the security functional requirement FPT_PHP.3 (against probing) help to protect other security features or functions including those being implemented in the Security IC Embedded Software. Details depend on the implementation.

Leakage (refer to FDP_ITT.1, FPT_ITT.1) shall directly avert the disclosure of primary assets identified in Section 3.1. In addition, inherent leakage and forced leakage (refer to above) can be an important step in other attack scenarios if the corresponding security features or functions use secret data. For instance the security functional requirement FMT_LIM.2 may use passwords. Therefore, the security functional requirements FDP_ITT.1 and FPT_ITT.1 help to protect other security features or functions implemented in the Security IC Embedded Software (FDP_ITT.1) or provided by the TOE (FPT_ITT.1). Details depend on the implementation.

The user data of the Composite TOE are treated as required to meet the requirements defined for the specific application context (refer to Treatment of user data of the Composite TOE (A.Resp-Appl)). However, the TOE may implement additional functions. This can be a risk if their interface cannot completely be controlled by the Security IC Embedded Software. Therefore, the security functional requirements FMT_LIM.1 and FMT_LIM.2 are very important. They ensure that appropriate control is applied to the interface of these functions (limited availability) and that these functions, if being usable, provide limited capabilities only.

The combination of the security functional requirements FMT_LIM.1 and FMT_LIM.2 ensures that (especially after TOE Delivery) these additional functions cannot be abused by an attacker to (i) disclose or manipulate user data of the Composite TOE, (ii) to manipulate (explore, bypass, deactivate or change) security features or services of the TOE or of the Security IC Embedded Software or (iii) to enable other attacks on the assets. Hereby the binding between these two security functional requirements is very important.

The security functional requirement Limited Capabilities (FMT_LIM.1) must close gaps which could be left by the control being applied to the function's interface (Limited Availability (FMT_LIM.2)). Note that the security feature or services which limits the availability can be bypassed, deactivated or changed by physical manipulation or a malfunction caused by an attacker. Therefore, if Limited Availability (FMT_LIM.2) is vulnerable[3], it is important to limit the capabilities of the functions in order to limit the possible benefit for an attacker.

The security functional requirement Limited Availability (FMT_LIM.2) must close gaps which could result from the fact that the function's kernel in principle would allow to perform attacks. The TOE must limit the availability of functions which potentially provide the capability to disclose or manipulate user data of the Composite TOE, to manipulate security features or services of the TOE or of the Security IC Embedded Software or to enable other attacks on the assets. Therefore, if an attacker could benefit from using such functions[4], it is important to limit their availability so that an attacker is not able to use them.

No perfect solution to limit the capabilities (FMT_LIM.1) is required if the limited availability (FMT_LIM.2) alone can prevent the abuse of functions. No perfect solution to limit the availability (FMT_LIM.2) is required if the limited capabilities (FMT_LIM.1) alone can prevent the abuse of functions. Therefore, it is correct that both requirements are defined in a way that they together provide sufficient security.

It is important to avert malfunctions of TSF and of security functions implemented in the Security IC Embedded Software (refer to above). There are two security functional requirements which ensure that malfunctions can not be caused by exposing the TOE to environmental stress. First it must be ensured that the TOE operates correctly within some limits (Limited fault tolerance (FRU_FLT.2)). Second the TOE must prevent its operation outside these limits (Failure with preservation of secure state (FPT_FLS.1)). Both security functional requirements together prevent malfunctions. The two functional requirements must define the "limits". Otherwise there could be some range of operating conditions which is not covered so that malfunctions may occur. Consequently, the security functional requirements Limited fault tolerance (FRU_FLT.2) and Failure with preservation of secure state (FPT_FLS.1) are defined in a way that they together provide sufficient security.

[3] Or, in the extreme case, not being provided.

[4] The capabilities are not limited in a perfect way (FMT_LIM.1).

7. TOE Summary Specification (ASE_TSS)

This chapter contains the following sections:

Description of TSF features (7.1).

Rationale for TSF (7.2).

Architectural Design Summary (7.3).

