Public

Common Criteria Information Technology Security Evaluation

STRONGV2P0 of S5E9840 with Specific IC Dedicated Software

Version 1.0

17th February 2022

ST(Security Target) Lite

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Chip Handling Guide

Precaution against Electrostatic Discharge

When using semiconductor devices, ensure that the environment is protected against static electricity:

1. Wear antistatic clothes and use earth band.
2. All objects that are in direct contact with devices must be made up of materials that do not produce static electricity.
3. Ensure that the equipment and work table are earthed.
4. Use ionizer to remove electron charge.

Contamination

Do not use semiconductor products in an environment exposed to dust or dirt adhesion.

Temperature/Humidity

Semiconductor devices are sensitive to:

- Environment
- Temperature
- Humidity

High temperature or humidity deteriorates the characteristics of semiconductor devices. Therefore, do not store or use semiconductor devices in such conditions.

Mechanical Shock

Do not to apply excessive mechanical shock or force on semiconductor devices.

Chemical

Do not expose semiconductor devices to chemicals because exposure to chemicals leads to reactions that deteriorate the characteristics of the devices.

Light Protection

In non- Epoxy Molding Compound (EMC) package, do not expose semiconductor IC to bright light. Exposure to bright light causes malfunctioning of the devices. However, a few special products that utilize light or with security functions are exempted from this guide.

Radioactive, Cosmic and X-ray

Radioactive substances, cosmic ray, or X-ray may influence semiconductor devices. These substances or rays may cause a soft error during a device operation. Therefore, ensure to shield the semiconductor devices under environment that may be exposed to radioactive substances, cosmic ray, or X-ray.

EMS (Electromagnetic Susceptibility)

Strong electromagnetic wave or magnetic field may affect the characteristic of semiconductor devices during the operation under insufficient PCB circuit design for Electromagnetic Susceptibility (EMS).

Revision History

Revision No.	Date	Description
1.0	17th February 2022	Creation for initial version

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List of Conventions

Register RW Access Type Conventions

Type	Definition	Description
R	Read Only	The application has permission to read the Register field. Writes to read-only fields have no effect.
W	Write Only	The application has permission to write in the Register field.
RW	Read & Write	The application has permission to read and writes in the Register field. The application sets this field by writing 1'b1 and clears it by writing 1'b0.

Register Value Conventions

Expression	Description
x	Undefined bit
X	Undefined multiple bits
?	Undefined, but depends on the device or pin status
Device dependent	The value depends on the device
Pin value	The value depends on the pin status

Reset Value Conventions

Expression	Description
0	Clears the register field
1	Sets the register field
x	Don't care condition

Warning: Some bits of control registers are driven by hardware or write operation only. As a result the indicated reset value and the read value after reset might be different.

List of Terms

Terms	Descriptions
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.
Composite Product Integrator	Role installing or finalising the IC Embedded Software and the applications on platform transforming the TOE into the unpersonalised 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.
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 Software).
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).
Integrated Circuit (IC)	Electronic component(s) designed to perform processing and/or memory functions.
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.
Security IC	Composition of the TOE, the Security IC Embedded Software, User Data 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 Supporting Document
TOE Delivery	The period when the TOE is delivered which is 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 and its development and production environment are fulfilled. 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 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 specific circuitry, in non-volatile programmable memories (for instance E2PROM) or a combination thereof.
User data	All data managed by the Security IC Embedded Software in the application context. User data comprise all data in the final Security IC except the TSF data.

List of Acronyms

Acronyms	Descriptions
CC	Common Criteria
EAL	Evaluation Assurance Level
IT	Information Technology
PP	Protection Profile
ST	Security Target
TOE	Target of Evaluation
TSC	TSF Scope of Control
TSF	TOE Security Feature
TSFI	TSF Interface
TSP	TOE Security Policy
ECC	Error Correction Code

1 ST INTRODUCTION

1 This introductory chapter contains the following sections:

1.1 Security Target and TOE Reference

1.2 TOE Overview and TOE Description

1.3 Interfaces of the TOE

1.4 TOE Intended Usage

1.1 Security Target and TOE Reference

2 The Security Target Lite version is 1.0 and dated 17th February 2022
The Security Target Lite is strictly compliant to

3 [5] Eurosmart Security IC Platform Protection Profile with Augmentation Packages, Version 1.0, BSI-CC-PP-0084-2014.

4 The Protection Profile and the Security Target are built on *Common Criteria version 3.1*.

- Title: Security Target Lite of STRONGV2P0 of S5E9840 with Specific IC Dedicated Software
- TOE: Revision 1.1
- Target of Evaluation: STRONGV2P0 of S5E9840 with Specific IC Dedicated Software
- Provided by: Samsung Electronics Co., Ltd.
- Common Criteria version:

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

6 [2] Common Criteria, Part 2: Common Criteria for Information Technology Security Evaluation,Part2: Security Functional Components, Version 3.1, Revision 5, April 2017, CCMB-2017-04-002

7 [3] Common Criteria, Part 3: Common Criteria for Information Technology Security Evaluation, Part 3: Security Assurance Components, Version 3.1, Revision 5, April 2017, CCMB-2017-04-003

8 [4] Common Methodology for Information Technology Security Evaluation, Evaluation Methodology, Version 3.1, Revision 5, April 2017, CCMB-2017-04-004

1.2 TOE Overview and TOE Description

1.2.1 Introduction

9 The Target of Evaluation (TOE), the STRONGV2P0 secure subsystem is a Hard macro instantiated within an SOC which is composed of a processing unit, security components, hardware circuit for testing purpose during the manufacturing process and volatile and non-volatile memories (hardware). The TOE also includes any IC Designer/Manufacturer proprietary IC Dedicated Software as long as it physically exists in an STRONGV2P0 after being delivered by the IC Manufacturer. Such software (also known as IC bootloader/firmware) is used for providing additional services to facilitate the usage of the hardware and/or to provide additional services, a random number generation library and a random number generator. All other software is called Security IC Embedded Software and is not part of the TOE. The Security IC Embedded Software is initially stored in encrypted form in external NVM (Flash). The SoC S5E9840 is necessary to operate the STRONGV2P0 but it is not TOE hardware.

1.2.2 TOE Definition

10 The TOE is a Secure Sub-Systems implemented in a SoC which is designed and packaged specially for mobile applications.

11 The CORTEX-M35P CPU architecture of STRONGV2P0 follows the Harvard architecture, that is, it has separate program and data memories. Using those separate memory access paths, both instruction and data can be fetched simultaneously without causing a stall.

12 The main security features of the **TOE** are:

- Security sensors or detectors including High and Low Temperature detectors, High and Low Supply Voltage detectors, Supply Voltage Glitch detector and Laser detector
- Shields against physical intrusive attacks
- Dedicated hardware mechanisms against side-channel attacks
- Secure TDES and AES Symmetric Cryptography support
- ECC/ Parity / CRC-32 calculators
- One Hardware Digital True Random Number Generator (DTRNG) that fulfills Test Procedure A specified by AIS31 standard.
- The IC Dedicated Software includes:
  - DTRNG library built around Hardware DTRNG together with corresponding DTRNG application notes. This library fulfills the criteria of Test Procedure A specified by AIS31 standard.
  - Secure Boot Loader is a loader for copying the embedded software from an external FLASH storage into the internal SRAM

13 The above main security features are part of the evaluation scope.

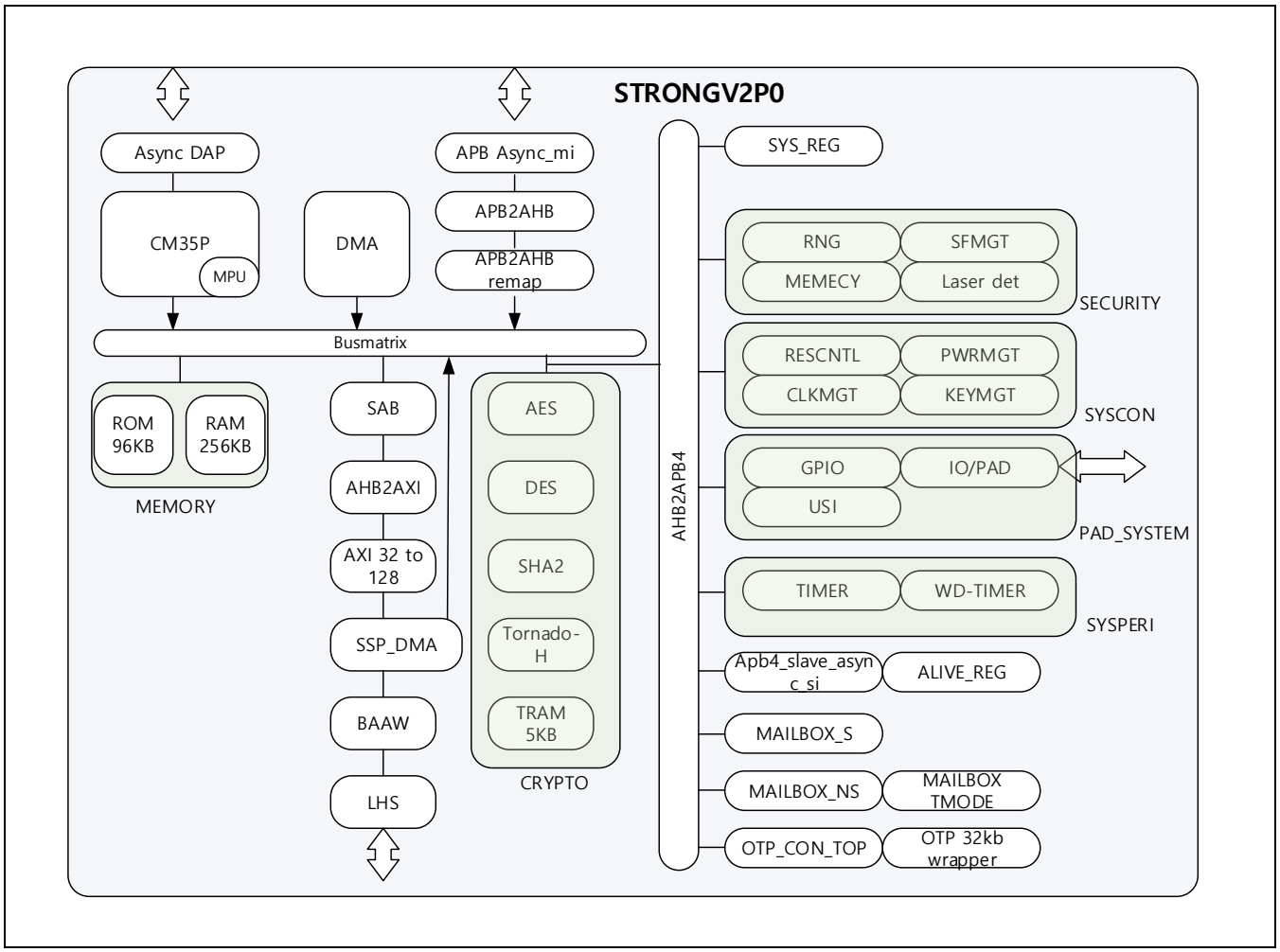


Figure 0-1. TOE(STRONGV2P0) Block Diagram

NOTE: TOE contains DES co-processor but Single DES is not in evaluation scope. DES co-processor is used to implement Triple DES that is in the evaluation scope.

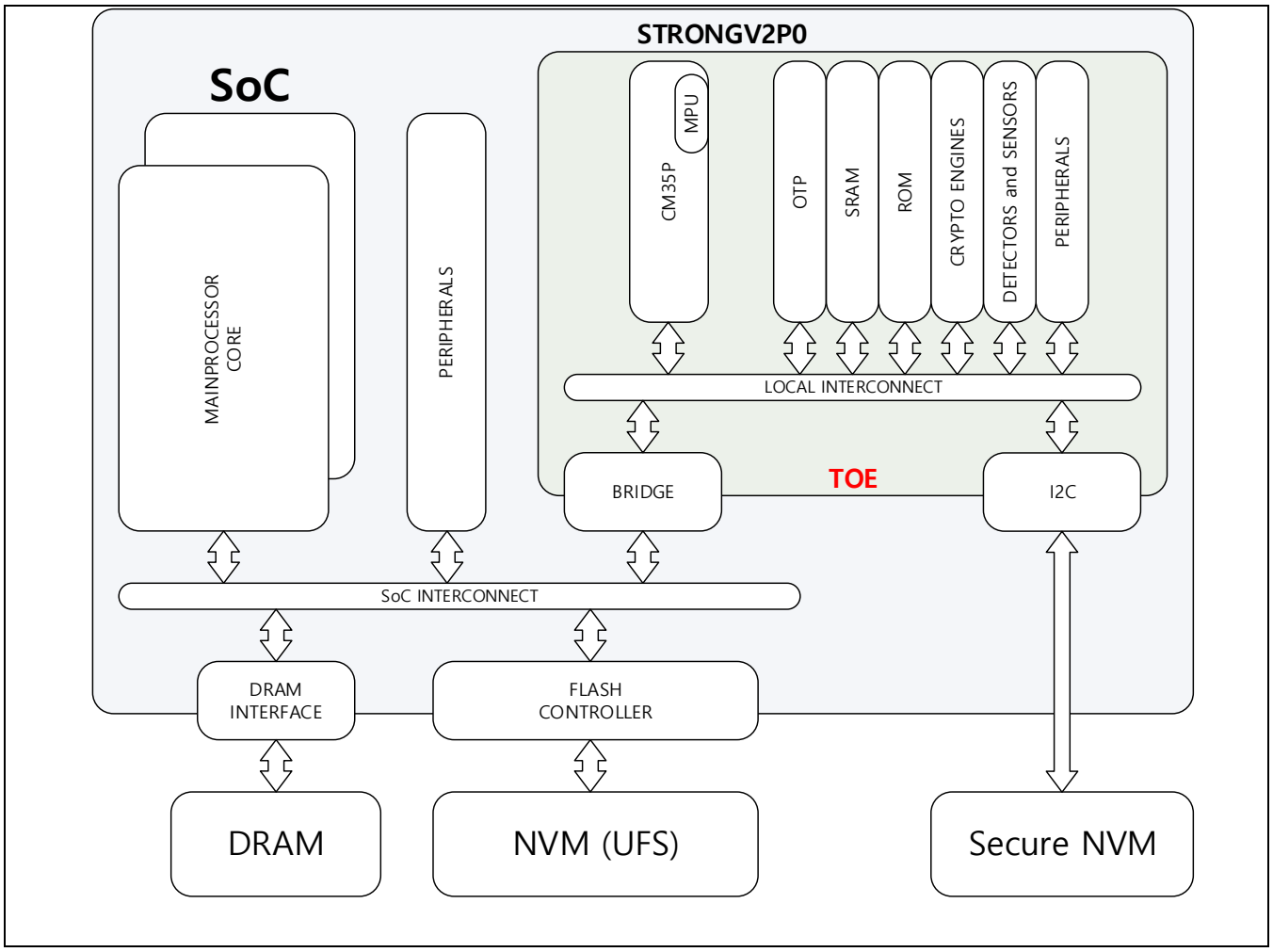


Figure 0-2. Overall Block Diagram of the SoC that includes TOE

14 Figure 0-**2**. shows the overall SoC block diagram.

15 The TOE consists of the following Hardware and Software:

TOE Hardware

- 32K-bit OTP storage/ 256K bytes SRAM/ 5K bytes CryptoRAM(TRAM) / 96K bytes ROM
- 32-bit Central Processing Unit (CPU)
- Memory Protection Unit (MPU) up to 4 GB
- Internal Voltage Regulator (IVR)
- Power on Reset
- Two Internal Clocks
- Detectors & Security Logic
- Bilateral Pseudo Random Number Generator (BPRNG). Used internally by the Secure Boot Loader, the security of this only in scope of evaluation under the specific usage of Secure Boot Loader.

