Public

Common Criteria

Information Technology

Security Evaluation

Project S3FT9FA

Security Target Lite of

Samsung S3FT9FA

16-bit RISC Microcontroller

for Smart Card

Version 7.2

17th January 2024

SAMSUNG ELECTRONICS

REVISION HISTORY

UPDATES:

Version	Date	Modification
1.0	30th April 2014	Creation
2.0	19th June 2015	Updated for PP0084 and table 1
2.1	23th June 2015	Updated for table 1, chapter 1.2, 2.2 and 7.
2.2	25th August 2015	Update the chapter 1.2.2, 6.1 and 7.1 for RNG
2.3	26th August 2015	Update the chapter 6.1
2.4	11th May 2016	Updated for table 1
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2.6	22nd March 2017	Updated version in table 1 Update the chapter 1.2.4
2.7	23rd March 2017	Updated version in table 1 Corrected the chapter 1.2.4
2.8	14th March 2018	Updated version in table 1
2.9	09th March 2019	Updated version in table 1 Update the chapter 1.2.4 for site
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4.0	26th February 2021	Updated version in table 1
5.0	22th March 2022	The Table 1 is updated
5.1	23th March 2022	Corrected the chapter 1.1
5.2	31th March 2022	Update the chapter 1.1 and 2.1 and 8.3
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5.4	14th April 2022	Update the chapter 1.1 and 1.2.2 and 6.1
6.0	3rd February 2023	Update the chapter 1.1 and 1.2.4 Update Table 1
7.0	14th December 2023	Update the chapter 1.1, 1.2.2 and 1.2.3 Update Table 1
7.1	8th January 2024	Update the chapter 1.1, 1.2.2, 1.2.4, 2.2, 2.3, 6.1, 6.3.2, 7.1, and 8.3 Update Table 1, 6, and 8
7.2	17th January 2024	Update the chapter 1.1, 6.1, 6.3.2 and 8.3

CONTENTS

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 7.2 and dated 17th January 2024

The Security Target Lite is strictly compliant to

3 [5] Eurosmart Security IC Platform Protection Profile, Version 1.0, January 2014, BSI-CC-PP-0084-2014

4 The Protection Profile and the Security Target are built on *Common Criteria version 3.1 Revision5*.

- Title: Security Target Lite of S3FT9FA
- Target of Evaluation: S3FT9FA
- **TOE reference:** S3FT9FA_20240430
- 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 S3FT9FA microcontroller is a smartcard integrated circuit which is composed of a processing unit, security components, contact based I/O ports, 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 the smartcard integrated circuit after being delivered by the IC Manufacturer. Such software (also known as IC firmware) is used for testing purpose during the manufacturing process but also provides additional services to facilitate the usage of the hardware and/or to provide additional services, an [6]AIS31 compliant random number generation library and an [6]AIS31 compliant random number generator. All other software is called Smartcard Embedded Software and is not part of the TOE.

1.2.2 TOE Definition

10 The S3FT9FA single-chip CMOS micro-controller is designed and packaged specifically for "Smart Card" applications.

11 The CalmRISC16 CPU architecture of the S3FT9FA microcontroller follows the Harvard style, that is, it has separate program memory and data memory. Both instruction and data can be fetched simultaneously without causing a stall, using separate paths for memory access.

12 The main security features of the S3FT9FA integrated circuit are:

- Security sensors or detectors or filters
- Dedicated hardware mechanisms against side-channel attacks
- Secure DES Symmetric Cryptography support
- Hardware True Random Number Generators (DTRNG FRO) that meet P2 class of BSI-AIS31 (German Metric).
- The IC Dedicated Software includes:
  - Three DTRNG FRO libraries built around Hardware DTRNG FRO together with DTRNG FRO application notes that meet some of ANSSI requirements as well as P2 class of BSI-AIS31 (German Metric).

13 The main hardware blocks of the S3FT9FA Integrated Circuit are described in Figure 1 below:

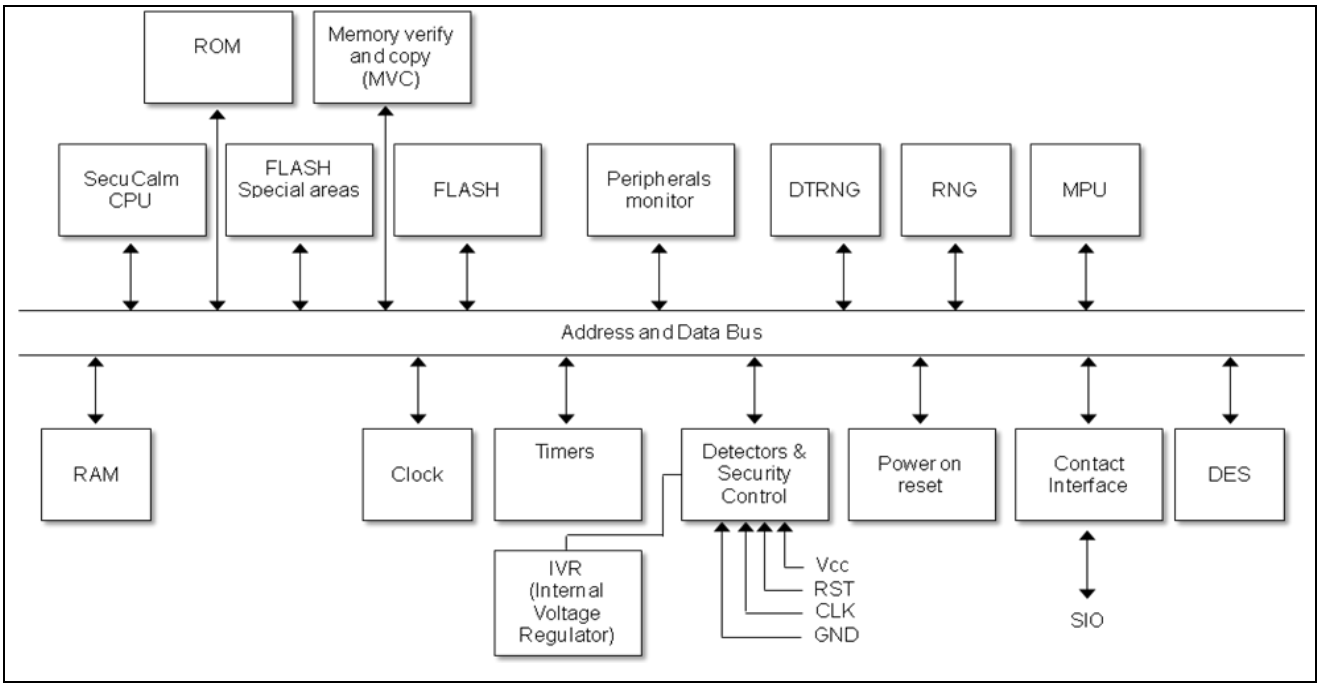


Figure 1. S3FT9FA Block Diagram

*Note that only the Triple DES algorithm belongs to the TOE, not the Single DES.