7.1. Description of TSF features

7.1.1. SF_PMODE

Product Mode

SF_PMODE manages the different steps of the product life cycle. At each step (boot mode, test mode and user mode), registers, data and memories accesses are limited or not. This allows to restrict product access according to the step (from manufacturing phase to final user phase). In addition, it is not possible to come back to test mode after the deployment of the product.

Related SFR:

FMT_LIM.1	Limited capabilities.
FMT_LIM.2	Limited availability.
FAU_SAS.1	Audit storage.
FDP_SDC.1	Stored data confidentiality.
FDP_ACC.1/Memory	Subset access control – Memory.
FDP_ACF.1/Memory	Security attribute based access control – Memory.

7.1.2. SF_AUDIT_STORAGE

Audit storage

SF_AUDIT_STORAGE allows to store specific data which shall remain permanent in the system such as the unique identification of the product stored in the Flash memory, pre-personalization data and security information.

Related SFR:

FAU_SAS.1	Audit storage.

7.1.3. SF_AUTHENT

Authentication

SF_AUTHENT provides mutual authentication between the TOE and the “Terminal” based on cryptographic mechanisms. Authentication is done before the loading operation.

Related SFR:

FTP_ITC.1	Inter-TSF trusted channel.
FIA_API.1	Authentication Proof of Identity.
FDP_ACC.1/Loader	Subset access control – Loader.
FDP_ACF.1/Loader	Security attribute based access control – Loader.

7.1.4. SF_CONF_INT

Confidentiality and integrity

SF_CONF_INT provides confidentiality and integrity to data stored in the memories (ROM, RAM, FLASH), in registers and in buses. The SF_CONF_INT prevents the disclosure of internal user data thanks to:

- Memories encryption.
- Buses encryption.
- Register masking and cycling.
- Address scrambling.
- Integrity mechanisms on memories, buses and registers.

Related SFR:

FDP_SDC.1	Stored data confidentiality.
FPT_ITT.1	Basic internal TSF data transfer protection.
FDP_ITT.1	Basic internal transfer protection.
FDP_IFC.1	Subset information flow control.
FPT_PHP.3	Resistance to physical attack.
FDP_SDI.2	Stored data integrity monitoring and action.

7.1.5. SF_EXEC

Correct Execution

SF_EXEC provides protection against an un-correct execution of the code such as:

- Mechanisms to detect code re-routing.
- Mechanisms to detect illegal opcode execution.
- Mechanisms to control the operating conditions.

In case of detection of an abnormal execution, an alarm is sent.

SF_EXEC ensures also the correct operating conditions of the product during the execution and prevents any malfunction using sensors.

Related SFR:

FRU_FLT.2	Limited fault tolerance.
FPT_FLS.1	Failure with preservation of secure state.
FDP_IFC.1	Subset information flow control.

7.1.6. SF_MEM_ACCESS

Memory Access Control

SF_MEM_ACCESS provides:

- a Memory Protection Unit (MPU) that defines access permission on different memories areas.
- a Flash Protection Unit that defines access permission on NVR areas.

SF_MEM_ACCESS provides also an access control to user data stored in Flash during the deployment of the Loader and after.

Related SFR:

FDP_ACC.1/Memory	Subset access control – Memory.
FDP_ACF.1/Memory	Security attribute based access control – Memory.
FMT_MSA.3	Static attribute initialisation.
FMT_MSA.1	Management of security attributes.
FMT_SMF.1	Specification of Management Function.
FDP_ACC.1/Loader	Subset access control – Loader.
FDP_ACF.1/Loader	Security attribute based access control – Loader.
FDP_SDC.1	Stored data confidentiality.

7.1.7. SF_PHY_PRO

Physical Protection

SF_PHY_PRO provides physical protection to the product against physical manipulation and physical probing. The following features are used:

- Active Shield.
- Countermeasures added during the layout design.

Related SFR:

FPT_PHP.3	Resistance to physical attack.
FPT_ITT.1	Basic internal TSF data transfer protection.
FDP_ITT.1	Basic internal transfer protection.
FDP_SDC.1	Stored data confidentiality.

7.1.8. SF_ALARM

Alarm Management

SF_ALARM enables to trig either an interrupt or a hardware reset. This TSF provides preservation of secure state in case of exposure to operation conditions which are not tolerated.