- Digital True Random Number Generator (DTRNG)
- Triple DES cryptographic coprocessor with 112- or 168-bit key size
- AES cryptographic coprocessor with 128 bits, 192bits and 256bits key size
- TORNADO-H coprocessor supports a Montgomery type multiplication, a modular addition/subtraction, and a computation for the square of a Montgomery constant up to 4128-bit operand sizes. Used internally by the Secure Boot Loader for embedded software authentication, the security of this only in scope of evaluation under the specific usage of Secure Boot Loader.
- SHA. SHA-512 internally by the Secure Boot Loader for embedded software integrity check, the security this only in the scope of the evaluation under specific usage for Secure Boot Loader. SHA-256 and SHA384 out of the scope.
- ECC/ Parity / CRC-32 calculators
- Timers
- Mailbox to communicate with SOC main core

TOE Software

16 The TOE software comprises the following components:

- A Digital True Random Number Generator library (DTRNG library) that fulfills the criteria of Test Procedure A specified by AIS31 standard.

- Secure Boot Loader is a loader for copying the firmware in an external FLASH storage into the internal SRAM. Additionally, the Secure Boot Loader includes ROM APIs intended to support ES firmware. The ROM APIs are not part of the scope of the evaluation.

- The TOE configuration is summarized in table 1 below:

Item type	Item	Version	Form of delivery
Hard macro	STRONGV2P0 Hard macro, Secure Element Platform	1.1	Hard macro instantiated within an SOC packaged PoP
Hardware	Package SoC	1341-FCFBGA-14.0x15.4	PoP(Package-on-Package) with DRAM
Hardware	SoC S5E9840 embedding the STRONGV2P0 hard macro	1.1	SOC packaged PoP
Software	Secure Boot loader	1.5	Included in ROM of the STRONGV2P0
Software	DTRNG library (S5E9840_DTRNG_library_v2.0.lib)	2.0	Softcopy
Document	HW DTRNG and DTRNG Library Application Note (STRONGV2P0_DTRNG_Library_AN_v2.0.pdf)	2.0	Softcopy

Item type	Item	Version	Form of delivery
Document	Hardware User's manual (STRONGV2P0 of S5E9840 Hardware_UM_v0.7.pdf)	0.7	Softcopy
Document	Security Application Note (SAN_STRONGV2P0_v0.4.pdf)	0.4	Softcopy
Document	Chip Delivery Specification (DeliverySpec_S5E9840 Rev0.5.pdf)	0.5	Softcopy
Document	Bootloader User's Manual (STRONGV2P0_Secure_Boot Loader_Manual_v0.4.pdf)	0.4	Softcopy
Document	CPU Reference Manual (Cortex-M35P_Reference_Manual v0.0.pdf)	0.0	Softcopy

Address	Items	The value
Refer to the chapter 6 in Delivery specification	Device type	SSP01 of S5E9840: 0E 09 08 04 00 H
	SSP01 Hard macro Version	0x0001_0001
	SoC IC version	0x0001_0001
	Boot loader code version	0x0001_0005
	The SoC package's visual identification	2100

Table 1 TOE Configuration

1.2.3 TOE Features

17 CPU

- Cortex-M35P 32-bit core (MPU extension to 4GB)

18 Memory

- 96 KB MASK ROM (64 KB is for Samsung built-in boot loader and 32 KB for ROM API)
- 256 KB SRAM (general purpose)
- 5KB CryptoRAM (specially used for TORNADO-H operation, therefore user cannot use this area for general purpose)
- 32KB secure storage OTPK-bit secure storage OTP

19 Triple DES

- Built-in hardware Triple DES accelerator
- Circuit for resistance against SPA, DPA and safe error attacks
- ECB mode. Note: ECB Mode is not included in Agreed Cryptographic Mechanisms v1.2 document by SOG-IS

  Note: TDES algorithm is legacy in Agreed Cryptographic Mechanisms v1.2 document by SOG-IS. It is in scope for compatibility with composite that require use of TDES (i.e. banking, e-passport).

20 AES

- Built-in hardware AES accelerator
- Circuit for resistance against SPA, DPA and safe error attacks
- ECB mode. Note: ECB Mode is not included in Agreed Cryptographic Mechanisms v1.2 document by SOG-IS
- CBC mode. Used internally by the Secure Boot Loader, the security of the crypto service for the user is not in the scope of the evaluation.
- CTR mode (out of scope)
- GCM mode (out of scope)

21 TORNADO-H

- Built-in hardware accelerator for big number calculation. Used internally by the Secure Boot Loader for embedded software authentication, the security of this only in scope of evaluation under the specific usage of Secure Boot Loader.

22 Abnormal Condition Detectors

23 Interrupts

- Nested Vector Interrupt Controller: 32ea
- SYSTICK

24 Reset and Power Down Mode

25 Random Number Generator

- A Digital True Random Number Generator (DTRNG):
- A Bilateral Pseudo Random Number Generator (BPRNG): no compliance to any specific metric. Used internally by the Secure Boot Loader, the security of this only in scope of evaluation under the specific usage of Secure Boot Loader.

26 Memory Protection Unit

27 Memory Encryption and Bus Scrambling

28 Timers

- 16-Bit Timer programmable interval timers
- 20-bit Watchdog Timer

29 CRC

- 32bit - CRC32

30 Clock Sources

31 HASH

- SHA256/384/512 based on HASH standard-NIST FIPS 180-4. SHA-512 internally by the Secure Boot Loader for embedded software integrity check, the security this only in the scope of the evaluation under specific usage for Secure Boot Loader. SHA-256 and SHA384 out of the scope.

32 Operating Voltage Range

- 1.8V+-5%

33 Operating Temperature

- - 25°C to 85°C Ta

34 Physically isolated Power sources

35 Mailbox to communicate with external component (application processor, external memories)

36 SecureDMA

37 Package on package

- 1341-FCFBGA-14.0x15.4

1.2.4 TOE Life cycle

38 The complex development and manufacturing processes of a Composite Product can be separated into seven distinct phases. The phases 2, 3 and 4 of the Composite Product life cycle cover the IC development and production:

Site / Building	Phase
Hwasung Plant/ DSR Building	Phase 2
Giheung Plant/ SR3 Building	Phase 2
Hwasung Plant/ Line S3	Phase 3
Hwasung Plant/ MR2(NRD) Building	Phase 3
Giheung Plant/ Line 5	Phase 3
Giheung Plant/ Line 2	Phase 3
Onyang Plant/ Warehouse	Phase 4
Onyang Plant/ Line 2	Phase 3+4

Table 3 Sites of the TOE life cycle

- IC Development (Phase 2):
  - IC design,
  - IC Dedicated Software development

- the IC Manufacturing (Phase 3):
  - Integration and photomask fabrication,
  - IC production,
  - IC testing,
  - preparation and
  - Pre-personalisation if necessary

39 The Composite Product life cycle phase 4 is included in the evaluation of the IC:

- the IC Packaging (Phase 4):
  - Security IC packaging (and testing),
  - Pre-personalisation if necessary

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

- Security IC Embedded Software Development (Phase 1),
- the Composite Product finishing process, preparation and shipping to the personalisation line for the

Composite Product (Composite Product Integration Phase 5),

- the Composite Product Personalisation and testing stage where the User Data 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.

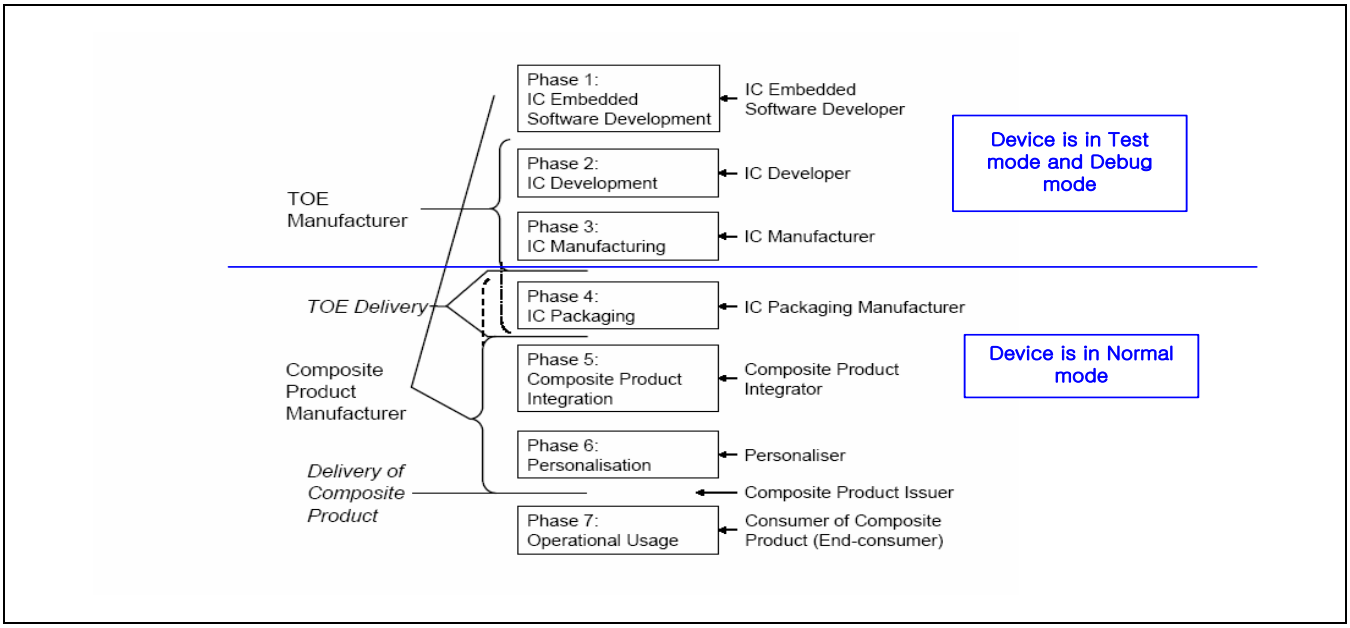


Figure 2 Definition of "TOE Delivery" and responsible Parties

41 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. The TOE is packaged in Phase 4.

1.3 Interfaces of the TOE

42 TOE has the following interfaces:

- The physical interface of the TOE with the external environment is the entire surface of the STRONGV2P0
- The electrical interface of the TOE with the external environment is XOTP_SSP_VPP, XSSP_DET, XSSP_BGR, AVDD18_LDO_SSP, AVDD18_OTP_SSP, VDD075_ALIVE.
- The data interface of the TOE is made of Mailbox and Secure DMA
- The software interface of the TOE with the hardware consists of Special Function Registers (SFR) and CPU instructions
- The DTRNG interface of the TOE is defined by the DTRNG libraries interface
- The Bootloader interface

1.4 TOE Intended Usage

43 The TOE is dedicated to applications such as:

- Cryptographic operations such as AES encryption and decryption, TDES/3DES encryption and decryption, and random number generation

2 CONFORMANCE CLAIMS

44 This chapter 2 contains the following sections:

2.1 CC Conformance Claim

45 This Security target claims to be conformant to the Common Criteria version 3.1 R5.

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

47 This Security Target has been built with the Common Criteria for Information Technology Security Evaluation; Version 3.1 which comprises

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

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

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

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

48 has been taken into account.

2.2 PP Claim

49 This Security Target is strictly compliant to the Security IC Platform Protection Profile [5]. The Security IC Platform Protection Profile is registered and certified by the Bundesamt für Sicherheit in der Informationstechnik (BSI) under the reference BSI-CC-PP-0084, Version 1.0, dated 01.2014

50 This ST does not claim conformance to any other PP.

2.3 Package Claim

51 The assurance level for this Security Target is EAL5 augmented with AVA_VAN.5 and ALC_DVS.2.

52 This Security Target is strictly compliant to the Security IC Platform Protection Profile [5] with additional packages:

- Package "Authentication of the Security IC"
- Package 2: Loader dedicated for usage by authorized users only

2.4 Conformance Claim Rationale

53 This security target claims strict conformance only to one PP, the Security IC Platform Protection Profile [5].

54 The Evaluation Assurance Level (EAL) of the PP [5] is EAL 5 augmented with the assurance components ALC_DVS.2 and AVA_VAN.5. The Assurance Requirements of the TOE obtain the Evaluation Assurance Level 5 augmented with the assurance components ALC_DVS.2 and AVA_VAN.5 for the TOE.

55 The Target of Evaluation (TOE) is a complete solution implementing a security integrated circuit (security IC) as defined in the PP [5] section 1.2.2, so the TOE is consistent with the TOE type in the PP [5].

56 The security problem definition of this security target is consistent with the statement of the security problem definition in the PP [5], as the security target claimed strict conformance to the PP [5]. Additional threats, organizational security policies and assumptions are introduced in chapter 3 of this ST, a rationale is given in chapter 4.4.

57 The security objectives of this security target are consistent with the statement of the security objectives in the PP [5], as the security target claimed strict conformance to the PP [5]. Additional security objectives are added in chapter 4.1 of this ST, a rationale is given in chapter 4.4.

58 The security requirements of this security target are consistent with the statement of the security requirements in the PP [5], as the security target claimed strict conformance to the PP [5]. Additional security requirements are added in chapter 6.1 of this ST, a rationale is given in chapter 6.3. All assignments and selections of the security functional requirements are done in the PP [5] and in this security target section 6.

3 SECURITY PROBLEM DEFINITION

59 This chapter 3 contains the following sections:

3.1 Description of Assets

60 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.

61 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.

62 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.

63 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.

64 If User Data is stored in external FLASH memory, the security IC shall protect it in confidentiality before exporting it outside the TOE Hardware and storing it in external FLASH memory. The security IC shall implement security mechanisms to protect User Data of the Composite TOE in integrity, confidentiality, authenticity and actuality if stored in external FLASH memory. It is considered as a security service provided by the TOE for the Security IC Embedded Software.

65 The Protection Profile[5] 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 as described in the annexe 7 of the protection profile or define TOE specific 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.

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

- SC4 deficiency of random numbers.

67 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.

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

69 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 (refer to Section 1.2.4) 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 (cf. [8] for details on assessment of knowledge of the TOE in the vulnerability analysis).

70 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.

71 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

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

3.2 Threats

73 The following explanations help to understand the focus of the threats and objectives defined below. For example, certain attacks are only one step towards a disclosure of assets, others may directly lead to a compromise of the application security.