The TOE consists of the following Hardware and Software:

TOE Hardware

- FLASH/RAM/User ROM/Flash special area
- 16-bit Central Processing Unit (CPU)

- Internal Voltage Regulator (IVR)
- Detectors & Security Logic
- Filters
- Digital True random number generator (DTRNG FRO) and Bilateral Pseudo Random Number Generator (BPRNG)
- Memory Protection Unit (MPU)
- Triple DES cryptographic coprocessor
- Hardware UART for contact I/O modes
- Address & data buses
- Internal Clock
- Timers
- Power on Reset
- Error Correcting Code (ECC)

TOE Software

14 The TOE software comprises the following components:

- Test ROM code that is used for testing the chip during production
- Three Digital True Random Number Generator (DTRNG FRO) libraries.
- Secure Boot Loader can download the encrypted user code
- The TOE software comprises the following components:

15 The TOE configuration is summarized in table 1 below:

Item Type	Item	Version	Date	Form of delivery
Hardware	S3FT9FA 16-Bit RISC Microcontroller for Smart Card	0		Wafer or Module
Software	Test ROM Code	1.0		- Included in S3FT9FA Test ROM - Test ROM code is not part of the TOE.
Software	Secure Boot loader code (S3FT9xx_Bootloader_80nm_FA_CF1BH_20130822.rom)	4.5	2013.08.22	Included in S3FT9FA in ROM
Software	DTRNG FRO library (S3FT9XX_DTRNG_lib_v6.0.a)	6.0	2013.11.14	Software Library. This library is delivered as object file and is optionally integrated into user NVM code.
Software	DTRNG FRO library (S3FT9XX_DTRNG_lib_v8.0.a)	8.0	2021.02.04	Software Library. This library is delivered as object file and is optionally integrated into user NVM code.
Software	DTRNG FRO library (S3FT9XX_DTRNG_lib_v8.2.a)	8.2	2023.11.16	Software Library. This library is delivered as object file and is optionally integrated into user

				NVM code.
Document	S3FT9XX HW DTRNG FRO and DTRNG FRO Library Application Note for DTRNG FRO library v6.0 (S3FT9XX_DTRNG_FRO_AN_v1.18.pdf)	1.18	2023.12.07	Softcopy
Document	S3FT9XX HW DTRNG FRO and DTRNG FRO Library Application Note for DTRNG FRO library v8.0 (S3FT9XX_DTRNG_FRO_AN_v3.2.pdf)	3.2	2023.12.07	Softcopy
Document	S3FT9XX HW DTRNG FRO and DTRNG FRO Library Application Note for DTRNG FRO library v8.2 (S3FT9XX_DTRNG_FRO_AN_v4.1.pdf)	4.1	2023.12.07	Softcopy
Document	Hardware User's manual (S3FT9XX_UM_REV1.33.pdf)	1.33	2017.03.20	Softcopy
Document	USER'S MANUAL ERRATA of S3FT9XX_UM_REV1.33 (S3FT9XX_UM1.33_Errata_v0.3.pdf)	0.3	2020.03	Softcopy
Document	Security Application Note (SAN_S3FT9FD_PF_PE_FA_v3.5.pdf)	3.5	2023.12.10	Softcopy
Document	Chip Delivery Specification (S3FT9FA_DV13.pdf)	1.3	2018.03	Softcopy
Document	Bootloader User's Manual (S3FT9xx_80nm_Bootloader Specification_v2.4.pdf)	2.4	2017.03.23	Softcopy
Document	Architecture Reference: SecuCalm CPU Core (S3xT9xx_AR14_SecuCalm Core.pdf)	14	2011.03.03	Softcopy
Document	Cryptographic Mechanisms (Cryptographic_Mechanisms_S3FT9FA_v0.1.pdf)	0.1	2023.01.27	Softcopy

Refer to the chapter 7 in Delivery specification	Device type	S3FT9FA: 0F0A
	IC Version	00
	Test ROM Code Version	10
	Boot loader code version	45
	DTRNG FRO libraries Version	6.0, 8.0, 8.2

Table 1. TOE Configuration

1.2.3 TOE Features

CPU
- 16-bit SecuCalm core

Memory
- ROM
- Test ROM
- FLASH
- RAM

FLASH Write Operations

Triple DES
- Built-in hardware Triple DES accelerator

Abnormal Condition Detectors
- Abnormal detectors

Filters

Interrupts
- Two interrupt sources and vectors (FIQ,IRQ)

Serial I/O Interface
- T=0 and 1 (ISO 7816-3)

Reset and Power Down Mode
- Stop mode

Random Number Generator

Memory Protection Unit (MPU)

Memory Encryption and Bus Scrambling

Timers

ECC

Clock Sources
- External clock: 1 MHz–10 MHz

Operating Voltage Range
- 2.7 V - 5.5 V

Operating Temperature
- - 25°C to 85°C

Package

- Wafer
- 8-pin COB (compliant with ISO 7816)

1.2.4 TOE Life cycle

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

Site / Building	Phase
Hwasung Plant	Phase 2
Giheung Plant	Phase 3
Onyang Plant	Phase 3+4
Photronics Plant	Phase 3
HANAMICRON Plant	Phase 3+4
Inesa Plant	Phase 3+4
TESNA Plant	Phase 3
ASE Korea	Phase 3+4
SFA Plant	Phase 4

- 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

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

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

18 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),

Package in Phase 5	Description
Package 1	Loader dedicated for usage in Secured Environment only

- 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.

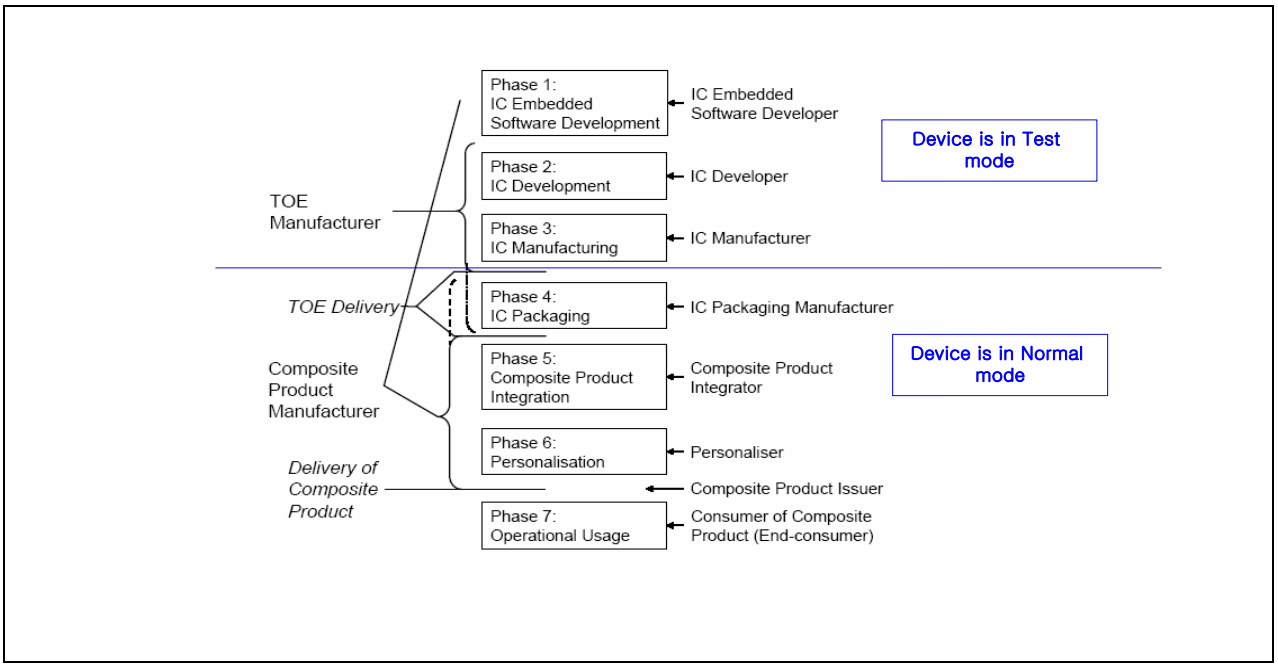


Figure 1: Definition of "TOE Delivery" and responsible Parties

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

1.3 Interfaces of the TOE

- The physical interface of the TOE with the external environment is the entire surface of the IC
- The electrical interface of the TOE with the external environment is made of the chip's pads including the Vdd, RESETB, XCLK, GND, IO1.
- The data interface of the TOE is made of the Contact I/O pads.
- The software interface of the TOE with the hardware consists of Special Function Registers (SFR) and CPU instructions.
- The TRNG interface of the TOE is defined by the DTRNG FRO library interface.

1.4 TOE Intended Usage

20 The TOE is dedicated to applications such as:

- Banking and finance applications for credit or debit cards, electronic purse (stored value cards) and electronic commerce.
- Network based transaction processing such a mobile phones (GSM SIM cards), pay TV (subscriber and pay-per-view cards), communication highways (Internet access and transaction processing).
- Transport and ticketing applications (access control cards).
- Governmental cards (ID cards, health cards, driving licenses).

- Multimedia applications and Digital Right Management protection.