Related SFR:

FPT_FLS.1	Failure with preservation of secure state.
FDP_SDI.2	Stored data integrity monitoring and action.

7.1.9. SF_RANDOM

Randomization

SF_RANDOM provides mechanisms to prevent access to sensitive assets during the use by the Secure Embedded Software thanks to:

- Generate variation of the clock frequency around a range of frequency.
- Randomize the clock stealer.
- Randomize the execution of the commands.

Related SFR:

FDP_IFC.1	Subset information flow control.
FDP_ITT.1	Basic internal transfer protection.
FPT_ITT.1	Basic internal TSF data transfer protection.

7.1.10. SF_RNG

Random Number Generator

SF_RNG provides a random number generator (PTRNG) that meets PTG.2 class of BSI-AIS31 (German Scheme). It is used for key generation or for security measures.

Related SFR:

FCS_RNG.1/PTG.2	Random number generator – PTG.2.

7.1.11. SF_SEC_LOAD

Secure Loading

SF_SEC_LOAD allows to load some code in the product in a secure way and, after the loading, to lock the loading mechanism.

Related SFR:

FDP_ACC.1/Loader	Subset access control – Loader.
FDP_ACF.1/Loader	Security attributes based access control – Loader.
FDP_UCT.1	Basic data exchange confidentiality.
FDP_UIT.1	Data exchange integrity.
FMT_LIM.1/Loader	Limited capabilities – Loader.
FMT_LIM.2/Loader	Limited availability – Loader.

7.2. Rationale for TSF

7.2.1. Mapping between Security Functional Requirement and Security Functionality

The overview of the mapping between Security Functional Requirement (SFR) and Security Functionality (SF) is given above. The results are shown in Table 9 below.

SFR / SF	SF_PMODE	SF_AUDIT_STORAGE	SF_AUTHENT	SF_CONF_INT	SF_EXEC	SF_MEM_ACCESS	SF_PHY_PRO	SF_ALARM	SF_RANDOM	SF_RNG	SF_SEC_LOAD
FRU_FLT.2					X						
FPT_FLS.1					X			X			
FMT_LIM.1	X										
FMT_LIM.2	X										
FAU_SAS.1	X	X									
FDP_SDC.1	X			X		X	X				
FDP_SDI.2				X				X			
FPT_PHP.3				X			X				
FDP_ITT.1				X			X		X		
FPT_ITT.1				X			X		X		
FDP_IFC.1				X	X				X		

SFR / SF	SF_PMODE	SF_AUDIT_STORAGE	SF_AUTHENT	SF_CONF_INT	SF_EXEC	SF_MEM_ACCESS	SF_PHY_PRO	SF_ALARM	SF_RANDOM	SF_RNG	SF_SEC_LOAD
FCS_RNG.1/PTG.2										X	
FIA_API.1			X								
FMT_LIM.1/Loader											X
FMT_LIM.2/Loader											X
FTP_ITC.1			X								
FDP_UCT.1											X
FDP_UIT.1											X
FDP_ACC.1/Loader			X			X					X
FDP_ACF.1/Loader			X			X					X
FDP_ACC.1/Memory	X					X					
FDP_ACF.1/Memory	X					X					
FMT_MSA.3						X					
FMT_MSA.1						X					
FMT_SMF.1						X					

Table 9: Mapping SFR - SF

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).

As Table 8 shows, all other dependencies of functional requirements are fulfilled by security requirements defined in this Security Target.

The discussion in Section 6.3.1 has shown, how the security functional requirements support each other in meeting the security objectives of this Security Target. In particular the security functional requirements providing resistance of the hardware against manipulations (e. g. FPT_PHP.3) support all other more specific security functional requirements (e. g. FCS_RNG.1) because they prevent an attacker from disabling or circumventing the latter.

The dependency of **FDP_ACF.1/Loader** on FMT_MSA.3 isn't necessary because the security attributes used to enforce the Loader SFP are fixed by the IC manufacturer and no new objects under control of the Loader SFP are created.