- Manipulation of user data (which includes user data and code of the Composite TOE, stored in or processed by the Security IC) means that an attacker is able to alter a meaningful block of data. This

should be considered for the threats T.Malfunction, T.Phys-Manipulation and T.Abuse-Func

- Disclosure of user data (which may include user data and code of the Composite TOE, stored in protected memory areas or processed by the Security IC) or TSF data means that an attacker is realistically able to determine a meaningful block of data. This should be considered for the threats T.Leak-Inherent, T.Phys-Probing, T.Leak-Forced and T.Abuse-Func.
- Manipulation of the TSF or TSF data means that an attacker is able to deliberately deactivate or otherwise change the behaviour of specific security functionality in a manner which enables exploitation. This should be considered for the threat T.Malfunction, T.Phys-Manipulation and T.Abuse-Func.

74 The cloning of the functional behaviour of the Security IC on its physical and command interface is the highest level security concern in the application context. This should be considered for the threat T.Masquerade_TOE.

75 The cloning of that functional behaviour requires to (i) develop a functional equivalent of the Security IC Embedded Software, (ii) disclose, interpret and employ the user data of the Composite TOE stored in the TOE, and (iii) develop and build a functional equivalent of the Security IC using the input from the previous steps.

76 The Security IC is a platform for the Security IC Embedded Software which ensures that especially the critical user data of the Composite TOE are stored and processed in a secure way (refer to below). The Security IC Embedded Software must also ensure that critical user data of the Composite TOE are treated as required in the application context. In addition, the personalisation process supported by the Security IC Embedded Software (and perhaps by the Security IC in addition) must be secure. This last step is beyond the scope of this security target. As a result the threat "cloning of the functional behaviour of the Security IC on its physical and command interface" is averted by the combination of mechanisms which split into those being evaluated according to this security target (Security IC) and those being subject to the evaluation of the Security IC Embedded Software or Security IC and the corresponding personalisation process. Therefore, functional cloning is indirectly covered by the security concerns and threats described below.

77 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.

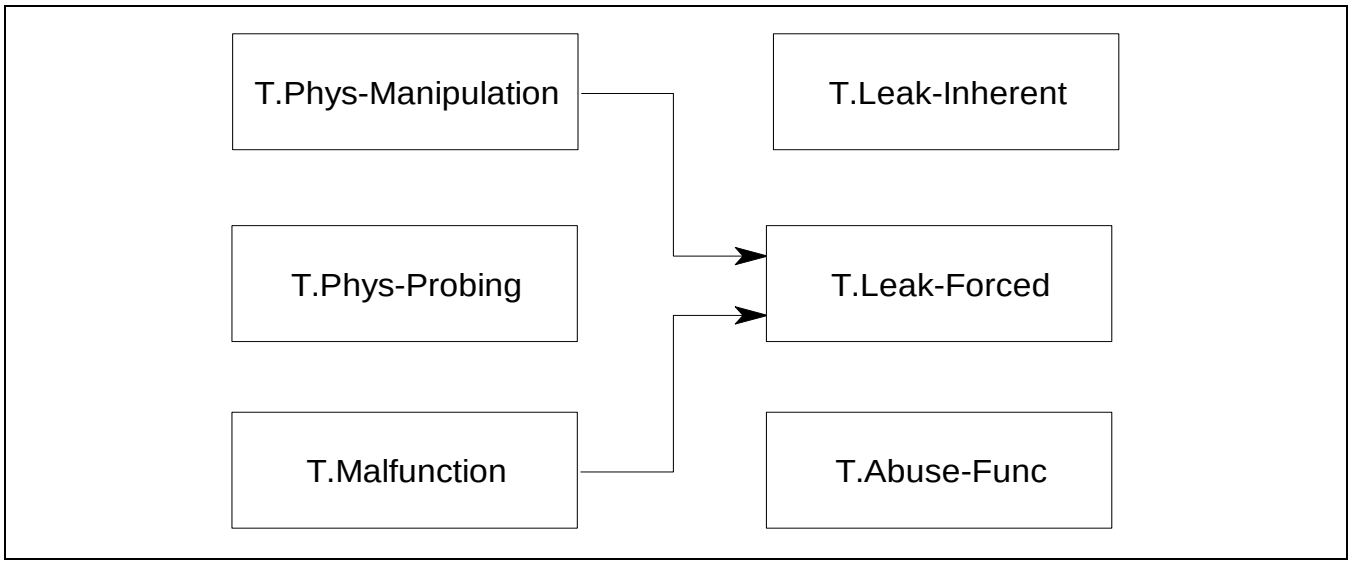


Figure 3 Standard Threats

78 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).

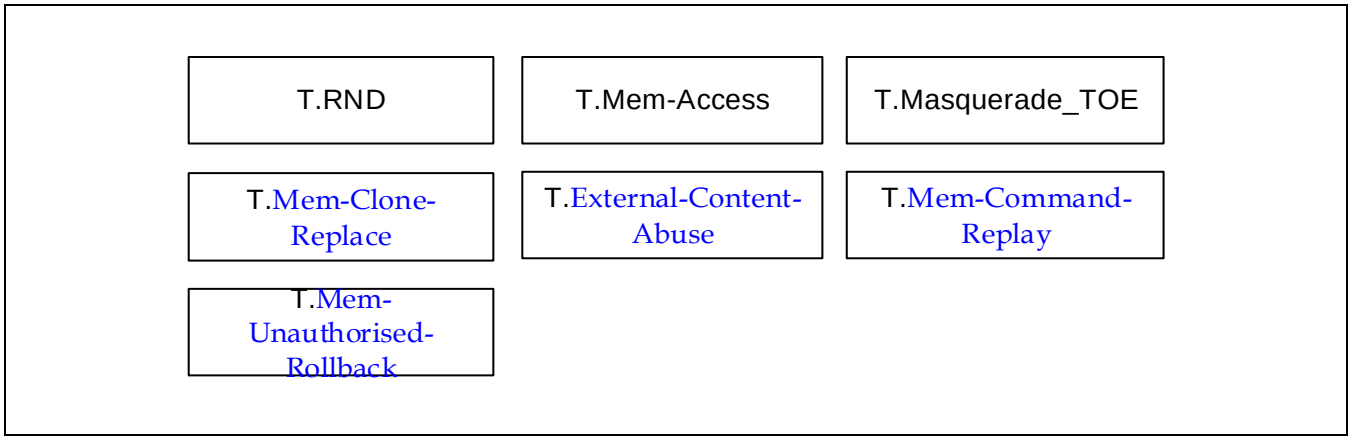


Figure 4 Threats related to security service

79 The Security IC Embedded Software must contribute to averting the threats: At least it must not undermine the security provided by the TOE.

80 The above security concerns are derived from considering the end-usage phase (Phase 7) since

- Phase 1 and the Phases from TOE Delivery up to the end of Phase 6 are covered by assumptions and
- the development and production environment starting with Phase 2 up to TOE Delivery are covered by an organisational security policy.

81 The TOE's countermeasures are designed to avert the threats described below. Nevertheless, they may be effective in earlier phases (Phases 4 to 6).

82 The TOE is exposed to different types of influences or interactions with its outer world. Some of them may result from using the TOE only but others may also indicate an attack. The different types of influences or

interactions are visualised in Figure 5. Due to the intended usage of the TOE all interactions are considered as possible.

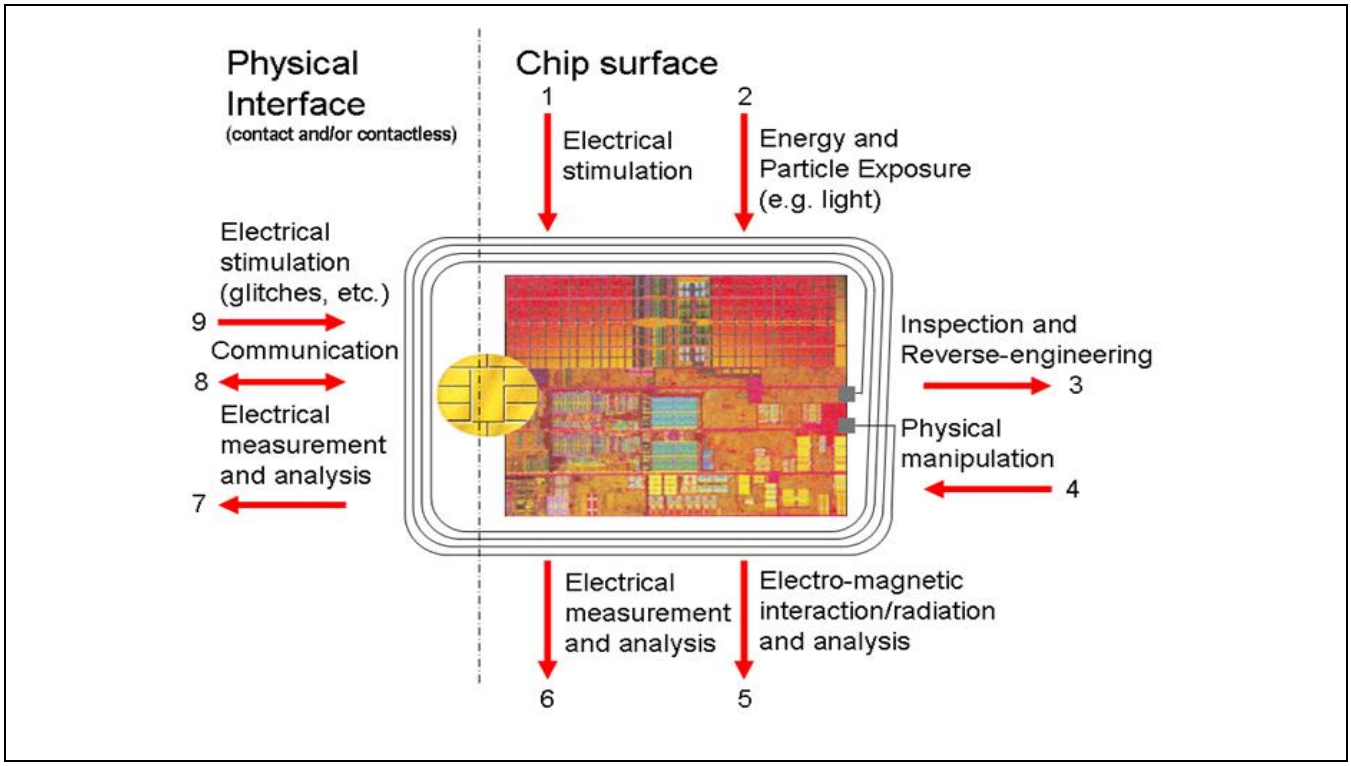


Figure 5 Interactions between the TOE and its outer world

83 An interaction with the TOE can be done through the physical interfaces (Number 7 – 9 in Figure 5) which are realised using contacts and/or a contactless interface. Influences or interactions with the TOE also occur through the chip surface (Number 1 – 6 in Figure 5). In Number 1 and 6 galvanic contacts are used. In Number 2 and 5 the influence (arrow directed to the chip) or the measurement (arrow starts from the chip) does not require a contact. Number 3 and 4 refer to specific situations where the TOE and its functional behaviour is not only influenced but definite changes are made by applying mechanical, chemical and other methods (such as 1, 2). Many attacks require a prior inspection and some reverse-engineering (Number 3). This demonstrates the basic building blocks of attacks. A practical attack will use a combination of these elements.

3.2.1 Standard Threats

84 The TOE shall avert the threat "Inherent Information Leakage (T.Leak-Inherent)" as specified below.

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.

85 No direct contact with the Security IC internals is required here. Leakage may occur through emanations, variations in power consumption, I/O characteristics, clock frequency, or by changes in processing time requirements. One example is the Differential Power Analysis (DPA). This leakage may be interpreted as a covert channel transmission but is more closely related to measurement of operating parameters, which may be derived either from direct (contact) measurements (Numbers 6 and 7 in Figure 5) or measurement

of emanations (Number 5 in Figure 5) and can then be related to the specific operation being performed.

86 The TOE shall avert the threat "Physical Probing (T.Phys-Probing)" as specified below.

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.

87 Physical probing requires direct interaction with the Security IC internals (Numbers 5 and 6 in Figure 5). Techniques commonly employed in IC failure analysis and IC reverse engineering efforts may be used. Before that hardware security mechanisms and layout characteristics need to be identified (Number 3 in Figure 5). Determination of software design including treatment of user data of the Composite TOE may also be a pre-requisite.

88 This pertains to "measurements" using galvanic contacts or any type of charge interaction whereas manipulations are considered under the threat "Physical Manipulation (T.Phys-Manipulation)". The threats "Inherent Information Leakage (T.Leak-Inherent)" and "Forced Information Leakage (T.Leak-Forced)" may use physical probing but require complex signal processing in addition.

89 The TOE shall avert the threat "Malfunction due to Environmental Stress (T.Malfunction)" as specified below.

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 (Numbers 1, 2 and 9 in Figure 5).

90 The modification of security services of the TOE may e.g. affect the quality of random numbers provided by the random number generator up to undetected deactivation when the random number generator does not produce random numbers and the Security IC Embedded Software gets constant values. In another case errors are introduced in executing the Security IC Embedded Software. To exploit this an attacker needs information about the functional operation, e.g. to introduce a temporary failure within a register used by the Security IC Embedded Software with light or a power glitch.

91 The TOE shall avert the threat "Physical Manipulation (T.Phys-Manipulation)" as specified below.

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.

92 The modification may be achieved through techniques commonly employed in IC failure analysis (Numbers 1, 2 and 4 in Figure 5) and IC reverse engineering efforts (Number 3 in Figure 5). The modification may result in the deactivation of a security feature. Before that hardware security mechanisms and layout characteristics need to be identified. Determination of software design including treatment of user data of the Composite TOE may also be a pre-requisite. Changes of circuitry or data can be permanent or temporary.

93 In contrast to malfunctions (refer to T.Malfunction) the attacker requires gathering significant knowledge about the TOE's internal construction here (Number 3 in Figure 5).

94 The TOE shall avert the threat "Forced Information Leakage (T.Leak-Forced)" as specified below:

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.

95 This threat pertains to attacks where 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 (Numbers 5, 6, 7 and 8 in Figure 5) which normally do not contain significant information about secrets.

96 The TOE shall avert the threat "Abuse of Functionality (T.Abuse-Func)" as specified below.

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 the user data of the Composite TOE or the Security IC Embedded Software.

3.2.2 Threats related to security services

97 The TOE shall avert the threat "Deficiency of Random Numbers (T.RND)" as specified below.

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.

An attacker may gather information about the random numbers produced by the TOE security service. Because unpredictability is the main property of random numbers this may be a problem in case they are used to generate cryptographic keys. The entropy provided by the random numbers must be appropriate for the strength of the cryptographic algorithm, the key or the cryptographic variable is used for. Here the attacker is expected to take advantage of statistical properties of the random numbers generated by the

TOE. Malfunctions or premature ageing are also considered which may assist in getting information about random numbers.

3.2.3 Threats related to additional TOE Specific Functionality

98 The TOE shall avert the additional threat "Memory Access Violation (T.Mem-Access)" as specified below.

T.Mem-Access	Memory Access Violation Parts of the Security IC 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 Security IC Embedded Software.

