Federal Office
for Information Security

Certification Report

BSI-DSZ-CC-0451-2007

for

S3CC91C
16-Bit RISC Microcontroller for Smart Card
Version 0

from

Samsung Electronics Co., Ltd.

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Bundesamt
für Sicherheit in der
Informationstechnik

Deutsches IT-Sicherheitszertifikat

erteilt vom Bundesamt für Sicherheit in der Informationstechnik

BSI-DSZ-CC-0451-2007

S3CC91C 16-Bit RISC Microcontroller for Smart Card
Version 0

from	Samsung Electronics Co., Ltd.
PP Conformance:	Protection Profile BSI-PP-0002-2001
Functionality:	BSI-PP-0002-2001 conformant plus product specific extensions Common Criteria Part 2 extended
Assurance:	Common Criteria Part 3 conformant EAL 4 augmented by ALC_DVS.2, AVA_MSU.3, AVA_VLA.4, ADV_IMP.2

Common Criteria
Arrangement
for components
up to EAL 4

Common Criteria

The IT product identified in this certificate has been evaluated at an accredited and licensed/ approved evaluation facility using *the Common Methodology for IT Security Evaluation, Version 2.3 extended by advice of the Certification Body for* components beyond EAL 4 and guidance specific for the technology of the product for conformance to the *Common Criteria for IT Security Evaluation (CC), Version 2.3 (ISO/IEC 15408:2005)* .

This certificate applies only to the specific version and release of the product in its evaluated configuration and in conjunction with the complete Certification Report.

The evaluation has been conducted in accordance with the provisions of the certification scheme of the German Federal Office for Information Security (BSI) and the conclusions of the evaluation facility in the evaluation technical report are consistent with the evidence adduced.

This certificate is not an endorsement of the IT product by the Federal Office for Information Security or any other organisation that recognises or gives effect to this certificate, and no warranty of the IT product by the Federal Office for Information Security or any other organisation that recognises or gives effect to this certificate, is either expressed or implied.

Bonn, 10. September 2007
The President of the Federal Office for Information Security

Dr. Helmbrecht L.S.

IT Security Certified
SOGIS - MRA

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Preliminary Remarks

Under the BSIG[1] Act, the Federal Office for Information Security (BSI) has the task of issuing certificates for information technology products.

Certification of a product is carried out on the instigation of the vendor or a distributor, hereinafter called the sponsor.

A part of the procedure is the technical examination (evaluation) of the product according to the security criteria published by the BSI or generally recognised security criteria.

The evaluation is normally carried out by an evaluation facility recognised by the BSI or by BSI itself.

The result of the certification procedure is the present Certification Report. This report contains among others the certificate (summarised assessment) and the detailed Certification Results.

The Certification Results contain the technical description of the security functionality of the certified product, the details of the evaluation (strength and weaknesses) and instructions for the user.

[1] Act setting up the Federal Office for Information Security (BSI-Errichtungsgesetz, BSIG) of 17 December 1990, Bundesgesetzblatt I p. 2834

Contents

A Certification

1 Specifications of the Certification Procedure

The certification body conducts the procedure according to the criteria laid down in the following:

- BSIG[2]
- BSI Certification Ordinance[3]
- BSI Schedule of Costs[4]
- Special decrees issued by the Bundesministerium des Innern (Federal Ministry of the Interior)
- DIN EN 45011 standard
- BSI certification: Procedural Description (BSI 7125)
- Common Criteria for IT Security Evaluation (CC), Version 2.3 (ISO/IEC 15408:2005)[5]
- Common Methodology for IT Security Evaluation, Version 2.3
- BSI certification: Application Notes and Interpretation of the Scheme (AIS)
- Advice from the Certification Body on methodology for assurance components above EAL4 (AIS 34)

2 Recognition Agreements

In order to avoid multiple certification of the same product in different countries a mutual recognition of IT security certificates - as far as such certificates are based on ITSEC or CC - under certain conditions was agreed.