The dependency FMT_SMR.1 introduced by the two components **FMT_MSA.1** and **FMT_MSA.3** is considered to be satisfied because the access control specified for the intended TOE is not role-based but enforced for each subject. Therefore, there is no need to identify roles in form of a security functional requirement FMT_SMR.1.

7.3. Architectural Design Summary

Since the Security Target claims the assurance requirement ASE_TSS.2, the Security Target has to contain architectural information. The objective is to provide potential consumers of the TOE with a high-level view of how the TOE protects itself against interference, logical tampering and bypass.

7.3.1. Protection against interference and logical tampering

Interference and logical tampering can be used to get access to the sensitive assets. The threat is the modification or the observation of internal data by untrusted subjects.

Interference

Interference consists in interfering with the TSF in order to get access to the assets.

The TOE is protected from interference by the following security mechanisms: filters, monitors and sensors that control the operating conditions (see section 7.2.6).

Logical tampering

Logical tampering consists in getting access to the assets by a logical mean.

For this TOE, logical tampering may be used on:

- The access control.
- The subset information flow control.

The access control is protected by the following security mechanism: “Memory Access Control”.

The subset information flow control is protected by the following security mechanisms dealing with the memories protection: “Memories encryption”, “Address scrambling” and “Memory & Bus & Register Integrity”.

7.3.2. Protection against bypass

Non-bypassability is a property that the security functionality as specified by the SFRs is always invoked.

The bypass of the TSF can be caused by a physical perturbation on the IC. Protection against this kind of bypass is insured by “Active Shield” and by monitors and sensors that control the operating conditions (see section 7.2.6).

Another protection mechanism is the protection against the modification of data in memories, buses and registers: “Memory & Bus & Register Integrity”.

Switching back from User Mode to Test Mode could also be a way to get more privilege and bypass some TSF. The product is protected from bypass by the security domains separation. Only one security domain is available to the user: the Operational Domain corresponding to the User Mode. Switching back from User Mode to Test Mode is not possible after the deployment of the product. The security domain separation is enforced by the following security mechanism: “Product Mode”.

8. Glossary

Application Data	All data managed by the Security IC Embedded Software in the application context. Application data comprise all data in the final Security IC.
Authentication reference data	Data used to verify the claimed identity in an authentication procedure.
Authentication verification data	Data used to prove the claimed identity in an authentication procedure.
Composite Product Integrator	Role installing or finalizing the IC Embedded Software and the applications on platform transforming the TOE into the impersonalized Composite Product after TOE delivery. The TOE Manufacturer may implement IC Embedded Software delivered by the Security IC Embedded Software Developer before TOE delivery (e.g. if the IC Embedded Software is implemented in ROM or is stored in the non-volatile memory as service provided by the IC Manufacturer or IC Packaging Manufacturer).
Composite Product Manufacturer	The Composite Product Manufacturer has the following roles (i) the Security IC Embedded Software Developer (Phase 1), (ii) the Composite Product Integrator (Phase 5) and (iii) the Personaliser (Phase 6). If the TOE is delivered after Phase 3 in form of wafers or sawn wafers (dice) he has the role of the IC Packaging Manufacturer (Phase 4) in addition. The customer of the TOE Manufacturer who receives the TOE during TOE Delivery. The Composite Product Manufacturer includes the Security IC Embedded Software developer and all roles after TOE Delivery up to Phase 6 (refer to Figure 2 on page 11 and Section 7.1.1 of the BSI-PP-CC-0084-2014 [5]).
End-consumer	User of the Composite Product in Phase 7.
IC Dedicated Software	IC proprietary software embedded in a Security IC (also known as IC firmware) and developed by the IC Developer. Such software is required for testing purpose (IC Dedicated Test Software) but may provide additional services to facilitate usage of the hardware and/or to provide additional services (IC Dedicated Support Soft-ware).
IC Dedicated Test Software	That part of the IC Dedicated Software (refer to above) which is used to test the TOE before TOE Delivery but which does not provide any functionality thereafter.
IC Dedicated Support Software	That part of the IC Dedicated Software (refer to above) which provides functions after TOE Delivery. The usage of parts of the IC Dedicated Software might be restricted to certain phases.
Initialisation Data	Initialisation Data defined by the TOE Manufacturer to identify the TOE and to keep track of the Security IC's production and further life-cycle phases are considered as belonging to the TSF data. These data are for instance used for traceability and for TOE identification (identification data). If "Package Authentication of the Security IC" is used the Initialisation data contain the confidential authentication verification data of the IC. If the "Package 2: Loader dedicated for usage by authorized users only" the Initialisation data may contain the authentication verification data or key material for the trusted channel between the TOE and the authorized users using the Loader.