Clarification: This threat does not address the proper definition and management of the security rules implemented by the Security IC Embedded Software, this being software design and correctness issue. This threat addresses the reliability of the abstract machine targeted by the software implementation. To avert the threat, the set of access rules provided by this TOE should be undefeated if operated according to the provided guidance. The threat is not realized if the Security IC Embedded Software is designed or implemented to grant access to restricted information. It is realized if an implemented access denial is granted under unexpected conditions or if the execution machinery does not effectively control a controlled access.

Here the attacker is expected to (i) take advantage of flaws in the design and/or the implementation of the TOE memory access rules (refer to T.Abuse-Func but for functions available after TOE delivery), (ii) introduce flaws by forcing operational conditions (refer to T.Malfunction) and/or by physical manipulation (refer to T.Phys-Manipulation). This attacker is expected to have a high level potential of attack.

99 The TOE shall avert the threat "Cloning the TOE with a Copy of the external memory (T.Mem-Clone-Replace)" as specified below.

T.Mem-Clone-Replace	Cloning or replacement of external memory An attacker may attempt to clone the full content of the external memory or a specific memory area storing User Data of the TOE and write it to the external memory used by a different unit; alternatively, an attacker may physically replace the external memory used by a TOE with a different memory that may come from a different unit.

This threat refers to the case where partial or full content of the external memory is cloned to a different device. It can also cover the replacement of the physical external memory used by the TOE with the memory of a different unit. The second case might not be viable on some architectures or memory when the physical design or assembly procedures impede it.

The effect of this threat is in replacing the data and/or image of a TOE with a different one and to obtain a valid but unauthorised instance of the TOE.

This threat involves using two different TOE units or instances. One TOE unit is used as a source for the external memory content. This content is used to replace the genuine content of the external memory of the second TOE unit.

Another possible scenario for this threat can be contemplated for passive external non-volatile memory:

the external non-volatile memory is replaced with an empty or virgin non-volatile memory, removing the user and TSF data used by the TOE, and possibly forcing the TSF to generate new user and TSF data, potentially affecting the TSF behavior.

100 The TOE shall avert the threat "Abuse of external memory content (T.External-Content-Abuse)" as specified below.

T.External-Content-Abuse	Abuse of external memory content An attacker may attempt to access for disclosing or modifying the content of the external memory used by the TOE. Thereby an attacker may compromise confidentiality and/or integrity of TSF data and/or user data that shall be protected by the TOE.

An attacker may obtain unauthorised access to the external memory and attempt to read, disclose, modify or replace the content of the external memory. This threat addresses also the authenticity of the data stored in the external memory.

Note that the access to the external memory or the transfer of data between the TOE and the external memory may also support an attack.

101 The TOE shall avert the threat "Replay of commands between the TOE and the external memory (T.Mem-Command-Replay)" as specified below.

T.Mem-Command-Replay	Replay of commands between the TOE and the external memory An attacker may attempt to replay the write and erase commands or responses to the read commands between the TOE and the passive external memory, to affect the freshness of the content read from or written to the external memory.

The read, write and erase commands issued by the TOE to exercise the storage functionality of the external memory, and their payloads, can be intercepted by an attacker (e.g. eavesdrop the commands on the link between the TOE and the external memory). Such attacker may use copies of these commands to try to misuse the TOE or compromise data. The command replay attack can take the following forms:

- The attacker reacts on a read command and replies a previously recorded answer e.g. to a previous read request. Thereby the TOE gets an old version of such content.
- The attacker issues a previous write command, trying to overwrite the external memory with the previous content, leading to the TOE obtaining old versions of such content in later read operations.
- The attacker issues a previous erase command, trying to overwrite status information or other data that may lead to misuse for the TOE.

102 The TOE shall avert the threat "Unauthorised rollback of content in the external memory (T.Mem-Unauthorised-Rollback)" as specified below.

T.Mem-Unauthorised-Rollback	Unauthorised rollback of content in the external memory An attacker may attempt to read the content of the external memory, record it, and later write it back to the external memory after the original content were updated by the TOE.

This threat takes advantage of the fact that the external memory is not integrated into the TOE. Hence, physical protections for preventing the replacement of content may not cover the external memory. This situation enables an attacker to read and write the content of the external memory. Even if the confidentiality and integrity of the external memory content is protected, the replacement with an old copy may be valid as well, since it is retrieved from the external memory.

If the TOE image is stored in an external non-volatile memory, this threat may lead to an unauthorised rollback of the TOE image to an older version. Even when the TOE stores data and not code in the external memory, this data rollback might affect the behavior of the TSF.

The replacement of content stored in the external memory with previous versions of it may refer to the full content of the external memory or partial content of it, depending on the organization and protection of the data stored in the external memory.

3.2.4 Threats related to Authentication of the Security IC

103 The TOE shall avert the threat "Masquerade the TOE (T. Masquerade_TOE)" as specified below.

T.Masquerade_TOE Masquerade the TOE

An attacker may threaten the property being a genuine TOE by producing a chip which is not a genuine TOE but wrongly identifying itself as genuine TOE sample.

The threat T.Masquerade_TOE may threaten the unique identity of the TOE as described in the P.Process-TOE or the property as being a genuine TOE without unique identity. Mitigation of masquerade requires tightening up the identification by authentication.

3.3 Organizational Security Policies

104 The following Figure 6 shows the policies applied in this Security Target.

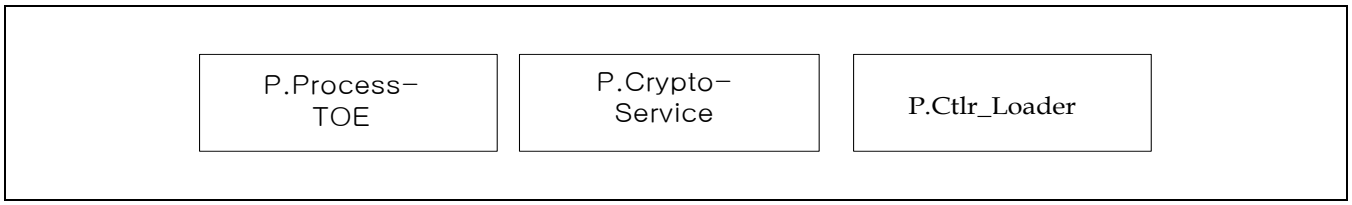


Figure 6 Policies

105 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.

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

107 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, Security IC Embedded Software, Initialisation Data and Pre-personalisation Data,
- 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.

108 The TOE provides specific cryptographic services which can be used by the Security IC Embedded Software. In the following specific cryptographic services are listed which is not derived from threats identified for the TOE's environment because it can only be decided in the context of the Security IC applications, against which threats the Security IC Embedded Software will use the specific cryptographic service.

The IC Developer / Manufacturer must apply the policy "Cryptographic Service (P.Crypto-Service)" as specified below.

P.Crypto-Service	Cryptographic Services provided by the TOE The TOE shall provide the following cryptographic services to the IC Embedded Software: ● Triple Data Encryption Standard (TDES) ● Advanced Encryption Standard (AES)

The organizational security policy "Controlled usage to Loader Functionality (P.Ctlr_Loader)" applies to Loader dedicated for usage by authorized users only.

P.Ctlr_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

109 The following Figure 7 shows the assumptions applied in this Security Target.

Figure 7 Assumptions

110 The intended usage of the TOE is twofold, depending on the Life Cycle Phase: (i) The Security IC Embedded Software developer use it as a platform for the Security IC software being developed. The Composite Product Manufacturer (and the consumer) uses it as a part of the Security IC. The Composite Product is used in a terminal which supplies the Security IC (with power and clock) and (at least) mediates the communication with the Security IC Embedded Software.

111 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.

112 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.

113 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

114 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.

115 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.

116 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). This document will be provided for the evaluation of the composite product. 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.

117 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.

118 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.

119 The developer of the Security IC Embedded Software must ensure the appropriate “Usage of Key-dependent Functions (A.Key-Function)” while developing this software in Phase 1 as specified below.

A.Key-Function	Usage of Key-dependent Functions Key-dependent functions (if any) shall be implemented in the Security IC Embedded Software in a way that they are not susceptible to leakage attacks (as described under T.Leak-Inherent and T.Leak-Forced).

120 Note that here the routines which may compromise keys when being executed are part of the Security IC Embedded Software. In contrast to this the threats T.Leak-Inherent and T.Leak-Forced address (i) the cryptographic routines which are part of the TOE and (ii) the processing of User Data including cryptographic keys.

4 SECURITY OBJECTIVES

121 This chapter Security Objectives contains the following sections:

4.1 *Security Objectives for the TOE*

4.2 *Security Objectives for the Security IC* Embedded Software

4.3 *Security Objectives for the* operational Environment

4.4 *Security Objectives Rationale*

4.1 Security Objectives for the TOE

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

- SG1 maintain the integrity 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.

123 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.

124 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 8). Note that the integrity of the TOE is a means to reach these objectives.

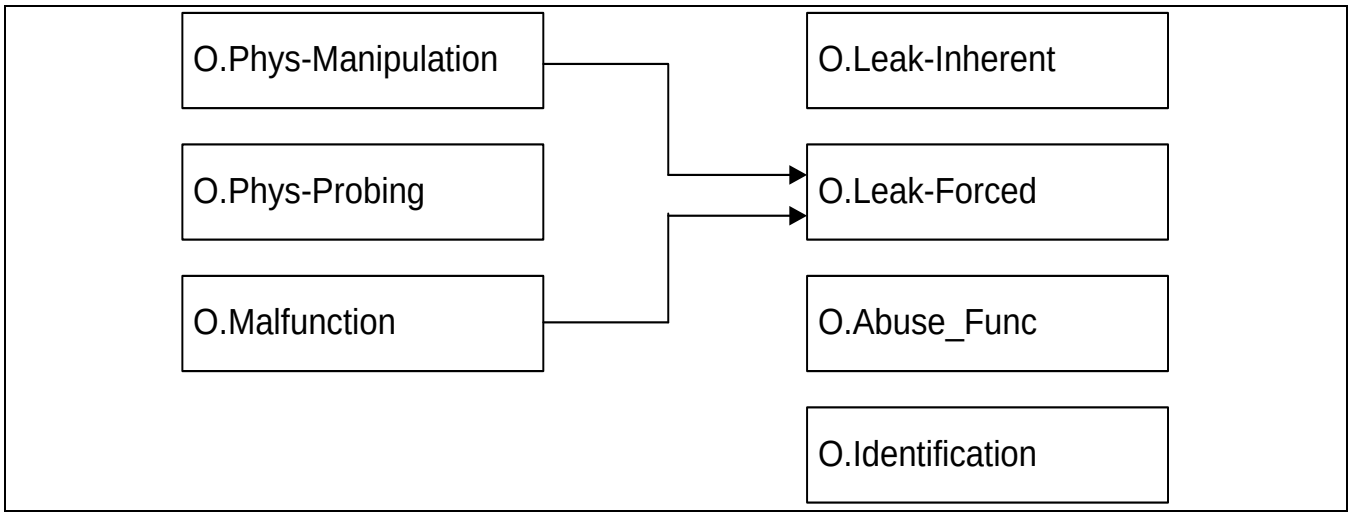


Figure 8 Standard Security Objectives

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

- SG4 provide random numbers.

126 The additional high-level security considerations are refined below by defining security objectives as required by the Common Criteria (refer to Figure 9).

127

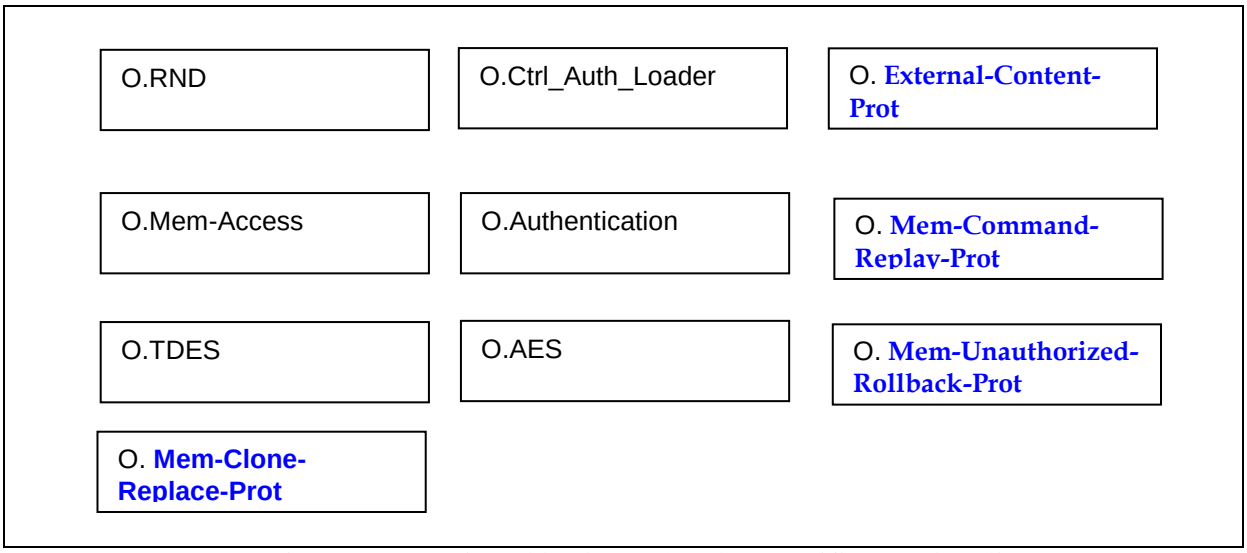


Figure 9 Security Objectives related to Specific Functionality

4.1.1 Standard Security Objectives

128 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 (User Data or TSF 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.

129 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.

130 The TOE shall provide "Protection against Malfunctions (O.Malfunction)" as specified below.

O.Malfunction Protection against Malfunctions

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.

131 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.

132 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.

133 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.

134 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.

4.1.2 Security Objectives related to Specific Functionality (referring to SG4)

135 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 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.

4.1.3 Security Objectives for Added Function

136 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 Security IC 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.

137 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 confidentiality protection, replay protection and authentication of the user data to be loaded and access control for usage of the Loader functionality.

138 The TOE shall provide "Cryptographic service Triple-DES (O.TDES)" as specified below.

O.TDES Cryptographic service Triple-DES

The TOE provides secure hardware based cryptographic services implementing the Triple-DES for encryption and decryption.

139 The TOE shall provide "Cryptographic service AES (O.AES)" as specified below.

O.AES Cryptographic service AES

The TOE provides secure hardware based cryptographic services for the AES for encryption and decryption.

140 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.

141 The TOE shall provide "Protection of external Content (O.External-Content-Protect)" as specified below.

O.External-Content-Prot Protection against disclosure and undetected modification of external

memory content

The content in the external memory must be protected against disclosure and undetected modification, because an attacker can directly access the external memory.

142 The TOE shall provide "Protection against replay of commands to store or modify data in external memory to the TOE (O.Mem-Command-Replay-Prot)" as specified below.

O.Mem-Command-Replay-Prot Protection against replay of commands to store or modify data in external memory to the TOE.

The TOE shall protect against replay of content during write, read and erase operations to the external memory by the TOE.

143 The TOE shall provide "Protection against an unauthorised rollback of external memory content (O.Mem-Unauthorized-Rollback-Prot)" as specified below.

O.Mem-Unauthorized-Rollback-Prot **Protection against an unauthorised rollback of external memory content.**

The TOE shall protect against replacement of the external memory content with a previous version, even if it was valid in the past.