2 CONFORMANCE CLAIMS

21 This chapter 2 contains the following sections:

2.1 CC Conformance Claim

2.2 PP Claim

2.3 Package Claim

2.4 Conformance Claim Rationale

2.1 CC Conformance Claim

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

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

24 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,Part2: 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

has been taken into account.

2.2 PP Claim

25 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.

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

2.3 Package Claim

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

- Package "Authentication of the Security IC"
- Package "TDES"
- Package 1 : Loader dedicated for usage in secured environment only

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

2.4 Conformance Claim Rationale

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

30 The Evaluation Assurance Level (EAL) of the PP [5] is EAL 4 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.

31 The Target of Evaluation (TOE) is a complete solution implementing a security integrated circuit (security IC) as defined in the PP [5] section 1.3.1, so the TOE is consistent with the TOE type in the PP [5].

32 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, organisational security policies and assumptions are introduced in chapter 3 of this ST, a rationale is given in chapter 4.4.

33 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.

34 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 6.1.

3 SECURITY PROBLEM DEFINITION

35 This chapter 3 contains the following sections:

3.1 Description of Assets

3.2 Threats

3.3 Organizational Security Policies

3.4 Assumptions

3.1 Description of Assets

Assets regarding the Threats

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

- the User Data,
- the Security IC Embedded Software stored and in operation,
- the security services provided by the TOE for the Security IC Embedded Software.

37 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 and 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.

38 The Security IC may not distinguish between User Data which are public known or kept confidential. Therefore the security IC shall protect the confidentiality and integrity of the User Data, unless the Security IC Embedded Software chooses to disclose or modify it.

39 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. Though the Security IC Embedded Software (normally stored in the ROM) will in many cases not contain secret data or algorithms, it must be protected from being disclosed, since for instance knowledge of specific implementation details may assist an attacker.

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

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

SC4 deficiency of random numbers.

42 To be able to protect these assets the TOE shall protect its security functionality. Therefore critical information about the TOE shall be protected. Critical information includes:

- 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.

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

44 Note that there are many ways to manipulate or disclose the User Data: (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 security functionality. The knowledge of this information enables or supports attacks on the assets. Therefore the TOE Manufacturer must ensure that the development and production of the TOE is secure so that no information is unintentionally made available for the operational phase of the TOE.

45 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.

46 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,
- test and characterisation related data,
- material for software development support, and
- photomasks and products in any form

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

3.2 Threats

47 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, stored in protected memory areas or processed by the Security IC) means that an attacker is realistically[1] able to determine a

[1] taking into account the assumed attack potential (and for instance the probability of errors)

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 a specific function in a manner which enables exploitation. This should be considered for the threat T.Malfunction, T.Phys-Manipulation and T.Abuse-Func.

48 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.

49 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 secret User Data stored in the TOE, and (iii) develop and build a functional equivalent of the Security IC using the input from the previous steps.

50 The Security IC is a platform for the Security IC Embedded Software which ensures that especially the critical User Data are stored and processed in a secure way (refer to below). The Security IC Embedded Software must also ensure that critical User Data 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 the Protection Profile. 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 measures which split into those being evaluated according to the Protection Profile (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.

51 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 or the Security IC Embedded Software and is not a success for the attacker in itself.

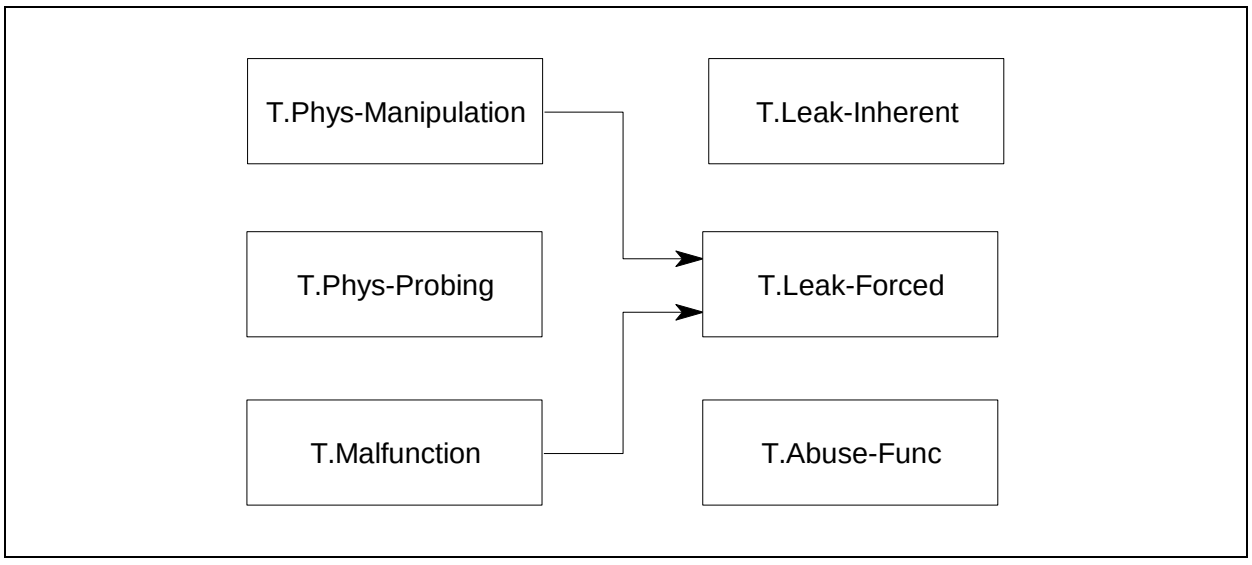


Figure 3: Standard Threats

52 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).

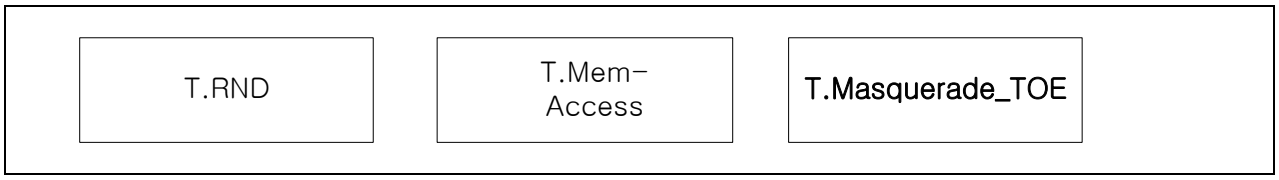


Figure 4: Threats related to security service

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

54 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.

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

56 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.