Integrated Circuit (IC)	Electronic component(s) designed to perform processing and/or memory functions.
Non-Volatile Registers (NVR)	The NVRs are made of Flash areas, each NVR having its own usage, encryption or scrambling, and access rights depending on product mode.
Pre-personalisation Data	Any data supplied by the Card Manufacturer that is injected into the non-volatile memory by the Integrated Circuits manufacturer (Phase 3). These data are for instance used for traceability and/or to secure shipment between phases. If “Package 2: Loader dedicated for usage by authorized users only” is used the Pre-personalisation Data may contain the authentication reference data or key material for the trusted channel between the TOE and the authorized users using the Loader.
Security IC	(as used in this Security Target) Composition of the TOE, the Security IC Embedded Software, user data of the Composite TOE and the package (the Security IC carrier).
Security IC Embedded Software	Software embedded in a Security IC and normally not being developed by the IC Designer. The Security IC Embedded Software is designed in Phase 1 and embedded into the Security IC in Phase 3 or in later phases of the Security IC product life-cycle. Some part of that software may actually implement a Security IC application others may provide standard services. Nevertheless, this distinction doesn’t matter here so that the Security IC Embedded Software can be considered as being application dependent whereas the IC Dedicated Software is definitely not.
Security IC Product	Composite product which includes the Security Integrated Circuit (i.e. the TOE) and the Embedded Software and is evaluated as composite target of evaluation in the sense of the CC Supporting Document
Secured Environment	Operational environment maintains the confidentiality and integrity of the TOE as addressed by OE.Process-Sec-IC and the confidentiality and integrity of the IC Embedded Software, TSF data or user data associated with the smartcard product by security procedures of the smartcard product manufacturer, personaliser and other actors before delivery to the smartcard end-user depending on the smartcard life-cycle.
Test Features	All features and functions (implemented by the IC Dedicated Test Software and/or hardware) which are designed to be used before TOE Delivery only and delivered as part of the TOE.
TOE Delivery	The period when the TOE is delivered which is (refer to Figure 2 on page 11 of the BSI-PP-CC-0084-2014 [5]) either (i) after Phase 3 (or before Phase 4) if the TOE is delivered in form of wafers or sawn wafers (dice) or (ii) after Phase 4 (or before Phase 5) if the TOE is delivered in form of packaged products.
TOE Manufacturer	The TOE Manufacturer must ensure that all requirements for the TOE (as defined in Section 1.2.2 of the BSI-PP-CC-0084-2014 [5]) and its development and production environment are fulfilled (refer to Figure 2 on page 11 of the BSI-PP-CC-0084-2014 [5]). The TOE Manufacturer has the following roles: (i) IC Developer (Phase 2) and (ii) IC Manufacturer (Phase 3). If the TOE is delivered after Phase 4 in form of packaged products, he has the role of the (iii) IC Packaging Manufacturer (Phase 4) in addition.

TSF data	Data for the operation of the TOE upon which the enforcement of the SFR relies. They are created by and for the TOE, that might affect the operation of the TOE. This includes information about the TOE's configuration, if any is coded in non-volatile non-programmable memories (ROM), in non-volatile programmable memories (for instance EEPROM or flash memory), in specific circuitry or a combination thereof.
User data of the Composite TOE	All data managed by the Smartcard Embedded Software in the application context.
User data of the TOE	Data for the user of the TOE, that does not affect the operation of the TSF. From the point of view of TOE defined in this Security Target the user data comprises the Security IC Embedded Software and the user data of the Composite TOE.

Log of changes		
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Written by	F. MORIER	Security Manager		31 Jan 2022
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