144 The TOE shall provide "Protection against external memory cloning or replacement (O.Mem-Clone-Replace-Prot)" as specified below.

O.Mem-Clone-Replace-Prot **Protection against external memory cloning or replacement.**

The TOE shall protect against cloning or replacement of user data with user data stored in the memory of another instance of the TOE and against replacement of the external memory with the one from another instance of the TOE.

4.2 Security Objectives for the Security IC Embedded Software

145 The development of the Security IC Embedded Software is outside the development and manufacturing of the TOE. 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.

146 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.

4.2.1 Clarification of "Treatment of User Data of the Composite TOE(OE.Resp-Appl)"

147 Regarding the cryptographic services this objective of the environment has to be clarified. By definition cipher or plain text data and cryptographic keys are User Data. The Security IC Embedded Software shall treat these data appropriately, use only proper secret keys (chosen from a large key space) as input for the cryptographic function of the TOE and use keys and functions appropriately in order to ensure the strength of cryptographic operation.

148 This means that keys are treated as confidential as soon as they are generated. The keys must be unique with a very high probability, as well as cryptographically strong. If keys are imported into the TOE and/or derived from other keys, quality and confidentiality must be maintained. This implies that appropriate key management has to be realised in the environment.

149 Regarding the area based access control this objective of the environment has to be clarified. The treatment of User Data of the Composite TOE is also required when a multi-application operating system is implemented as part of the Security IC Embedded Software on the TOE. In this case the multi-application operating system should not disclose security relevant user data of one application to another application when it is processed or stored on the TOE.

4.3 Security Objectives for the Operational Environment

150 TOE Delivery up to the End of Phase 6

151 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 must be protected appropriately.

152 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 support the trusted communication channel with the TOE by confidentiality protection and authenticity proof of the data to be loaded and fulfilling the access conditions required by the Loader

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.

4.3.1 Clarification of "Protection during Composite Product Manufacturing (OE.Process-Sec-IC)"

153 The protection during finishing and personalization includes also the personalization process and the personalization data during Phase 5 and Phase 6.

154 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.

4.4 Security Objectives Rationale

155 Table 4 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 Objective	Notes
A.Resp-Appl	OE.Resp-Appl	Phase 1
P.Process-TOE	O.Identification	Phase 2 – 3 optional Phase 4
A.Process-Sec-IC	OE.Process-Sec-IC	Phase 5 – 6 optional Phase 4
T.Leak-Inherent	O.Leak-Inherent	
T.Phys-Probing	O.Phys-Probing	
T.Malfunction	O.Malfunction	
T.Phys-Manipulation	O.Phys-Manipulation	
T.Leak-Forced	O.Leak-Forced	
T.Abuse-Func	O.Abuse-Func	
T.RND	O.RND	
T.Mem-Access	O.Mem-Access	
P.Crypto-Service	O.TDES O.AES	
A.Key-Function	OE.Resp-Appl	
P.Ctlr_Loader	O.Ctrl_Auth_Loader OE.Loader_Usage	
T.Masquerade_TOE	O.Authentication OE.TOE_Auth	
T.External-Content-Abuse	O.External-Content-Prot	
T.Mem-Command-Replay	O.Mem-Command-Replay-Prot	
T.Mem-Unauthorised-Rollback	O.Mem-Unauthorized-Rollback-Prot	
T.Mem-Clone-Replace	O.Mem-Clone.Replace-Prot	

Table 4 Security Objectives versus Assumptions, Threats or Policies

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

157 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.

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

159 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 paragraph 78. 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.

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

161 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.

162 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:

163 For all threats the corresponding objectives are stated in a way, which directly corresponds to the description of the threat. It is clear from the description of each objective, 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.

164 The justification related to the threat "Memory Access Violation (T.Mem-Access)" is as follows:

165 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 Security IC Embedded Software. Thereby security violations caused by accidental or deliberate access to restricted data (which may include code) can be prevented (refer to T.Mem-Access). The threat T.Mem-Access is therefore removed if the objective is met.

166 The clarification of O.Mem-Access makes clear that it is up to the Security IC Embedded Software to implement the memory management scheme by appropriately administrating the TSF. The TOE shall provide access control functions as a means to be used by the Security IC Embedded Software. This is further emphasised by the clarification of Treatment of User Data of the Composite TOE(OE.Resp-Appl) which reminds that the Security IC Embedded Software must not undermine the restrictions it defines. Therefore, the clarifications contribute to the coverage of the threat T.Mem-Access. .

167 Compared to Security IC Platform Protection Profile a clarification has been made for the security objective "Treatment of User Data of the Composite TOE(OE.Resp-Appl)": By definition cipher or plain text data and cryptographic keys are User Data. So, the Security IC Embedded Software will protect such data if required and use keys and functions appropriately in order to ensure the strength of cryptographic operation. Quality and confidentiality must be maintained for keys that are imported and/or derived from other keys. This implies that appropriate key management has to be realised in the environment. That is expressed by the assumption A.Key—Function which is covered from OE.Resp–Appl. These measures make sure that the assumption A.Resp-Appl is still covered by the security objective OE.Resp-Appl.

168 The organisational security policy "Controlled usage to Loader Functionality (P.Ctlr_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)".

169 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.

170 The justification related to the security objectives O.TDES and O.AES are followings: Since these objectives require the TOE to implement the same specific security functionality as required by P.Crypto-Service, the organization security policy is covered by the objective.

171 T.External-Content-Abuse is countered by O. External-Content-Prot, which requires the TOE to prevent disclosure and undetected modification of the content stored in external memory.

172 T.Mem-Command-Replay is countered by O.Mem-Command-Replay-Prot as follows:

O.Mem-Command-Replay-Prot requires protection against replay of commands exported from the TOE in the external NVM mitigating T.Mem-Command-Replay.

173 T.Mem-Unauthorised-Rollback is countered by O.Mem-Unauthorized-Rollback-Prot as follows:

O.Mem-Unauthorized-Rollback-Prot requires that the TOE protects against replacement of external memory content with older content of the same external memory, where the data freshness property is not met, thus, mitigating this threat.

174 T.Mem-Clone-Replace is countered by O.Mem-Clone-Replace-Prot, which requires the TOE to detect the replacement of the external memory content with one of a different TOE's memory, or physical replacement of the external memory with the external memory of a different instance of the TOE.

5 EXTENDED COMPONENTS DEFINITION

175 This chapter 5 Extended Components Definition contains the following sections:

5.1 Definition of the family FCS_RNG

5.2 Definition of the Family FMT_LIM

5.3 Definition of the Family FAU_SAS

5.4 Definition of the Family FDP_SDC

5.5 Definition of the Family FIA_API

5.6 Definition of the Family FDP_SDR

5.7 Definition of the Familyt FDP_URC

5.1 Definition of the Family FCS_RNG

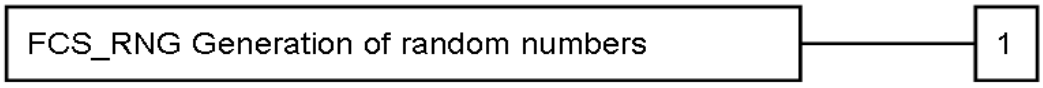
176 To define the IT security functional requirements of the TOE an additional family (FCS_RNG) of the Class FCS (cryptographic support) is defined here. This family describes the functional requirements for random number generation used for cryptographic purposes.

FCS_RNG Generation of Random Numbers

Family behaviour

This family defines quality requirements for the generation of random numbers which are intended to be used 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

177 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 appropriate to address the specific issues of preventing the abuse of functions by limiting the capabilities of the functions and by limiting their availability.

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

FMT_LIM Limited capabilities and availability

Family behaviour

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

Component levelling:

FMT_LIM.1	Limited capabilities requires that the TSF is built to provide only the capabilities (perform action, gather information) necessary for its genuine purpose.
FMT_LIM.2	Limited availability requires that the TSF restrict the use of functions (refer to Limited capabilities (FMT_LIM.1)). This can be achieved, for instance, by removing or by disabling functions in a specific phase of the TOE's life-cycle.
Management:	FMT_LIM.1, FMT_LIM.2 There are no management activities foreseen.
Audit:	FMT_LIM.1, FMT_LIM.2 There are no actions defined to be auditable.

179 The TOE Functional Requirement "Limited capabilities (FMT_LIM.1)" is specified as follows.

FMT_LIM.1	Limited capabilities
Hierarchical to:	No other components.
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 [assignment: *Limited capability policy*].
Dependencies:	FMT_LIM.2 Limited availability.

180 The TOE Functional Requirement "Limited availability (FMT_LIM.2)" is specified as follows.

FMT_LIM.2	Limited availability
Hierarchical to:	No other components.
FMT_LIM.2.1	The TSF shall be designed in a manner that limits its availability so that in conjunction with "Limited capabilities (FMT_LIM.1)" the following policy is enforced [assignment: *Limited availability policy*].
Dependencies:	FMT_LIM.1 Limited capabilities.
Application note:	The functional requirements FMT_LIM.1 and FMT_LIM.2 assume that there are two types of mechanisms (limitation of capabilities and limitation of availability) which together shall provide protection in order to enforce the same policy or two mutual supportive policies related to the same functionality. This allows e.g. that (i) the TSF is provided without restrictions in the product in its user environment but its capabilities are so limited that the policy is enforced or conversely (ii) the TSF is designed with high functionality but is removed or disabled in the product in its user environment.

5.3 Definition of the Family FAU_SAS

181 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.

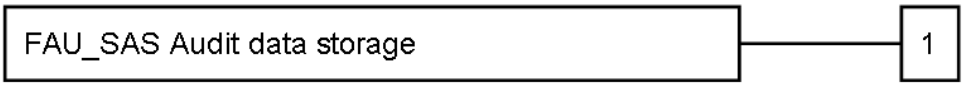
182 The family "Audit data storage (FAU_SAS)" is specified as follows.

FAU_SAS Audit data storage

Family behaviour

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.

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*].

Dependencies: No dependencies.

5.4 Definition of the Family FDP_SDC

183 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.

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

FDP_SDC.1 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 leveling

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

185 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.

186 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 (cf. [3], chapter "Extended components definition (APE_ECD)") from a TOE point of view.

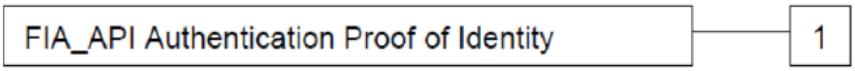
187 The family "Authentication Proof of Identity (FIA_API)" is specified as follows.

FIA_API.1 Authentication Proof of Identity

Family behaviour

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

Component levelling



FIA_API.1 Authentication Proof of Identity, provides 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.

5.6 Definition of the Family FDP_SDR

To define security requirements of the TOE an additional family (FDP_SDR) of Class FDP (User data protection) is defined here. This family describes the functional requirements for Stored Data Replay Protection.

FDP_SDR Stored Data Replay Protection

Family behavior

This family provides requirements that address protection of user data against replay attack while these data are stored within memory areas protected by the TSF.

Component leveling

FDP_SDR.1	Management of user data allows TSF components to manage user data.
Management:	FDF_SDR.1 There are no management activities foreseen.
Audit:	FDP_SDR.1 There are no audit activities foreseen.
FDP_SDR.1	**management of user data by TSF components**
Hierarchical to:	No other components
Dependencies:	No dependencies
FDP_SDR.1.1	The TSF shall detect replay of the information of user data while it is stored in the [assignment: memory area].

5.7 Definition of the Family FDP_URC

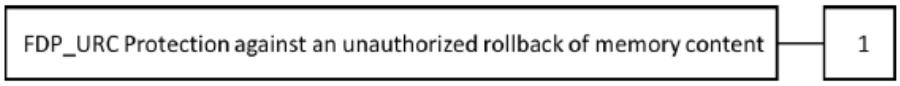
The Protection Profile defines the additional family (FDP_URC) of the Class FDP (User data protection) to verify the freshness of data stored in a physically separated memory. This family defines mechanisms to determine whether the content read from a physically separated memory meets the property of data freshness, by verifying that they are those resulting from the latest authorized operation (write or erase) of the TSF that modifies the content in the physically separated memory. If the content read from the physically separated memory cannot be uniquely linked to the latest write or erase operation executed by the TSF, the data freshness property is not met, and the read data is rejected.

FDP_URC Protection against an unauthorized rollback of memory content

Family behavior

This family defines functional requirements for the detection of an unauthorized rollback of content stored in the external memory.

Component Levelling



FDP_URC.1	Requires the TOE to protect against an unauthorized rollback of the content stored in the external memory.
Management	FDP_URC.1 There are no management activities foreseen.
Audit	FDP_URC.1 There are no actions defined to be auditable.

FDP_URC.1	**Protection against an unauthorized rollback of memory content**
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FDP_URC.1.1	The TOE shall detect an unauthorized replacement of the content stored in [assignment: physically separated memory] before the content is used. The detection shall be effective in any case where modification or read operation depends on the current content of this external memory.

FDP_URC.1.2 Upon detection of unauthorized rollback of the content stored in a physically separated memory, the TOE shall [selection: stop TOE operation, [assignment: other actions]]

6 IT security requirements

188 This chapter 6 IT Security Requirements contains the following sections:

6.1 Security Functional Requirements for the TOE

6.2 Security Assurance Requirements for the TOE

6.3 Security Requirements Rationale

6.1 Security Functional Requirements for the TOE

189 In order to define the Security Functional Requirements the Part 2 of Common Criteria and the Protection Profile [5] was used.

190 However, some Security Functional Requirements have been refined. The refinements are described below the associated SFR.

191 Please note that, the following conventions are used to state each Security Functional Requirement:

- Refinement operations are explicitly identified at the end of the SFR definition.
- Assignment operations are identified *italic*.
- Selection operations are identified by underline.
- Iteration is denoted by showing a slash "/".

6.1.1 Malfunctions

192 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
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)*.
Dependencies:	FPT_FLS.1 Failure with preservation of secure state
Refinement:	The term "failure" above means "circumstances". The TOE prevents failures for the "circumstances" defined above.
Application Note:	Environmental conditions include but are not limited to power supply, clock, and other external signals (e.g. reset signal) necessary for the TOE operation.

193 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.
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*.
Dependencies:	No dependencies
Refinement:	The term "failure" above also covers "circumstances". The TOE prevents failures for the "circumstances" defined above.
Application note:	The secure state is maintained by TOE's detectors. The TOE's detectors are

monitoring the failure occurs. The failures are abnormal frequency, abnormal voltage, abnormal temperature, and power glitch detectors that detect out of the specified range (refer to table 9). If the failures happen, the TOE goes into IRQ state. This satisfies the FPT_FLS.1 "Failure with preservation of secure state."

6.1.2 Abuse of Functionality

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

FMT_LIM.1/Test	Limited capabilities
Hierarchical to:	No other components.
FMT_LIM.1.1/Test	The TSF shall be designed and implemented in a manner that limits their capabilities so that in conjunction with "Limited availability (FMT_LIM.2/Test)" 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.*
Dependencies:	FMT_LIM.2/Test Limited availability.
FMT_LIM.1/Debug	Limited capabilities
Hierarchical to:	No other components.
FMT_LIM.1.1/Debug	The TSF shall be designed and implemented in a manner that limits their capabilities so that in conjunction with "Limited availability (FMT_LIM.2/Debug)" the following policy is enforced: *Deploying Debug 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.*
Dependencies:	FMT_LIM.2/Debug Limited availability.