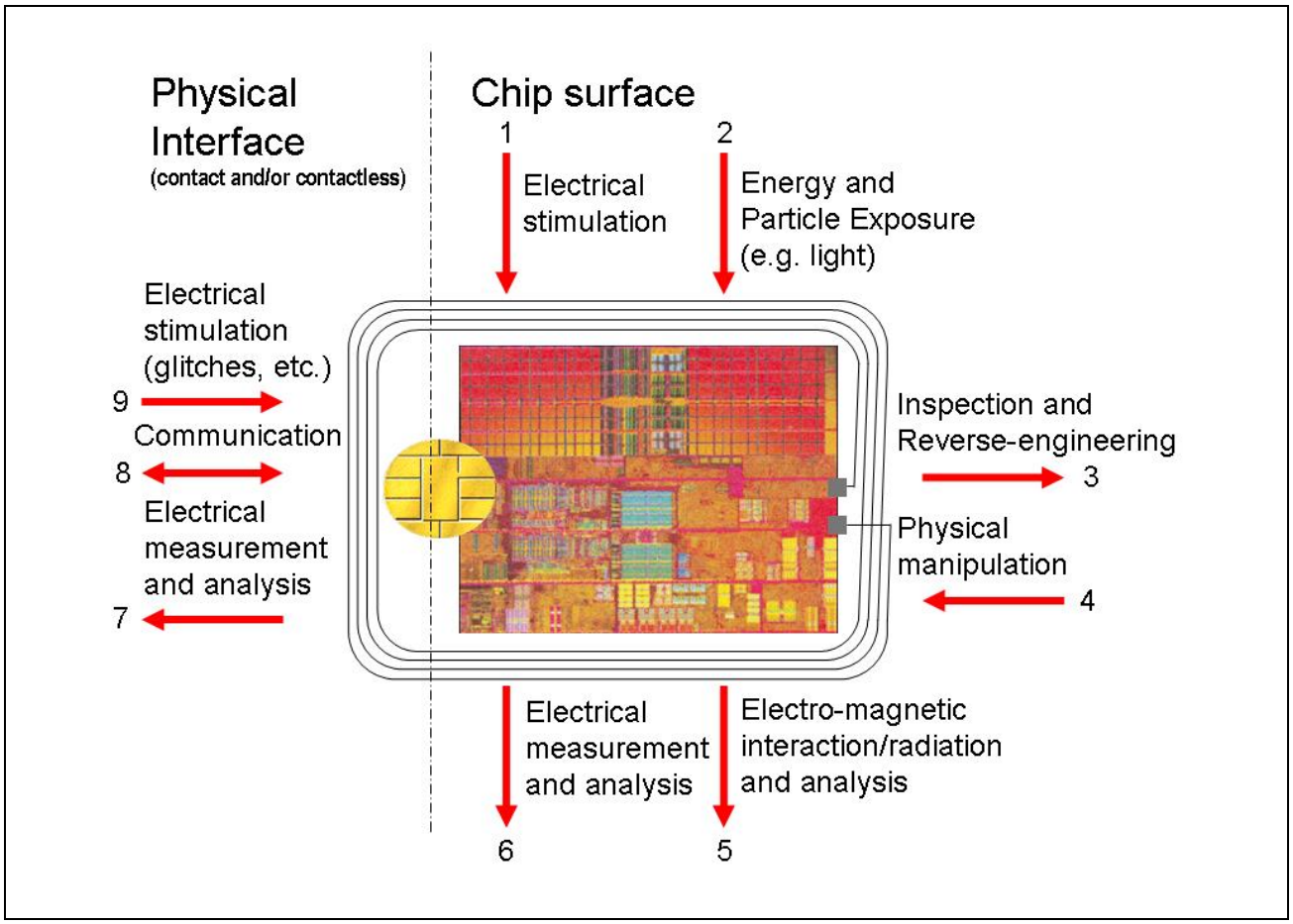


Figure 5: Interactions between the TOE and its outer world

57 An interaction with the TOE can be done through the physical interfaces (Number 7 – 9 in Figure 5) which are realised using contacts 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

58 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 data as part of the assets.

59 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.

60 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, (ii) to disclose/reconstruct the Security IC Embedded Software or (iii) to disclose other critical information about the operation of the TOE to enable attacks disclosing or manipulating the User Data or the Security IC Embedded Software.

61 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 may also be a pre-requisite.

62 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.

63 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 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).

64 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 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.

65 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, (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 or the Security IC Embedded Software.

66 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 may also be a pre-requisite. Changes of circuitry or data can be permanent or temporary.

67 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).

68 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 data as part of the assets even if the information leakage is not inherent but caused by the attacker.

69 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.

70 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, (ii) manipulate (explore, bypass, deactivate or change) security services of the TOE or (iii) manipulate (explore, bypass, deactivate or change) functions of the Security IC Embedded Software or (iv) enable an attack disclosing or manipulating the User Data or the Security IC Embedded Software.

3.2.2 Threats related to security services

71 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 for instance because of a lack of entropy of the random numbers provided. An attacker may gather information about the produced random numbers which might be a problem because they may be used for instance to generate cryptographic keys. Here the attacker is expected to take advantage of statistical properties of the random numbers generated by the TOE without specific knowledge about the TOE's generator. 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

72 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 IC Smartcard Embedded Software may cause security violations by accidentally or deliberately accessing restricted data (which may include

code). Any restrictions are defined by the security policy of the specific application context and must be implemented by the Smartcard 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.

3.2.4 Threats related to Authentication of the Security IC

73 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.

3.3 Organizational Security Policies

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

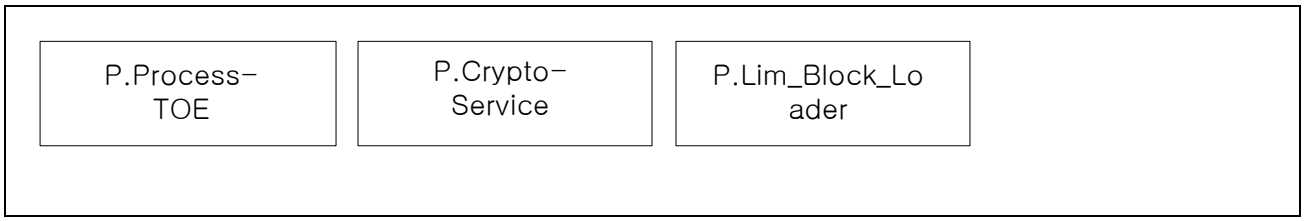


Figure 6: Policies

75 The IC Developer / Manufacturer must apply the policy "Protection during TOE Development and Production (P.Process-TOE)" as specified below.

P.Process-TOE	Protection 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.

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

77 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.

78 The TOE provides specific security functionality which can be used by the Smartcard Embedded Software. In the following specific security functionality is listed which is not derived from threats identified for the TOE's environment because it can only be decided in the context of the smartcard application, against which threats the Smartcard Embedded Software will use the specific security functionality.

79 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)

80 The IC Developer / Manufacturer must apply the organisational security policy "Limiting and Blocking the Loader Functionality (P.Lim_Block_Loader)" applies to Loader dedicated for usage in secured environment specified below.

P.Lim_Block_Loader Limiting and Blocking the Loader Functionality

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

3.4 Assumptions

81 The following figure shows the assumptions applied in this Security Target.

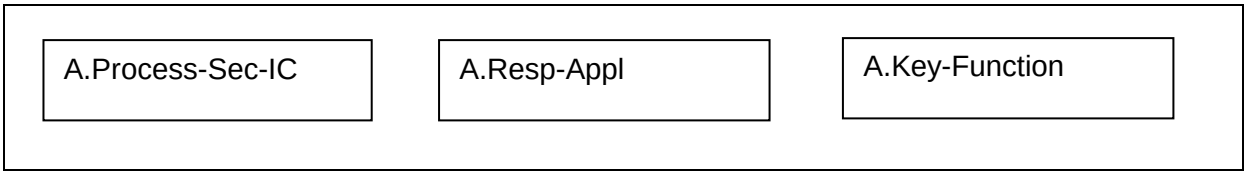


Figure 7: Assumptions

82 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.

83 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.

84 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 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.

85 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 and personalisation data including specifications of formats and memory areas, test related data,
- the User Data and related documentation, and
- material for software development support

86 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.

87 The developer of the Security IC Embedded Software must ensure the appropriate "Treatment of User Data (A.Resp-Appl)" while developing this software in Phase 1 as specified below.

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

88 The application context specifies how the User Data 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 by malicious Security IC Embedded Software. The assumption A.Resp-Appl ensures that the Security IC Embedded Software follows the security rules of the application context.

89 The developer of the Smartcard 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 Smartcard Embedded Software in a way that they are not susceptible to leakage attacks (as described under T.Leak-Inherent and T.Leak-Forced).

90 Note that here the routines which may compromise keys when being executed are part of the Smartcard 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

91 This chapter Security Objectives contains the following sections:

4.1 Security Objectives for the TOE

4.2 Security Objectives for the IC Embedded Software development Environment

4.3 Security Objectives for the operational Environment

4.4 Security Objectives Rationale

4.1 Security Objectives for the TOE

92 According to the Protection Profile[BSI-PP-0084] there are the following standard high-level security goals:

SG1 maintain the integrity of User Data and of the Security IC Embedded Software (when being executed/processed and when being stored in the TOE's memories) as well as

SG2 maintains the confidentiality of User Data and of the Security IC Embedded Software (when being processed and when being stored in the TOE's memories).

The Security IC may not distinguish between User Data which are public known or kept confidential. Therefore the security IC shall protect the confidentiality and integrity of the User Data, unless the Security IC Embedded Software chooses to disclose or modify it.