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

FMT_LIM.2/Test	Limited availability
Hierarchical to:	No other components.
FMT_LIM.2.1/Test	The TSF shall be designed in a manner that limits their availability so that in conjunction with "Limited capabilities (FMT_LIM.1/Test)" 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.*
Dependencies:	FMT_LIM.1/Test Limited capabilities.

FMT_LIM.2/Debug	Limited availability
Hierarchical to:	No other components.
FMT_LIM.2.1/Debug	The TSF shall be designed in a manner that limits their availability so that in conjunction with "Limited capabilities (FMT_LIM.1/Debug)" the following policy is enforced: *Deploying Debug 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*.
Dependencies:	FMT_LIM.1/Debug Limited capabilities.

196 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.
FAU_SAS.1.1	The TSF shall provide *the test process before TOE Delivery* with the capability to store *the Initialisation Data and/or Prepersonalisation Data* in a *OTP*.
Dependencies:	No dependencies.
Application Note:	The integrity and uniqueness of the unique identification of the TOE must be supported by the development, production and test environment.

6.1.3 Physical Manipulation and Probing

197 The TOE shall meet the requirement "Stored data confidentiality (FDP_SDC.1)" as specified below (Common Criteria Part 2 extended).

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 *SRAM or ROM*.
Refinement:	The asset "user data" selected above has been refined to include "user data" and "TSF data".

198 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 ECC error or *Parity error* on all objects, based on the following attributes*: SRAM or TRAM or ROM read operation*.
Refinement:	The asset "user data" selected above has been refined to include "user data" and "TSF data".
FDP_SDI.2.2	Upon detection of a data integrity error, the TSF shall *enforce a device an interrupt (IRQ)*.
Application Note:	This requirement is achieved by security features such as memory encryption, bus scrambling, security detectors and memory access control.

199 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.
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.
Dependencies:	No dependencies.
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.
Application Note:	This requirement is achieved by security feature as the Active shield must be removed and bypassed in order to perform physical intrusive attacks. The TOE makes a IRQ occurs to stops operation if a physical manipulation or physical probing attack is detected. And also Static Address/Data scrambling for bus and memory & Synthesizable processor core make the reverse-engineering of the TOE layout unpractical. So these functionalities meet the security functional requirement of FPT_PHP.3: Resistance to physical attack.

6.1.4 Leakage

200 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.
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.

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

201 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.
FPT_ITT.1.1	The TSF shall protect TSF data from disclosure when it is transmitted between separate parts of the TOE.
Dependencies:	No dependencies.
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.

This requirement is equivalent to FDP_ITT.1 above but refers to TSF data instead of user data. Therefore, it should be understood as to refer to the same *Data Processing Policy* defined under FDP_IFC.1 below.

202 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.
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*.
Dependencies:	FDP_IFF.1 Simple security attributes

203 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.

6.1.5 Random Numbers (DTRNG)

204 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	Random number generation
Hierarchical to:	No other components.
FCS_RNG.1.1	The TSF shall provide a physical random number generator that implements *a health test of the raw random numbers.*

FCS_RNG.1.2	The TSF shall provide 32-bit random numbers that meet *the requirement that AIS31 statistical tests (Test Procedure A) does not distinguish the generated random numbers from output sequences of an ideal RNG.*
Dependencies:	No dependencies.
Application Note:	The DTRNG library comprises of a function that performs statistical tests on the DTRNG raw random numbers in order to check if DTRNG hardware is working properly. If the test fails, the function shall return an error value and the DTRNG shall be turned off. These functions are described in DTRNG Application note. Please note that, DTRNG is not strictly compliant with AIS31 PTG.2 class as defined in [13, 14]. It is only claimed that the generated random numbers from DTRNG shall pass AIS31 Test Procedure A specified in [14].

6.1.6 Memory Access Control

205 Usage of multiple applications in one Security IC often requires separating code and data in order to prevent that one application can access code and/or data of another application. To support the TOE provides Area based Memory Access Control.

206 The security service being provided is described in the Security Function Policy (SFP) Memory Access Control Policy. The security functional requirement "Subset access control (FDP_ACC.1)" requires that this policy is in place and defines the scope were it applies. The security functional requirement "Security attribute based access control (FDP_ACF.1)" defines addresses security attribute 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. The decision whether an access is permitted or not is taken based upon attributes allocated to the software. The user software defines the attributes and memory areas. The corresponding permission control information is evaluated "on-the-fly" by the hardware so that access is granted/effective or denied/inoperable.

207 The security functional requirement "Static attribute initialization (FMT_MSA.3)" ensures that the default values of security attributes are appropriately either permissive or restrictive in nature. Alternative values can be specified by any subject provided that the Memory Access Control Policy allows that. This is described by the security functional requirement "Management of security attributes (FMT_MSA.1)". The attributes are determined during TOE manufacturing (FMT_MSA.3) or set at run-time (FMT_MSA.1).

208 From TOE´s point of view the different roles in the user software can be distinguished according to the memory based access control. However the definition of the roles belongs to the user software.

209 The following Security Function Policy (SFP) Memory Access Control Policy is defined for the requirement "Security attribute based access control (FDP_ACF.1)":

Memory Access Control Policy

The TOE shall control read, write, delete, and execute accesses of software running at between two different modes (privilege and user mode) on data including code stored in memory areas.

The TOE shall restrict the ability to define, to change or at least to finally accept the applied rules (as mentioned in FDP_ACF.1) to software with privilege mode).

210 The TOE shall meet the requirement "Subset access control (FDP_ACC.1)" as specified below:

FDP_ACC.1 Subset access control

Hierarchical to:	No other components.
FDP_ACC.1.1	The TSF shall enforce *the Memory Access Control Policy* on *all subjects (software with privilege mode and user mode), all objects (data including code stored in memories) and all the operations defined in the Memory Access Control Policy.* *Subjects are software codes in Privilege and User mode.* *Objects are data stored in ROM, SRAM and OTP memories.*
Dependencies:	FDP_ACF.1 Security attribute based access control

211 The TOE shall meet the requirement "Security attribute based access control (FDP_ACF.1)" as specified below:

FDP_ACF.1	Security attribute based access control The attributes are all the operations related to the data stored in memories, which are *the read, write* and *execute* operations.
Hierarchical to:	No other components.
FDP_ACF.1.1	The TSF shall enforce the *Memory Access Control Policy* to objects based on the following: *memory area where the software is executed from and/or the memory area where the access is performed to and/or the operation to be performed*.
FDP_ACF.1.2	The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed: *evaluate the corresponding permission control information before the access so that accesses to be denied cannot be utilised by the subject attempting to perform the operation*.
FDP_ACF.1.3	The TSF shall explicitly authorise access of subjects to objects based on the following additional rules: *none*.
FDP_ACF.1.4	The TSF shall explicitly deny access of subjects to objects based on the following additional rules*: none*.
Dependencies:	FDP_ACC.1 Subset access control FMT_MSA.3 Static attribute initialisation

212 The TOE shall meet the requirement "Static attribute initialisation (FMT_MSA.3)" as specified below:

FMT_MSA.3	Static attribute initialisation
Hierarchical to:	No other components.
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 *any subject (provided that the Memory Access Control Policy is enforced and the necessary access is therefore allowed)* to specify alternative initial values to override the default values when an object or information is created.
Dependencies:	FMT_MSA.1 Management of security attributes FMT_SMR.1 Security roles

213 The TOE shall meet the requirement "Management of security attributes (FMT_MSA.1)" as specified below:

FMT_MSA.1	Management of security attributes
Hierarchical to:	No other components.
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 attributes *permission control information* to *running at privilege mode.*
Dependencies:	[FDP_ACC.1 Subset access control or FDP_IFC.1 Subset information flow control] FMT_SMF.1 Specification of management functions FMT_SMR.1 Security roles

214 The TOE shall meet the requirement "Specification of management functions (FMT_SMF.1)" as specified below:

FMT_SMF.1	Specification of management functions
Hierarchical to:	No other components
FMT_SMF.1.1	The TSF shall be capable of performing the following management functions: *access the control registers of the MPU*.
Dependencies:	No dependencies

6.1.7 Cryptographic Support

215 FCS_COP.1 Cryptographic operation requires, a cryptographic operation to be performed in accordance with a specified algorithm and with a cryptographic key of specified sizes. The specified algorithm and cryptographic key sizes can be based on an assigned standard.

216 The following additional specific security functionality is implemented in the TOE:

- Triple Data Encryption Standard (TDES) with 112bit or 168bit key size
- Advanced Encryption Standard (AES) with 128 bit, 192bit and 256bit key size

6.1.8 Triple-DES Operation

217 The Triple DES (TDES) operation of the TOE shall meet the requirement "Cryptographic operation (FCS_COP.1)" as specified below.

FCS_COP.1/TDES	Cryptographic operation – TDES

Hierarchical to:	No other components.
FCS_COP.1.1/TDES	The TSF shall perform *encryption and decryption* in accordance with a specified cryptographic algorithm *Triple Data Encryption Standard (TDES) - ECB mode* and cryptographic key sizes *112 bit or 168 bit key size* that meet the following: *[FIPS SP800-67], chapter 2 and 3. TOE implements TDES with key option 1 and 2 with ECB mode.*
Dependencies:	[FDP_ITC.1 Import of user data without security attributes or FDP_ITC.2 Import of user data with security attributes, or FCS_CKM.1 Cryptographic key generation] FCS_CKM.4 Cryptographic key destruction
Application Note:	ECB Mode is not included in Agreed Cryptographic Mechanisms v1.2 document by SOG-IS.

6.1.9 AES Operation

218 The AES operation of the TOE shall meet the requirement "Cryptographic operation (FCS_COP.1)" as specified below.

FCS_COP.1/AES	Cryptographic operation – AES
Hierarchical to:	No other components.
FCS_COP.1.1/AES	The TSF shall perform *encryption and decryption* in accordance with a specified cryptographic algorithm *Advanced Encryption Standard (AES) - ECB mode* and cryptographic key sizes *128bit, 192bit or 256bit key size* that meet the following standard: *[FIPS197], chapter 5*.
Dependencies:	[FDP_ITC.1 Import of user data without security attributes or FDP_ITC.2 Import of user data with security attributes or FCS_CKM.1 Cryptographic key generation] FCS_CKM.4 Cryptographic key destruction
Application Note:	ECB Mode is not included in Agreed Cryptographic Mechanisms v1.2 document by SOG-IS.

6.1.10 Bootloader

219 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.
FTP_ITC.1.1	The TSF shall provide a communication channel between itself and *the authorized user for using the Bootloader* that is logically distinct from other communication channels and provides assured identification of its end points and protection of the channel data from modification or disclosure.

FTP_ITC.1.2	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 Authentication sequence*.
Dependencies:	No dependencies.

220 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.
FDP_UCT.1.1	The TSF shall enforce the *Loader SFP* to receive user data in a manner protected from unauthorised disclosure.
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]

221 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.
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.
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]

222 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.
FDP_ACC.1.1/ Loader	The TSF shall enforce the *Loader SFP* on *(1) the subjects Authentication Sequence,*

(2) the objects user data in external FLASH memory

(3) the operation deployment of Loader

Dependencies: FDP_ACF.1 Security attribute based access control.

Application Note: The TOE enforces the Loader SFP by FTP_ITC.1, FDP_UCT.1 and FDP_UIT.1 and FDP_ACF.1 to describe additional access control rules.

223 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.
FDP_ACF.1.1/ Loader	The TSF shall enforce the *Loader SFP* to objects based on the following: *(1) the subjects Bootloader with security attributes SRAM loading.* *(2) the objects user data in external FLASH memory with security attributes SRAM loading.*
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: *Bootloader can do loading operation in SRAM after succession of Authentication.*
FDP_ACF.1.3/ Loader	The TSF shall explicitly authorize access of subjects to objects based on the following additional rules: *SRAM can be controlled based on security attributes ,which can be limited by Bootloader sequence.*
FDP_ACF.1.4/ Loader	The TSF shall explicitly deny access of subjects to objects based on the following additional rules: *Bootloader can't loading the SRAM without succession of Authentication.*
Dependencies:	FMT_MSA.3 Static attribute initialisation.
Application Note:	*Bootloader is only allowed in ROM Booting state.* The SRAM Booting state cannot access all Bootloader functions except ROM API functions.

6.1.11 Authentication Proof of Identity

224 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 an *authentication sequence of Bootloader* to prove the identity of the TOE to an external entity

6.1.12 Protected External Content

225 The TOE shall meet the requirement "Stored Data Replay Protection (FDP_SDR.1)" as specified below (Common Criteria Part 2 extended).

FDP_SDR.1	Stored Data Replay Protection
Hierarchical to:	No other components
Dependencies:	No dependencies
FDP_SDR.1.1	The TSF shall detect replay of the information of user data while it is stored in the *external memory outside the physical boundary of the TOE.*

226 The TOE shall meet the requirement "Data Authentication with Identity of Guarantor (FDP_DAU.2/PM)" as specified below.

FDP_DAU.2/PM	Data Authentication with Identity of Guarantor
Hierarchical to:	FDP_DAU.1 Basic Data Authentication
Dependencies:	FIA_UID.1 Timing of identification
FDP_DAU.2.1/PM	The TSF shall provide a capability to generate evidence that can be used as a guarantee of the validity of *data objects and containers stored in the external memory*
FDP_DAU.2.2/PM	The TSF shall provide *the TOE* with the ability to verify evidence of the validity of the indicated information and the identity of the user that generated the evidence.

227 The TOE shall meet the requirement "Timing of identification (FIA_UID.1/PM)" as specified below.

FIA_UID.1/PM	Timing of Identification
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FIA_UID.1.1/PM	The TSF shall allow *the secure start-up or wake-up without access to data objects and containers stored in the external memory* on behalf of the user to be performed before the user is identified.
FIA_UID.1.2/PM	The TSF shall require each user to be successfully identified before allowing any other TSF-mediated actions on behalf of that user.
Refinement:	The user is the TOE itself. The data objects and containers stored in the external memory need to be identified before any further action.

228 The TOE shall meet the requirement "Replay detection (FPT_RPL.1/PM)" as specified below.

FPT_RPL.1/PM	Replay detection

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FPT_RPL.1.1/PM	The TSF shall detect replay for the following entities: *commands issued by the TOE Loader to the external memory for Embedded Software image download operation*.
FPT_RPL.1.2/PM	The TSF shall perform *halt the boot procedure* when a replay is detected.

229 The TOE shall meet the requirement "Protection against an unauthorized rollback of content (FDP_URC.1/PM)" as specified below.

FDP_URC.1/PM	Protection against an unauthorized rollback of memory content
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FDP_URC.1.1/PM	The TOE shall detect an unauthorized replacement of the content stored in *external memory* before the content is used. The detection shall be effective in any case where modification or read operation depends on the current content of this external memory.
FDP_URC.1.2/PM	Upon detection of unauthorized rollback of the content stored in a physically separated memory, the TOE shall stop TOE operation.

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

FDP_SDC.1/PM	Stored data confidentiality
Hierarchical to:	No other components.
Dependencies:	No dependencies.
FDP_SDC.1.1/PM	The TSF shall ensure the confidentiality of the information of the user data while it is stored in the *external memory*.

231 The TOE shall meet the requirement "Stored data confidentiality (FDP_SDI.2/PM)" as specified below.

FDP_SDI.2/PM	Stored data integrity monitoring and action
Hierarchical to:	FDP_SDI.1 Stored data integrity monitoring.
Dependencies:	No dependencies.
FDP_SDI.2.1/PM	The TSF shall monitor user data stored in containers controlled by the TSF for *integrity errors* on all objects, based on the following attributes: *checksum*.
FDP_SDI.2.2/PM	Upon detection of a data integrity error, the TSF shall *stop TOE operation*.

6.1.13 Summary of Security Functional Requirements

Security Functional Requirements
Limited fault tolerance (FRU_FLT.2)
Failure with preservation of secure state (FPT_FLS.1)
Audit storage (FAU_SAS.1)
Stored data confidentiality (FDP_SDC.1)
Stored data integrity monitoring and action (FDP_SDI.2)
Limited capabilities(FMT_LIM.1/Test and FMT_LIM.1/Debug)
Limited availability(FMT_LIM.2/Test and FMT_LIM.2/Debug)
Resistance to physical attack (FPT_PHP.3)
Basic internal transfer protection (FDP_ITT.1)
Basic internal TSF data transfer protection (FPT_ITT.1)
Subset information flow control (FDP_IFC.1)
Authentication Proof of Identity (FIA_API.1)
Inter-TSF trusted channel (FTP_ITC.1)
Basic data exchange confidentiality (FDP_UCT.1)
Data exchange integrity (FDP_UIT.1)
Subset access control - Loader (FDP_ACC.1/ Loader)
Security attribute based access control - Loader (FDP_ACF.1/Loader)
Quality metric for random numbers (FCS_RNG.1)

Table 5 Security Functional Requirements defined in Smart Card IC Protection Profile

Security Functional Requirements
Subset access control (FDP_ACC.1)
Security attribute based access control (FDP_ACF.1)
Static attribute initialization (FMT_MSA.3)
Management of security attributes (FMT_MSA.1)
Specification of management functions (FMT_SMF.1)
Cryptographic operation (FCS_COP.1/TDES)
Cryptographic operation (FCS_COP.1/AES)
Stored Data Replay Protection(FDP_SDR.1)
Data Authentication with Identity of Guarantor (FDP_DAU.2/PM)
Timing of identification (FIA_UID.1/PM)
Replay detection (FPT_RPL.1/PM)

Protection against an unauthorized rollback of memory content (FDP_URC.1/PM)
Stored data confidentiality (FDP_SDC.1/PM)
Stored data integrity monitoring and action (FDP_SDI.2/PM)

Table 6 Augmented Security Functional Requirements

6.2 TOE Assurance Requirements

232 The Security Target will be evaluated according to

Security Target evaluation (Class ASE)

233 The TOE Assurance Requirements for the evaluation of the TOE and its development and operating environment are those taken from the

Evaluation Assurance Level 5 (EAL5)

234 and augmented by the following components

ALC_DVS.2 and AVA_VAN.5

235 corresponding to level "**EAL5+**".

236 All refinements from *Protection Profile BSI-PP-0084 version 1.0* for the assurance requirements (ALC_DEL, ALC_DVS, ALC_CMS, ALC_CMC, ADV_ARC, ADV_FSP, ADV_IMP, ATE_COV, AGD_OPE, AGD_PRE and AVA_VAN) have to be taken into consideration.

Class ADV: Development

Architectural design	(ADV_ARC.1)
Functional Specification	(ADV_FSP.5)
Implementation Representation	(ADV_IMP.1)
TSF Internals	(ADV_INT.2)
TOE Design	(ADV_TDS.4)

Class AGD: Guidance documents activities

Operational User Guidance	(AGD_OPE.1)
Preparative procedures	(AGD_PRE.1)

Class ALC: Life-cycle support

CM Capabilities	(ALC_CMC.4)
CM Scope	(ALC_CMS.5)
Delivery	(ALC_DEL.1)
Development Security	***(ALC_DVS.2)***
Life Cycle Definition	(ALC_LCD.1)
Tools and Techniques	(ALC_TAT.2)

Class ASE: Security Target evaluation

Conformance claims	(ASE_CCL.1)
Extended components definition	(ASE_ECD.1)

ST introduction	(ASE_INT.1)
Security objectives	(ASE_OBJ.2)
Derived security requirements	(ASE_REQ.2)
Security problem definition	(ASE_SPD.1)
TOE summary specification	(ASE_TSS.1)

Class ATE: Tests

Coverage	(ATE_COV.2)
Depth	(ATE_DPT.3)
Functional Tests	(ATE_FUN.1)
Independent Testing	(ATE_IND.2)

Class AVA: Vulnerability assessment

Vulnerability Analysis	*(AVA_VAN.5)*

6.3 Security Requirements Rationale

6.3.1 Rationale for the Security Functional Requirements

237 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
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" - AVA_VAN.5 "Advanced methodical vulnerability analysis"
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" - ADV_ARC.1 "Architectural Design with domain separation and non-bypassability"
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, AVA_VAN.5 plus those listed for O.Malfunction and O.Phys-Manipulation - FRU_FLT.2, FPT_FLS.1, FPT_PHP.3, ADV_ARC.1

Objective	TOE Security Functional and Assurance Requirements
O.Abuse-Func	- FMT_LIM.1/Test "Limited capabilities" - FMT_LIM.1/Debug "Limited capabilities" - FMT_LIM.2/Test "Limited availability" - FMT_LIM.2/Debug "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, ADV_ARC.1
O.Identification	- FAU_SAS.1 "Audit storage"
O.RND	- FCS_RNG.1 "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, AVA_VAN.5, ADV_ARC.1
OE.Resp-Appl	not applicable

Objective	TOE Security Functional and Assurance Requirements
OE.Process-Sec-IC	not applicable
O.Mem-Access	- FDP_ACC.1 “Subset access control” - FDP_ACF.1 “Security attribute based access control” - FMT_MSA.3 “Static attribute initialisation” - FMT_MSA.1 “Management of security attributes” - FMT_SMF.1 “Specification of Management Functions”
O.TDES	- FCS_COP.1/TDES
O.AES	- FCS_COP.1/ AES
O.Authentication	- FIA_API.1 ” Authentication Proof of Identity”
OE.TOE_Auth	not applicable
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" - FDP_SDR.1 "Stored Data Replay Protection"
OE.Loader_Usage	not applicable
O.External-Content-Prot	- FDP_SDC.1/PM for confidentiality protection - FDP_SDI.2/PM for integrity protection
O.Mem-Command-Replay-Prot	- FPT_RPL.1/PM for Replay detection
O.Mem-Unauthorized-Rollback-Prot	- FDP_URC.1/PM for Protection against an unauthorized rollback of content
O.Mem-Clone-Replace-Prot	- FDP_DAU.2/PM for Data Authentication with Identity of Guarantor - FIA_UID.1/PM for Timing of identification

Table 7: Security Requirements versus Security Objectives

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

239 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 behavior of

the TOE while data are transmitted between or processed by TOE parts.

240 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.

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

242 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.

243 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.

244 The justification related to the security objective "Protection against Malfunctions (O.Malfunction)" is as follows:

245 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.

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

247 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.

248 It is possible that the TOE needs additional support by the Embedded Software (for instance by implementing FDP_SDI.1 to check data integrity with the help of appropriate checksums, refer to Section 6.1). This support must be addressed in the Guidance Documentation. Together with this FPT_PHP.3 is suitable to meet the objective.

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

250 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 measures 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.

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

252 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/Test and FMT_LIM.2/Debug, and the second one by FMT_LIM.1/Test and FMT_LIM.1/Debug. 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.

253 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.

254 It was chosen to define FMT_LIM.1/Test, FMT_LIM.1/Debug, FMT_LIM.2/Test and FMT_LIM.2/Debug 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.

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

256 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.

257 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 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.

258 The objective must be supported by organisational and other measures, which the TOE Manufacturer has to implement. These measures are a subset of those measures, which are examined during the evaluation of the assurance requirements of the classes AGD and ALC.

259 The justification related to the security objective "Random Numbers (O.RND)" is as follows:

260 FCS_RNG.1 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

261 Other security functional requirements, which prevent physical manipulation and malfunction of the TOE (see the corresponding objectives listed in the table), support this objective because they prevent attackers

from manipulating or otherwise affecting the random number generator.

262 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.

263 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.

264 It was chosen to define FCS_RNG.1 explicitly, because Part 2 of the Common Criteria does 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.)

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

266 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, FDP_ACF.1/Loader and FDP_SDR.1.

267 The SFR FTP_ITC.1 requires the TSF to establish a trusted channel with assured identification of its end points and protection of the channel data from modification or disclosure.

268 The SFR FDP_UCT.1 requires the TSF to receive data protected from unauthorised disclosure.

269 The SFR FDP_UIT.1 requires the TSF to verify the integrity of the received user data.

270 The SFR FDP_ACF.1/Loader requires the TSF to implement access control for the Loader functionality.

271 The SFR FDP_SDR.1 requires the TSF to implement replay protection of the user data.

272 The FCS_COP.1/TDES meets the security objective “Cryptographic service Triple-DES (O.TDES)”.

273 The FCS_COP.1/AES meets the security objective “Cryptographic service AES (O.AES)”.

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

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

276 The security functional requirement “Subset access control (FDP_ACC.1)” with the related Security Function Policy (SFP) “Memory Access Control Policy” exactly require the implementation of an area based memory access control, which is a requirement from O.Mem-Access. Therefore, FDP_ACC.1 with its SFP is suitable to meet the security objective.

277 The security functional requirement “Security attribute based access control (FDP_ACF.1)” with the related Security Function Policy (SFP) “Memory Access Control Policy” exactly requires the implementation of an area based memory access control, which is a requirement from O.Mem-Access. Therefore, FDP_ACF.1 with its SFP is suitable to meet the security objective.

278 The security functional requirement “Static attribute initialisation (FMT_MSA.3)” requires that the TOE provides default values for the 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.

279 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 realised using the functions provided by the TOE. Therefore FMT_MSA.1 is suitable to meet the security objective O.Mem_Access.

280 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.

281 The justification related to the security objective “Protection during Packaging, Finishing and Personalisation (OE.Process-Sec-IC)” is as follows:

282 The Composite Product Manufacturer has to use adequate measures to fulfil OE.Process-Sec-IC. Depending on the security needs of the application, the Security IC Embedded Software may have to support this for instance by using appropriate authentication mechanisms for personalisation functions.

283 The justification related to the security objective “Protection against unauthorized disclosure and undetected modification of external memory content (O.External-Content-Prot)” is as follows:

284 The SFR FDP_SDC.1/PM ensures protection of confidentiality of the content stored in the external memory, while the SFR FDP_SDI.2/PM ensures protection of the integrity of the content stored in the external memory. Since the protection is under full control inside the TOE also the transfer between the TOE and the external memory is protected. Therefore, these security functional requirements support the objective.

285 The justification related to the security objective “Protection against replay of commands between the TOE and the external memory (O.Mem-Command-Replay-Prot)” is as follows:

286 The SFR FPT_RPL.1/PM requires the TSF to detect replayed transactions to the external memory. This requirement is considered in the assignment of FPT_RPL.1.1/PM. Therefore, this security functional requirement supports the objective.

287 The justification related to the security objective “Protection against content (O.Mem-Unauthorized-Rollback-Prot)” is as follows:

288 The SFR FDP_URC.1/PM requires that the TSF detects the case when the content of the external memory has been replaced by previous versions of them. This way, this security functional requirement supports the objective.

289 The justification related to the security objective “Protection against external memory cloning or replacement (O.Mem-Clone-Replace-Prot)” is as follows:

The SFR FDP_DAU.2/PM requires the TOE to be able to generate evidence that guarantees the validity of data objects and containers stored in the external memory. The SFR FIA_UID.1/PM requires the definition of actions that can be performed without user identification. The authenticity external memory content needs to be identified instead of a user. This is described in a refinement for this SFR. The authenticity of the data stored in the external memory needs to be identified before any user data is accessed. By providing the mechanism required by these two SFRs, the security objective O.Mem-Clone-Replace-Prot is directly supported.

6.3.2 Dependencies of Security Functional Requirements

290 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 requirements
FRU_FLT.2	FPT_FLS.1	Yes
FPT_FLS.1	None	No dependency
FMT_LIM.1/Test, FMT_LIM.1/Debug	FMT_LIM.2/Test, FMT_LIM.2/Debug	Yes
FMT_LIM.2/Test, FMT_LIM.2/Debug	FMT_LIM.1/Test, FMT_LIM.1/Debug	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	Yes
FDP_IFC.1	FDP_IFF.1	See discussion below
FPT_ITT.1	None	No dependency
FCS_RNG.1	None	No dependency
FCS_COP.1 /TDES	FCS_CKM.4	Yes (by environment, see discussion below)
	FDP_ITC.1 or FDP_ITC.2 (if not FCS_CKM.1) or FCS_CKM.1	Yes (by environment, see discussion below)
FCS_COP.1 /AES	FCS_CKM.4	Yes (by environment, see discussion below)
	FDP_ITC.1 or FDP_ITC.2 (if not FCS_CKM.1) or FCS_CKM.1	Yes (by environment, see discussion below)
FDP_ACC.1	FDP_ACF.1	Yes
FDP_ACF.1	FDP_ACC.1 FMT_MSA.3	Yes Yes
FMT_MSA.3	FMT_MSA.1 FMT_SMR.1	Yes See discussion below
FMT_MSA.1	FDP_ACC.1 or FDP_IFC.1 FMT_SMR.1 FMT_SMF.1	Yes See discussion below Yes
FMT_SMF.1	None	No dependency
FTP_ITC.1	None	No dependency

Security Functional Requirement	Dependencies	Fulfilled by security requirements
FDP_UCT.1	FTP_ITC.1 or FTP_TRP.1, FDP_ACC.1 or FDP_IFC.1	Yes
FDP_UIT.1	FTP_ITC.1 or FTP_TRP.1, FDP_ACC.1 or FDP_IFC.1	Yes
FDP_ACC.1/ Loader	FDP_ACF.1	Yes
FDP_ACF.1/ Loader	FMT_MSA.3	See discussion below
FIA_API.1	None	No dependency
FDP_SDR.1	None	Yes
FDP_SDC.1/PM	None	No dependency
FDP_SDI.2/PM	None	No dependency
FPT_RPL.1/PM	None	No dependency
FDP_URC.1/PM	None	No dependency
FDP_DAU.2/PM	FIA_UID.1	Yes
FIA_UID.1/PM	None	No dependency

Table 8 Dependencies of the Security Functional Requirements

291 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). Therefore the dependency is considered satisfied.

292 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. Together with the discussion of the dependencies above this shows that the security functional requirements build a mutually supportive whole.