In particular integrity of the Security IC Embedded Software means that it is correctly being executed which includes the correct operation of the TOE's functionality. Though the Security IC Embedded Software (normally stored in the ROM) will in many cases not contain secret data or algorithms, it must be protected from being disclosed, since for instance knowledge of specific implementation details may assist an attacker.

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

SG4 provide random numbers.

93 These standard high-level security goals are refined below by defining security objectives as required by the *Common Criteria* (refer to Figure 8). Note that the integrity of the TOE is a mean to reach these objectives.

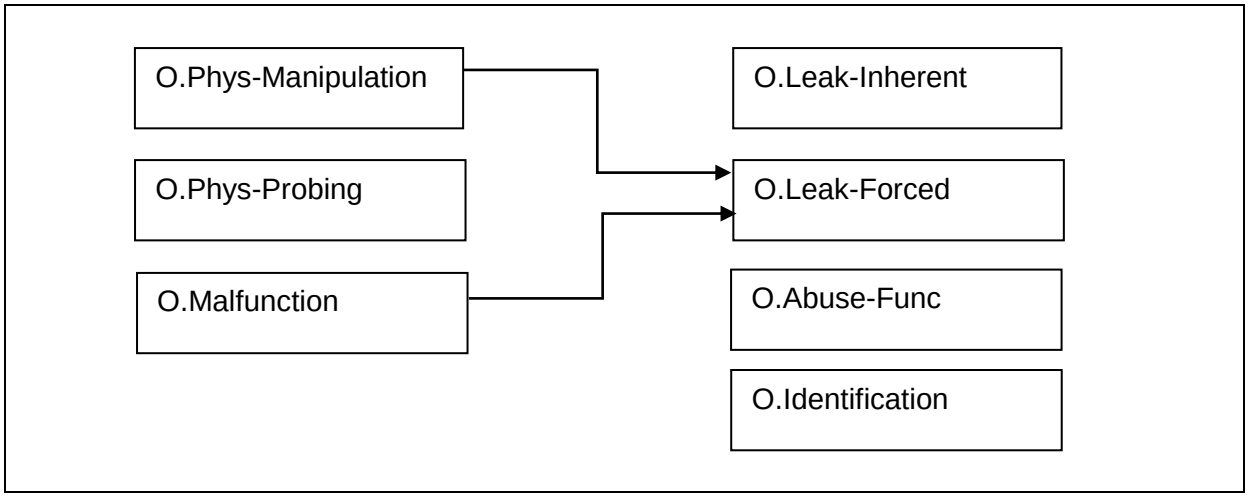


Figure 8: Standard Security Objectives

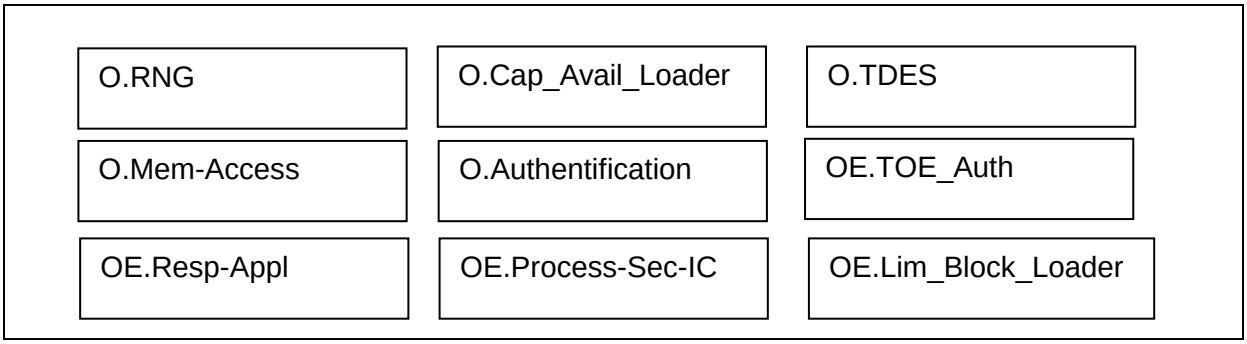


Figure 9: Security Objectives related to Specific Functionality

Standard Security Objectives

94 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 Smartcard 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.

95 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 of User Data, against the disclosure/reconstruction of the Smartcard Embedded Software or against the disclosure of other critical operational information. 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.

96 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 prevent its operation outside the normal operating conditions where reliability and secure operation has not been proven or tested. This is to prevent errors. The environmental conditions may include 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.

97 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 Smartcard Embedded Software and the User Data. This includes protection against

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

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.

98 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.

99 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 (i) to disclose critical User Data, (ii) to manipulate critical User Data of the Smartcard Embedded Software, (iii) to manipulate Soft-coded Smartcard Embedded Software or (iv) bypass, deactivate, change or explore security features or functions 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.

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

O.Identification TOE Identification

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

Security Objectives for Random Numbers

101 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.

Security Objectives for Cryptographic Services

102 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.

Security Objectives for Memory Access Control

103 The TOE shall provide "Area based Memory Access Control (O.Mem-Access)" as specified below.

O.Mem-Access Area based Memory Access Control

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

Security Objectives for Loader

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

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

4.2 Security Objectives for the Security IC Embedded Software Development Environment

105 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 objectives for the operational environment enforced by the Security IC Embedded software.

Phase 1

106 The Security IC Embedded Software shall provide "Treatment of User Data (OE.Resp-Appl)" as specified below.

OE.Resp-Appl	Treatment of User Data Security relevant User Data (especially cryptographic keys) are treated by the Smartcard Embedded Software as required by the security needs of the specific application context. For example the Smartcard Embedded Software will not disclose security relevant user data to unauthorised users or processes when communicating with a terminal.

107 The Security IC Embedded Software 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.

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

108 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 Smartcard 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.

109 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.

110 Regarding the area based access control this objective of the environment has to be clarified. The treatment of User Data is also required when a multi-application operating system is implemented as part of the Smartcard 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.

111 The treatment of User Data is still required when a multi-application operating system is implemented as part of the Smartcard 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

TOE Delivery up to the End of Phase 6

112 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 "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.

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

OE.Lim_Block_Loader	Limitation of capability and blocking the Loader Authorized user will limit the capability of the Loader before the TOE is delivered to unauthorized user and terminate irreversibly the Loader after intended usage.

114 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)"

115 The protection during packaging, finishing and personalization includes also the personalization process and the personalization data during Phase 4, Phase 5 and Phase 6.

116 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

117 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	
P.Crypto-Service	O.TDES	
T.Mem-Access	O.Mem-Access	
A.Key-Function	OE.Resp-Appl	
P.Lim_Block_Loader	O.Cap_Avail_Loader OE.Lim_Block_Loader	Phase5
T.Masquerade_TOE	O.Authentication OE.TOE_Auth	

Table 4: Security Objectives versus Assumptions, Threats or Policies

118 The justification related to the assumption "Treatment of User Data (A.Resp-Appl)" is as follows:

119 Since OE.Resp-Appl requires the developer of the Smartcard Embedded Software to implement measures as assumed in A.Resp-Appl, the assumption is covered by the objective.

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

121 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 44. 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.

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

123 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.

124 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:

125 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.

126 The justification related to the threat “Memory Access Violation (T.Mem-Access)” is as follows:

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

128 The clarification of O.Mem-Access makes clear that it is up to the Smartcard 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 Smartcard Embedded Software. This is further emphasised by the clarification of Treatment of User Data (OE.Resp-Appl) which reminds that the Smartcard Embedded Software must not undermine the restrictions it defines. Therefore, the clarifications contribute to the coverage of the threat T.Mem-Access.

129 The justification related to the security objective “Cryptographic Service (O.TDES)” is as follows: since these security objectives require the TOE to implement exactly the same specific security functionality as required by P.Crypto-Service, the organisational security policy is covered by the objective.

130 Nevertheless the security objectives O.Leak-Inherent, O.Phys-Probing, O.Malfunction, O.Phys-Manipulation and O.Leak-Forced define how to implement the specific security functionality required by P.Crypto-Service. (Note that these objectives support that the specific security functionality is provided in a secure way as expected from P.Crypto-Service.) Especially O.Leak-Inherent and O.Leak-Forced refer to the protection of confidential data (User Data or TSF data) in general. User Data are also processed by the specific security functionality required by P.Crypto-Service.

131 Compared to Smartcard IC Platform Protection Profile a clarification has been made for the security objective “Treatment of User Data (OE.Resp-Appl)”: By definition cipher or plain text data and cryptographic keys are User Data. So, the Smartcard 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 although additional functions are being supported according to P.Crypto-Service.

132 The justification of the additional policy and the additional assumption show that they do not contradict to the rationale already given in the Protection Profile for the assumptions, policy and threats defined there.

133 The organisational security policy Limitation of capability and blocking the Loader (P.Lim_Block_Loader) is directly implemented by the security objective for the TOE “Capability and availability of the Loader (O.Cap_Avail_Loader)” and the security objective for the TOE environment “Limitation of capability and blocking the Loader (OE.Lim_Block_Loader)”. The TOE security objective “Capability and availability of the Loader” (O.Cap_Avail_Loader)” mitigates also the threat “Abuse of Functionality “ (T.Abuse-Func) if attacker tries to misuse the Loader functionality in order to manipulate security services of the TOE provided or depending on IC Dedicated Support Software or user data of the TOE as IC Embedded Software, TSF data or user data of the smartcard product..

134 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.

5 EXTENDED COMPONENTS DEFINITION

135 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

5.1 Definition of the Family FCS_RNG

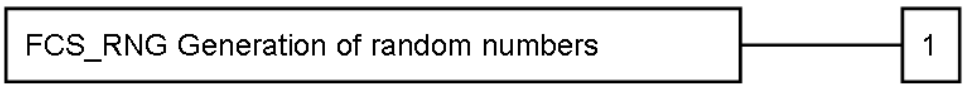
136 To define the IT security functional requirements of the TOE an additional family (FCS_RNG) of the Class FCS (cryptographic support) is defined here. This family describes the functional requirements for random number generation used for cryptographic purposes.

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] random number generator that implements: [assignment: list of security capabilities].
FCS_RNG.1.2	The TSF shall provide random numbers that meet [assignment: a defined quality metric].

5.2 Definition of the Family FMT_LIM

137 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.

138 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.

139 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 and availability policy].

Dependencies: FMT_LIM.2 Limited availability.

140 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 their availability so that in conjunction with "Limited capabilities (FMT_LIM.1)" the following policy is enforced [assignment: Limited capability and availability policy].

Dependencies: FMT_LIM.1 Limited capabilities.

141 Application note: The functional requirements FMT_LIM.1 and FMT_LIM.2 assume that there are two types of mechanisms (limited capabilities and limited availability) which together shall provide protection in order to enforce the policy. This also allows 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.

The combination of both requirements shall enforce the policy.

5.3 Definition of the Family FAU_SAS

142 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.

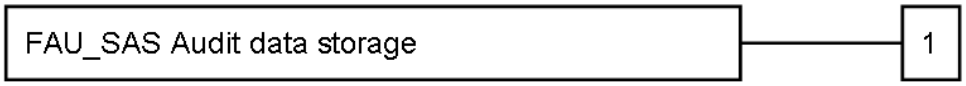
143 The family "Audit data storage (FAU_SAS)" is specified as follows.

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

144 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.

145 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

146 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.

147 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.

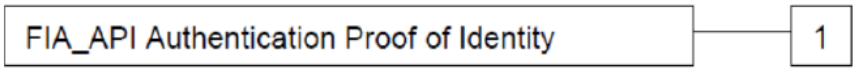
148 The family "Authentication Proof of Identity (FIA_API)" is specified as follows.

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.

6 IT SECURITY REQUIREMENTS

149 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

150 In order to define the Security Functional Requirements the Part 2 of the Common Criteria was used. However, some Security Functional Requirements have been refined. The refinements are described below the associated SFR. The operations completed in the ST are marked in italic font.

Malfunctions

151 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
FRU_FLT.2.1	The TSF shall ensure the operation of all the TOE's capabilities when the following failures occur.
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.

152 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.
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.

Abuse of Functionality

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

FMT_LIM.1	Limited capabilities

Hierarchical to: No other components.

FMT_LIM.1.1 The TSF shall be designed in a manner that limits their capabilities so that in conjunction with "Limited availability (FMT_LIM.2)" the following policy is enforced.

Dependencies: FMT_LIM.2 Limited availability.

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

FMT_LIM.2 Limited availability

Hierarchical to: No other components.

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

Dependencies: FMT_LIM.1 Limited capabilities.

155 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.

Dependencies: No dependencies.

Application Note: The integrity and uniqueness of the unique identification of the TOE must be supported.

Physical Manipulation and Probing

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

FDP_SDC.1 **Stored data confidentiality**

Hierarchical to: No other components.

Dependencies: No dependencies.

FDP.SDC.1.1 The TSF shall ensure the confidentiality of the information of the user data while it is stored.

157 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: No other components.

Dependencies: No dependencies.

FDP.SDI.2.1 The TSF shall monitor user data stored in containers controlled by the TSF.

FDP.SDI.2.2	Upon detection of a data integrity error, the TSF shall *enforce*.
Application Note:	This requirement is achieved by security features.

158 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.

Leakage

159 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.

160 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.

161 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

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

163 User Data and TSF data shall not be accessible from the TOE except when the Security IC Embedded Software decides to communicate the User Data 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.

Random Numbers (DTRNG FRO)

164 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/P2High	Random number generation – AIS31 P2-High
Hierarchical to:	No other components.
FCS_RNG.1.1/P2High	The TSF shall provide *a physical* random number generator that implements *total-failure and online tests of the random source*.
FCS_RNG.1.2/P2High	The TSF shall provide 16-bit random numbers generated by a physical random number generator (referred to as DTRNG FRO) *coupled with Von-Neumann post-processing mechanism that meets AIS31 version 3.1 Functional Classes and Evaluation Methodology for Physical Random Number Generators, 25 September 2001, Class P2-High (German metric).*
Dependencies:	No dependencies.

FCS_RNG.1/RGS_B1	Random number generation – RGS_B1
Hierarchical to:	No other components.
FCS_RNG.1.1/RGS_B1	The TSF shall provide *a physical* random number generator that implements *- the rules RègleArchiGVA-1 and the recommendation RecomArchiGVA-1 of [12] ;*

- total failure tests and online tests.

FCS_RNG.1.2/RGS_B1 The TSF shall provide random numbers that meet *the rule RègleArchiGVA-2 of [12].*

Dependencies: No dependencies.

Warning: The TSF fulfils some but not all the necessary rules to comply with [12] regardingrandom numbers generators (RNG). The composite product's RNG will comply with [12] only when all the rules of §2.4 "Génération d'aléa cryptographique" of [12] are addressed. In particular, a cryptographic post-processing must be implemented by the composite developer.

Memory Access Control

165 Usage of multiple applications in one Smartcard 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.

166 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.

167 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).

168 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.

169 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 access .

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).

170 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*.

Dependencies:	FDP_ACF.1 Security attribute based access control

171 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.
Hierarchical to:	No other components.
FDP_ACF.1.1	The TSF shall enforce the *Memory Access Control Policy* to objects based on the *memory area*
FDP_ACF.1.2	The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed.
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

172 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 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

173 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 the security attributes.
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

174 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 security management functions*: access the control registers of the MPU*.
Dependencies:	No dependencies

Cryptographic Support

175 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.

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

- Triple Data Encryption Standard (TDES) with 112bit or 168bit key size

Triple-DES Operation

177 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 *TDES in ECB mode* and cryptographic key sizes *112 bit, 168 bit* that meet the following: *[NIST SP 800-67] chapter 2 and 3, [NIST SP 800-38A]*
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:	The TOE implements TDES with key option 1 and 2 with ECB mode.

178 The TOE shall meet the requirement "Cryptographic key destruction - TDES (FCS_CKM.4/TDES)" as specified below.

FCS_CKM.4/TDES	Cryptographic key destruction - TDES
Hierarchical to:	No other components.
FCS_CKM.4.1/TDES	The TSF shall destroy cryptographic keys in accordance with a specified cryptographic key destruction method *overwriting* that meets the following: *none*.
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]
Application Note:	The cryptographic key destruction can be done by overwriting the internal stored key or by TOE reset.