293 The functional requirements FCS_CKM.1 and FCS_CKM.4 which are dependent to FCS_COP.1/TDES and FCS_COP.1/AES are not included in this Security Target since the TOE only provides an engine for encryption and decryption. But the Security IC Embedded Software may fulfill these requirements related to the needs of the implemented application. The dependent requirements of FCS_COP.1/TDES and FCS_COP.1/AES concerning these functions shall be fulfilled by the environment (Security IC Embedded Software).

294 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.

295 The dependency FMT_MSA.3 of FDP_ACF.1/Loader is not be necessary. The security attributes of ROM used to enforce the Loader SFP are fixed by the IC manufacturer. The access attribute of ROM have

DEFAULT value.

6.3.3 Rationale for the Assurance Requirements

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

ALC_DVS.2 Sufficiency of Security Measures

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

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

AVA_VAN.5 Advanced Methodical Vulnerability Analysis

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

6.3.4 Security Requirements are Internally Consistent

300 The discussion of security functional requirements and assurance components in the preceding sections has shown that mutual support and 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.

301 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.

302 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. 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/Test, FMT_LIM.2/Debug, FCS_RNG.1 and those implemented in the Security IC Embedded Software.

303 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. 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/Test, FMT_LIM.1/Debug, FMT_LIM.2/Test, FMT_LIM.2/Debug, FCS_RNG.1 and those implemented in the Security IC Embedded Software.

304 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 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).

305 Physical probing (refer to FPT_PHP.3) shall directly avert the disclosure of primary assets. 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/Test and FMT_LIM.2/Debug) 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.

306 Leakage (refer to FDP_ITT.1, FPT_ITT.1) shall directly avert the disclosure of primary assets. 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/Test and FMT_LIM.2/Debug) 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.

307 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/Test, FMT_LIM.1/Debug, FMT_LIM.2/Test and FMT_LIM.2/Debug 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.

308 The combination of the security functional requirements FMT_LIM.1/Test, FMT_LIM.1/Debug, FMT_LIM.2/Test and FMT_LIM.2/Debug 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:

309 The security functional requirement Limited Capabilities (FMT_LIM.1/Test and FMT_LIM.1/Debug) must close gaps which could be left by the control being applied to the function's interface (Limited Availability (FMT_LIM.2/Test and FMT_LIM.2/Debug)). 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/Test and FMT_LIM.2/Debug) is vulnerable, it is important to limit the capabilities of the functions in order to limit the possible benefit for an attacker.

310 The security functional requirement Limited Availability (FMT_LIM.2/Test and FMT_LIM.2/Debug) 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, it is important to limit their availability so that an attacker is not able to use them.

311 No perfect solution to limit the capabilities (FMT_LIM.1/Test and FMT_LIM.1/Debug) is required if the limited availability (FMT_LIM.2/Test and FMT_LIM.2/Debug) alone can prevent the abuse of functions. No perfect solution to limit the availability (FMT_LIM.2/Test and FMT_LIM.2/Debug) is required if the limited capabilities (FMT_LIM.1/Test and FMT_LIM.1/Debug) 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.

312 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 cannot 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.

313 The security functional requirements required to meet the security objectives O.Leak-Inherent, O.Phys-Probing, O.Malfunction, O.Phys-Manipulation and O.Leak-Forced also protect the cryptographic algorithms implemented according to the security functional requirement FCS_COP.1. Therefore, these security functional requirements support the secure implementation and operation of FCS_COP.1.

314 Parts of the Security IC Embedded Software may cause security violations by accidentally or deliberately accessing restricted data (which may include code). In order to avert the memory access violation it is important to the security functional requirement defining the scope where the Memory Access Policy is applied (FDP_ACC.1) and the security functional requirement defining the Memory Access Policy(FDP_ACF.1), and the security functional requirement ensuring the default value of security attribute(FMT_MSA.3) and the security functional requirement managing security attribute (FMT_MSA.1) and the security functional requirement performing security management function(FMT_SMF.1) are effective and bind well.

315 Two refinements from the PP [5] have to be discussed here in the ST as the assurance level is increased. The refinement for ALC_CMS from the PP [5] can even be applied at the assurance level EAL5 augmented with ALC_CMS.5. The assurance component ALC_CMS.4 is augmented to ALC_CMS.5 with aspects regarding the configuration control system for the TOE. The refinement is not touched. The refinement for ADV_FSP from the PP [5] can even be applied at the assurance level EAL5 augmented with ADV_FSP.5. The assurance component ADV_FSP.4 is extended to ADV_FSP.5 with aspects regarding the description level. The level is increased from informal to semi-formal with informal description. The refinement is not touched by this measure.

7 TOE SUMMARY SPECIFICATION

316 This chapter 7 TOE Summary Specification contains the following sections:

7.1 List of Security Functional Requirements

7.1 List of Security Functional Requirements

SFR1: FPT_FLS.1: Failure with preservation of secure state

317 Abnormal events/failures are detected when the TOE operated in the range defined in table 9. This allows to take User-defined appropriate actions by software the TOE.

318 The secure state is maintained by TOE's detectors. The TOE's detectors are monitoring the failure occurs. This satisfies the FPT_FLS.1 "Failure with preservation of secure state."

TOE's Detectors

319 These functions records in register the events notified by the detectors (refer to list below). The software configures the reaction in case of detection:

- The TOE generates immediately interrupt when an event is detected.
- Or, a special function register bit is set.

TOE's detectors are implemented by the hardware. The detection cannot be affected or bypassed by Security IC Embedded Software. The reaction to the detection can be configured by the software.

320 Security domains are maintained since accesses to the access-prohibited area are trapped by this access control function.

SFR2: FRU_FLT.2: Limited fault tolerance

321 These Integrity Checkers are used for preventing noise and laser from causing undefined or unpredictable behaviour of the chip.

SFR3: FPT_PHP.3: Resistance to physical attacks

~~322~~ This requirement is achieved by security mechanism as the Active shield secure routring and removal detector must be removed and bypassed in order to perform physical intrusive attacks, or the TOE detectors. The TOE makes a IRQ occurs to stops operation if a physical manipulation or physical probing attack is detected.

SFR4: FDP_ACC.1: Subset access control

323 This requirement is achieved by security register access control, invalid address access and access right for the code executed in the internal SRAM.

1) Security registers access control: This security mechanism manages access to the security control registers through access control security attributes.

2) Invalid address access: This mechanism detects invalid address access occurrence.

3) Access rights for the code executed in SRAM.

5) Protection of TOE against outside of TOE.

SFR5: FDP_ACF.1: Security attributes based access control.

~~324~~ This is covered by the Privilege and User modes of the TOE.

Access rights for the code executed in RAM.

SFR6: FMT_MSA.3: Static attribute initialization.

325 All Special Function Registers including MPU have DEFAULT values after Power on Reset.

Security registers access control.

SFR7: FMT_MSA.1: Management of security attributes.

326 This is achieved with the MPU security service.

SFR8: FMT_SMF.1: Specification of management functions.

327 This is achieved via access to Special Function Registers.

Security registers access control.

SFR9: FAU_SAS.1: Audit Storage

328 This is fulfilled by the traceability/identification data written once and for all during the TEST mode of the manufacturing process.

1) Non-reversibility of TEST, Debug mode and NORMAL mode.
2) TEST, Debug mode communication protocol and data commands.
3) Functional Tests.
4) Identification. : During the TEST mode of manufacturing process, traceability data are written in the non-volatile memory of the TOE. Once the TOE is switched from TEST to NORMAL mode, those traceability data are READ ONLY and cannot be modified anymore.

SFR10: FMT_LIM.1: Limited capabilities

FMT_LIM.1/Test

329 TEST mode can be accessed only by the TEST administrator through a proprietary protocol. Once the TOE is changed to NORMAL mode, TEST mode functions are no more available for NORMAL mode.

FMT_LIM.1/Debug

330 Debug mode can be accessed only by the Debugger in Debugging step. Once the TOE is changed to NORMAL mode, Debug mode functions are no more available for NORMAL mode.

SFR11: FMT_LIM.2: Limited availabilities

FMT_LIM.2/Test

331 TEST mode can be accessed only by the TEST administrator through a proprietary protocol. Once the TOE is changed to NORMAL mode, TEST mode commands are no more available for NORMAL mode. Functional test during manufacturing process is only available for TEST mode only.

FMT_LIM.2/Debug

332 Debug mode can be accessed only by the Debugger in Debugging step. Once the TOE is changed to NORMAL mode, Debug mode commands are no more available for NORMAL mode. Debugging test during developing code is only available for Debug mode only.

SFR12: FDP_IFC.1: Subset information flow control

333 Memory Encryption: This is achieved by the function protects the memory contents of the TOE from data analysis on the stored data as well as on internally transmitted data.

Active shield secure routing and removal detector: This requirement is achieved by security mechanism as the Active shield must be removed and bypassed in order to perform physical intrusive attacks.

SFR13: FDP_ITT.1: Basic internal transfer protection

334 This requirement is achieved by the combination of the TOE security mechanisms 1) to 5) as it is unpractical to get access to internal signals and interpret them.

1) Static Address/Data scrambling for bus and memory.

2) Dynamic Data encryption for bus.

3) Memory encryption: This security mechanims protects the memory contents of the TOE from data analysis on the stored data as well as on internally transmitted data.

4) Synthesizable processor core: The Central Processing Unit (CPU) of the TOE is synthesizable with glue logic, which makes reverse engineering and signal identification more difficult.

5) De-synchronization and signal-to-noise ratio reduction mechanisms: The TOE operations can be made asynchronous. They make a full range of intrusive (e.g. probing attacks) and non-intrusive attacks (e.g. side-channel attacks) more complex and difficult.

SFR14: FPT_ITT.1: Basic internal TSF data transfer protection

335 This requirement is achieved by the combination of the TOE security mechanisms 1) to 5) as it is unpractical to get access to internal signals and interpret them.

1) Static Address/Data scrambling for bus and memory: This function protects memory and address/data bus from probing attacks.

2) Dynamic Data encryption for bus: This function protects data bus from probing attacks.

3) Memory encryption: This security mechanisms protects the memory contents of the TOE from data analysis on the stored data as well as on internally transmitted data.

4) Synthesizable processor core: The Central Processing Unit (CPU) of the TOE is synthesizable with glue logic, which makes reverse engineering and signal identification more difficult.

5) De-synchronization and signal-to-noise ratio reduction mechanisms: The TOE operations can be made asynchronous.

SFR15: FCS_RNG.1: Random number generation

336 This requirement is ensured by the design of the Digital True Random Number Generator (DTRNG) and the associated DTRNG library that only evaluated as passing the AIS31 statistical tests (Test Procedure A) for Random Number Generation (FCS_RNG.1).

SFR16: FCS_COP.1: Cryptographic operation

337 This requirement is covered by the TOE.

Triple Data Encryption Standard Engine

338 This function is used for encrypting and decrypting data using the Triple DES symmetric algorithm (FCS_COP.1/TDES)

AES (Advanced Encryption Standard)

339 This function supports the AES operation. (FCS_COP.1/AES)

SFR17: Reserved

SFR18: Reserved

SFR19: Reserved

SFR20: Inter-TSF trusted channel (FTP_ITC.1)

This requirement is achieved by processing the Authentication sequence.

1) This channel is only distinct from other communication channels and provides assured identification for its end points and protection of the channel data from modification or disclose.

SFR21: Basic data exchange confidentiality (FDP_UCT.1)

This requirement is achieved by secure external FLASH loading. User data which is loaded in the external FLASH memory is encrypted data.

SFR22: Data exchange integrity (FDP_UIT.1)

This requirement is achieved by the mechanism integrity.

SFR23: Subset access control - Loader (FDP_ACC.1/ Loader)

This requirement is achieved by following mechanism.

Access attribute control of Bootloader.

SFR24: Security attribute based access control - Loader (FDP_ACF.1/Loader)

This is covered by the ROM Booting and SRAM Booting states of the TOE.

SFR25: Stored data confidentiality (FDP_SDC.1)

This requirement is achieved by the combination of the TOE security mechanisms 1) to 8) as it is unpractical to get access to internal signals and interpret them.

1) Static Address/Data scrambling for bus and memory: This function protects memory and address/data bus from probing attacks.

2) Dynamic Data encryption for bus: This function protects data bus from probing attacks.

3) Memory encryption: This security mechanism protects the memory contents of the TOE from data analysis on the stored data as well as on internally transmitted data.

4) Invalid address access: This function detects invalid address access occurrence.

5) shield secure routing and removal detector: This requirement is achieved by security mechanisms as the Active shield must be removed and bypassed in order to perform physical intrusive attacks.

7) Non-reversibility of TEST, Debug and NORMAL modes: This function disables the TEST mode and Debug mode, and enables the NORMAL mode of the TOE. This function ensures the non-reversibility of the NORMAL mode. This function is used once during the manufacturing process

8) Access attribute control of Bootloader: This requirement is achieved by the changing the Operating Mode Selection.

SFR26: Stored data integrity monitoring and action (FDP_SDI.2)

This requirement is achieved by following functions.

RAM ECC.

SFR27: Authentication Proof of Identity (FIA_API.1)

This requirement is achieved by processing the Authentication sequence.

SFR28: Stored Data Replay Protection (FDP_SDR.1)

This requirement is achieved by a set of rollback.

SFR29: Data Authentication with Identity of Guarantor (FDP_DAU.2/PM)

This requirement is achieved by the Authetication sequence of Secure BootLoader. Security IC Embedded Software is stored with a certificate and the TOE stores a means to verify the public key.

SFR30: Timing of identification (FIA_UID.1/PM)

This requirement is achieved by the Authentication sequence of Secure BootLoader. The Secure BootLoader requires to authenticate the Security IC Embedded Software before execute it.

SFR31: Replay detection (FPT_RPL.1/PM)

This requirement is achieved by checking the integrity and verification of the digital signature of the Security IC Embedded Software during loading into the TOE.

SFR32: Protection against unauthorized rollback of memory content (FDP_URC.1/PM)

This requirement is achieved by rollback counter in OTP and in Security IC Embedded Software image.

SFR33: Stored data confidentiality (FDP_SDC.1/PM)

This requirement is achieved by AES encryption on the Security IC Embedded Software image stored in external flash memory.

SFR34: Stored data integrity monitoring and action (FDP_SDI.2/PM)

This requirement is achieved by checksum mechanism on the Security IC Embedded Software image sotred in external flash memory.

8 Annex

8.1 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.

Composite Product Integrator

Role installing or finalising the IC Embedded Software and the applications on platform transforming the TOE into the unpersonalised 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.

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 Software).

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).

Integrated Circuit (IC)

Electronic component(s) designed to perform processing and/or memory functions.

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.

Security IC

Composition of the TOE, the Security IC Embedded Software, User Data 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 Supporting Document

TOE Delivery

The period when the TOE is delivered which is 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 and its development and production environment are fulfilled. 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 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 specific circuitry, in non-volatile programmable memories (for instance E2PROM) or a combination thereof.

User data

All data managed by the Security IC Embedded Software in the application context. User data comprise all data in the final Security IC except the TSF data.

8.2 Abbreviations

CC
Common Criteria

EAL
Evaluation Assurance Level

IT
Information Technology

PP
Protection Profile

ST
Security Target

TOE
Target of Evaluation

TSC
TSF Scope of Control

TSF
TOE Security Functionality

TSFI
TSF Interface

TSP
TOE Security Policy

8.3 References

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