Bootloader

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

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

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

FMT_LIM.2/Loader	Limited availability - Loader
Hierarchical to:	No other components.
FMT_LIM.2.1/Loader	The TSF shall be designed in a manner that limits its availability so that in conjunction with "Limited capabilities (FMT_LIM.1)" the following policy is enforced: The TSF prevents deploying the Loader functionality.
Dependencies:	FMT_LIM.1 Limited capabilities.

Authentication Proof of Identity

181 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 must provide a *Bootloader* to prove the identity of the TOE to an external entity

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)

Limited availability (FMT_LIM.2)
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)
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 key destruction (FCS_CKM.4/TDES)
Limited capabilities(FMT_LIM.1/Loader)
Limited availability - Loader(FMT_LIM.2/Loader)
Authentication Proof of Identity (FIA_API.1)

Table 6. Augmented Security Functional Requirements

6.2 TOE Assurance Requirements

182 The Security Target will be evaluated according to

Security Target evaluation (Class ASE)

183 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)

184 and augmented by the following components

ALC_DVS.2 and AVA_VAN.5

185 corresponding to level “EAL5+”.

186 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. In particular the document [10] is used in the context of vulnerability analysis

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

187 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	- FPT_PHP.3 "Resistance to physical attack" - FDP_SDC.1 "Stored data confidentiality"
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"

Objective	TOE Security Functional and Assurance Requirements
O.Phys-Manipulation	- FPT_PHP.3 "Resistance to physical attack" - FDP_SDI.2 "Stored data integrity monitoring and action"
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
O.Abuse-Func	- FMT_LIM.1 "Limited capabilities" - FMT_LIM.2 "Limited availability" plus those for O.Leak-Inherent, O.Phys-Probing, O.Malfunction, O.Phys-Manipulation, O.Leak-Forced - FDP_ITT.1, FPT_ITT.1, FDP_IFC.1, FPT_PHP.3, FRU_FLT.2, FPT_FLS.1, 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
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 - FCS_CKM.1/TDES
O.Cap_Avail_Loader	- FMT_LIM.1/Loader "Limited capabilities" - FMT_LIM.2/Loader "Limited availability – Loader"
OE.Lim_Block_Loader	- not applicable
O.Authentication	- FIA_API.1 " Authentication Proof of Identity"
OE.TOE_Auth	- not applicable

Table 7: Security Requirements versus Security Objectives

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

189 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.

190 Of course this has also to be supported by the Security IC Embedded Software. For example timing attacks were possible if the processing time of algorithms implemented in the software would depend on the content of secret variables.

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

192 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.

193 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). In this case the combination of the Security IC Embedded Software together with FPT_PHP.3 is suitable to meet the objective.

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

195 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. To support this, the functions implementing FRU_FLT.2 and FPT_FLS.1 must work independently so that their operation cannot affect by the Security IC Embedded Software (refer to the refinement). Therefore, there is no possible instance of conditions under O.Malfunction, which is not covered. The suitability of the implementation is subject of the evaluation of the assurance component ADV_ARC.1

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

197 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.

198 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). This support must be addressed in the Guidance Documentation. Together with this FPT_PHP.3 is suitable to meet the objective.

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

200 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.

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

202 This objective states that abuse of functions (especially provided by the IC Dedicated Test Software, for instance in order to read secret data) must not be possible in Phase 7 of the life-cycle. There are two possibilities to achieve this: (i) They cannot be used by an attacker (i. e. its availability is limited) or (ii) using them would not be of relevant use for an attacker (i. e. its capabilities are limited) since the functions are designed in a specific way. The first possibility is specified by FMT_LIM.2 and the second one by FMT_LIM.1. Since these requirements are combined to support the policy, which is suitable to fulfil O.Abuse-Func, both security functional requirements together are suitable to meet the objective.

203 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.

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

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

206 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.

207 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.

208 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, ALC and ADO.

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

210 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.

211 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.

212 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.

213 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.)

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

215 The FCS_COP.1/TDES meets the security objective "Cryptographic service Triple-DES (O.TDES)

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

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

218 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.

219 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.

220 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.

221 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.

222 The justification related to the security objective "Additional Specific Security Functionality (O.Add-Functions)" is as follows:

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

224 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.

6.3.2 Dependencies of Security Functional Requirements

225 Table 8 below lists the security functional requirements defined in this Protection Profile, their dependencies and whether they are satisfied by other security requirements defined in this Protection Profile. 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

Security Functional Requirement	Dependencies	Fulfilled by security requirements
FMT_LIM.1	FMT_LIM.2	Yes
FMT_LIM.2	FMT_LIM.1	Yes
FAU_SAS.1	None	No dependency
FDP_SDC.1	None	No dependency
FDP_SDI.2	None	No dependency
FPT_PHP.3	None	No dependency
FDP_ITT.1	FDP_ACC.1 or FDP_IFC.1	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_CKM.4/TDES	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
FMT_LIM.1/Loader	FMT_LIM.2	Yes
FMT_LIM.2/Loader	FMT_LIM.1	Yes
FIA_API.1	None	No dependency

Table 8: Dependencies of the Security Functional Requirements

226 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.

227 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.

228 The functional requirement FCS_CKM.1 which is dependent to FCS_COP.1/TDES is 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 concerning these functions shall be fulfilled by the environment (Security IC Embedded Software).

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

6.3.3 Rationale for the Assurance Requirements

230 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.

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

6.3.3.1 ALC_DVS.2 Sufficiency of Security Measures

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

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

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

6.3.3.2 AVA_VAN.5 Advanced Methodical Vulnerability Analysis

235 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.

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

237 AVA_VAN.5 has dependencies to ADV_ARC.1 “Security Architectural Design”, ADV_FSP.4 “Complete functional specification”, ADV_TDS.3 “Basic modular design”, ADV_IMP.1 “Implementation representation of the TSF”, AGD_OPE.1 “Operational user guidance”, AGD_PRE.1 “Preparative procedures”, and ATE_DPT.1 “Testing: Basic design”.

238 All these dependencies are satisfied by EAL5.

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

6.3.4 Security Requirements are Internally Consistent

240 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.

241 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.

242 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, FCS_RNG.1, and those implemented in the Security IC Embedded Software.

243 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, FMT_LIM.2, FCS_RNG.1, and those implemented in the Security IC Embedded Software.

244 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).

245 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 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.

246 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 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.

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

capabilities only.

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

249 The security functional requirement Limited Capabilities (FMT_LIM.1) must close gaps which could be left by the control being applied to the function's interface (Limited Availability (FMT_LIM.2)). Note that the security feature or function which limits the availability can be bypassed, deactivated or changed by physical manipulation or a malfunction caused by an attacker. Therefore, if Limited Availability (FMT_LIM.2) is vulnerable1, it is important to limit the capabilities of the functions in order to limit the possible benefit for an attacker.

250 The security functional requirement Limited Availability (FMT_LIM.2) must close gaps which could result from the fact that the function's kernel in principle would allow to perform attacks. The TOE must limit the availability of functions which potentially provide the capability to disclose or manipulate User Data, to manipulate security features or functions of the TOE or of the Security IC Embedded Software or to enable an attack. Therefore, if an attacker could benefit from using such functions1F, it is important to limit their availability so that an attacker is not able to use them.

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

252 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.

253 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 protect the cryptographic algorithms (FCS_COP.1) and the cryptographic key generations (FCS_CKM.1). Therefore these security functional requirements support the secure implementation and operation of FCS_COP.1 and FCS_CKM.1.

254 Parts of the Smartcard 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.

255 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 EAL 5 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

EAL 5 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

256 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

257 The detection thresholds of TOE's detectors are inside the operating range of the TOE. Therefore abnormal events/failures are detected before the secure state is compromised. This allows to take User's defined appropriate actions by software or to immediately RESET the TOE.

258 The secure state is maintained by TOE's detectors. The TOE's detectors are monitoring the failure occurs. If the failures happen, the TOE goes into RESET state. This satisfies the FPT_FLS.1 "Failure with preservation of secure state."

TOE's Detectors

259 These functions records in register the events notified by the detectors. The software configures the reaction in case of detection:

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

SFR2: FRU_FLT.2: Limited fault tolerance

260 All operating signals are filtered/regulated in order to prevent malfunction.

TOE's Filters

261 These filters are used for preventing noise, glitches and extremely high frequency in the external reset or clock pad from causing undefined or unpredictable behavior of the chip.

Integrity Checkers

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

263 TOE's filters and integrity checkers are implemented by the hardware. The filtering cannot be affected or bypassed by Smartcard Embedded Software. The reaction to the detection can be configured by the software. The influence on security and the way how to configure it is described in details in the S3FT9FA User's Manual. Therefore, FRU_FLT.2 is implemented by TOE.

SFR3: FPT_PHP.3: Resistance to physical attacks

264 This requirement is achieved by security feature as the shield must be removed and bypassed in order to perform physical intrusive attacks. The TOE makes a reset or FIQ occurs to stops operation if a physical manipulation or physical probing attack is detected of the TOE layout unpractical. So these functionalities meet the security functional requirement of FPT_PHP.3: Resistance to physical attack.

SFR4: FDP_ACC.1: Subset access control

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

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

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

3) Access rights for the code executed in FLASH

4) Access control for Operating state: This security function selects booting memory area. User can select ROM-BOOT or FLASH-BOOT

5) FLASH protection about Write operation

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

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

SFR6: FMT_MSA.3: Static attribute initialization.

267 All Special Function Registers including MPU have DEFAULT values after Power on Reset. The access attribute of ROM and Flash memory have DEFAULT values.

SFR7: FMT_MSA.1: Management of security attributes.

268 This is achieved with the MPU, OPRMON and CPAMON feature. The Memory Protection Unit (MPU) enables user to partition memory and set individual protection attributes for each partition. This allows the operating system to control the memory regions accessible by a User mode application process. The OPRMON enables user to ROM protection attributes. This allows the operating system to control the ROM regions accessible by a User mode application process. The CPAMON enables user to FLASH and set individual protection attributes.

SFR8: FMT_SMF.1: Specification of management functions.

269 This is achieved via access to Special Function Registers of Memory Protection Unit(MPU). MPU provides Special Function Registers which defines the base address and the limit address for a partition. The Registers exist for Flash, and RAM. Additional Registers exist for defining the protection attribute for each partition.

SFR9: FAU_SAS.1: Audit Storage

270 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 mode and NORMAL mode: This function disables the TEST 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.

2) TEST mode communication protocol and data commands: This function is the proprietary protocol used to operate the chip in TEST mode. This function enforces the identification and authentication of the TEST administrator during the test phase of the manufacturing process.

3) Functional Tests: During the manufacturing process, the operation of the TOE and the embedded software checksum are verified. This security function ensures the correct operation of the TOE security functions and the integrity of the embedded software.

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. In addition, user can identify the version of device Dedicated SW part. The Bootloader and DTRNG FRO library version are identified by

the version functions in the respective software parts. This enables to identify and track the TOE during the rest of its life.

SFR10: FMT_LIM.1: Limited capabilities

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

SFR11: FMT_LIM.2: Limited availabilities

272 TEST mode can be accessed only by the TEST administrator by supplying an authentication password 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.

SFR12: FDP_IFC.1: Subset information flow control

273 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.

Shield: This requirement is achieved by security feature as the Shield must be removed and bypassed in order to perform physical intrusive attacks.

Life cycle detector: Life cycle detector detects if detector signals are modified or not.

SFR13: FDP_ITT.1: Basic internal transfer protection

274 This requirement is achieved by the combination of the TOE security features TOE features 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 function 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

275 This requirement is achieved by the combination of the TOE security features TOE features 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 function protects the memory contents of the TOE from data analysis on the stored data as well as on internally transmitted data. The algorithms used for encryption are proprietary. The ROM encryption is static key while the RAM and the FLASH

encryption is dynamic key. RAM encryption is performed automatically while FLASH encryption is defined and managed by the embedded software. The key size for FLASH encryption is 16-byte.

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. Most sensitive hardware components such as buses are also hidden and implemented in deepest layers.

5) De-synchronization and signal-to-noise ratio reduction mechanisms: The TOE operations can be made asynchronous by using the Internal Variable Clock and the Random Wait Generator security features. They make a full range of intrusive (e.g. probing attacks) and non-intrusive attacks (e.g. side-channel attacks) more complex and difficult.

SFR15: FCS_RNG.1: Random number generation

276 This requirement is ensured by the design of the random number generation algorithm that makes use of Digital True Random Number Generator (DTRNG FRO) and the associated DTRNG FRO library conforming to some of ANSSI RGS_B1 requirements (French scheme) as well as BSI-AIS31 Class P2 requirements (German metric).

SFR16: FCS_COP.1: Cryptographic operation

277 This requirement is covered by the TOE.

Triple Data Encryption Standard Engine

278 This function is used for encrypting and decrypting data using the Triple DES symmetric algorithm with 112bit or 168bit key size. (FCS_COP.1/TDES)

SFR17: Limited capabilities - Loader(FMT_LIM.1/Loader)

279 This requirement is achieved by the changing the Operating Mode Selection from ROM Booting mode to Flash Booting mode and then locking. The Bootloader is only supported in ROM Booting mode. In Flash Booting mode, the Bootloader doesn't operate. The Bootloader supports the APDU command which change from ROM booting mode to FLASH Booting mode and locks the chip to the Flash mode by setting "Non Volatile Configuration module". If the chip is to be locking to Flash Reset mode, Deploying Loader functionality does not allow stored user data to be disclosed or manipulated. Bootloader can not be deployed any more after be locking to Flash Reset. It is not allowed to use read commands and write commands in Bootloader. So user can not read, download nor modify any data nor code to Flash using Bootlaoder.

SFR18: Limited availability – Loader (FMT_LIM.2/Loader)

280 This requirement is achieved by the changing the Operating Mode Selection from ROM Booting mode to Flash Booting mode and then locking. The Bootloader is only supported in ROM Booting mode. In Flash Booting mode, the Bootloader doesn't operate. The Bootloader supports the APDU command which change from ROM booting mode to FLASH Booting mode and locks the chip to the Flash mode by setting "Non Volatile Configuration module". If the chip is to be locking to Flash Reset mode, TSF prevents deploying the Loader functionality. Bootloader is to be disabled and user cannot change the mode any more after locking.

SFR19: Stored data confidentiality (FDP_SDC.1)

281 This requirement is achieved by the combination of the TOE security features TOE features 1) to 10) 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) Data encryption forbus: This function protects data bus from probing attacks.
3) Memory encryption: This security function protects the memory contents of the TOE from data analysis on the stored data as well as on internally transmitted data. The algorithms used for encryption are proprietary. The ROM encryption is static key while the RAM and the FLASH encryption is dynamic key. RAM encryption is performed automatically while FLASH encryption is defined and managed by the embedded software. The key size for FLASH encryption is 16-byte.
4) Invalid address access: This function detects invalid address access occurrence.
5) Shield: This requirement is achieved by security feature as the Shield must be removed and bypassed in order to perform physical intrusive attacks.
6) Life cycle detector: Life cycle detector detects if detector signals are modified or not.
7) Filters.
8) Non-reversibility of TEST and NORMAL modes: This function disables the TEST 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.
9) Control of Booting mode: This requirement is achieved by changing the Operating Mode Selection.

SFR20: Stored data integrity monitoring and action (FDP_SDI.2)

282 This requirement is achieved by following functions.

Flash/RAM: Error management features.

SFR21: Authentication Proof of Identity (FIA_API.1)

283 This requirement is achieved by processing the Authentication sequence.

SFR22: Cryptographic key destruction (FCS_CKM.4)

284 This requirement is covered by the TOE.

Cryptographic Key destruction – Triple Data Encryption Standard Engine

This requirement is achieved by overwriting the TDES key registers or by TOE reset (FCS_CKM.4/TDES).

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 Smartcard Embedded Software in the application context. User data comprise all data in the final Smartcard 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 Literature

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