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2 Act setting up the Federal Office for Information Security (BSI-Errichtungsgesetz, BSIG) of 17 December 1990, Bundesgesetzblatt I p. 2834

3 Ordinance on the Procedure for Issuance of a Certificate by the Federal Office for Information Security (BSI-Zertifizierungsverordnung, BSIZertV) of 07 July 1992, Bundesgesetzblatt I p. 1230

4 Schedule of Cost for Official Procedures of the Bundesamt für Sicherheit in der Informationstechnik (BSI-Kostenverordnung, BSI-KostV) of 03 March 2005, Bundesgesetzblatt I p. 519

5 Proclamation of the Bundesministerium des Innern of 10 May 2006 in the Bundesanzeiger dated 19 May 2006, p. 3730

2.1 European Recognition of ITSEC/CC - Certificates

The SOGIS-Agreement on the mutual recognition of certificates based on ITSEC became effective on 3 March 1998.

This agreement was signed by the national bodies of Finland, France, Germany, Greece, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. This agreement on the mutual recognition of IT security certificates was extended to include certificates based on the CC for all evaluation levels (EAL 1 – EAL 7). The German Federal Office for Information Security (BSI) recognises certificates issued by the national certification bodies of France and the United Kingdom within the terms of this Agreement.

The SOGIS-MRA logo printed on the certificate indicates that it is recognised under the terms of this agreement.

2.2 International Recognition of CC - Certificates

An arrangement (Common Criteria Arrangement) on the mutual recognition of certificates based on the CC evaluation assurance levels up to and including EAL 4 has been signed in May 2000 (CC-MRA). It includes also the recognition of Protection Profiles based on the CC.

As of February 2007 the arrangement has been signed by the national bodies of: Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Israel, Italy, Japan, Republic of Korea, The Netherlands, New Zealand, Norway, Republic of Singapore, Spain, Sweden, Turkey, United Kingdom, United States of America. The current list of signatory nations resp. approved certification schemes can be seen on the web site: http:\\www.commoncriteriaportal.org

The Common Criteria Arrangement logo printed on the certificate indicates that this certification is recognised under the terms of this agreement.

This evaluation contains the components ALC_DVS.2, AVA_MSU.3, AVA_VLA.4 and ADV_IMP.2 that are not mutually recognised in accordance with the provisions of the CCRA. For mutual recognition the EAL4-components of these assurance families are relevant.

3 Performance of Evaluation and Certification

The certification body monitors each individual evaluation to ensure a uniform procedure, a uniform interpretation of the criteria and uniform ratings.

The product S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0 has undergone the certification procedure at BSI. This is a re-certification based on BSI-DSZ-CC-0438-2007 . Specific results from the evaluation process based on BSI-DSZ-CC-0438-2007 were re-used.

The evaluation of the product S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0 was conducted by TÜV Informationstechnik GmbH. The

evaluation was completed on 31. August 2007 . The TÜV Informationstechnik GmbH is an evaluation facility (ITSEF)[6] recognised by the certification body of BSI.

For this certification procedure the sponsor and applicant is: Samsung Electronics Co., Ltd.

The product was developed by: Samsung Electronics Co., Ltd.

The certification is concluded with the comparability check and the production of this Certification Report. This work was completed by the BSI.

4 Validity of the certification result

This Certification Report only applies to the version of the product as indicated. The confirmed assurance package is only valid on the condition that

- all stipulations regarding generation, configuration and operation, as given in the following report, are observed,
- the product is operated in the environment described, where specified in the following report and in the Security Target.

For the meaning of the assurance levels and the confirmed strength of functions, please refer to the excerpts from the criteria at the end of the Certification Report.

The Certificate issued confirms the assurance of the product claimed in the Security Target at the date of certification. As attack methods may evolve over time, the resistance of the certified version of the product against new attack methods can be re-assessed if required and the sponsor applies for the certified product being monitored within the assurance continuity program of the BSI Certification Scheme. It is recommended to perform a re-assessment on a regular basis.

In case of changes to the certified version of the product, the validity can be extended to the new versions and releases, provided the sponsor applies for assurance continuity (i.e. re-certification or maintenance) of the modified product, in accordance with the procedural requirements, and the evaluation does not reveal any security deficiencies.

5 Publication

The following Certification Results contain pages B-1 to B-16 and D1 to D-4.

The product S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0 has been included in the BSI list of the certified products, which is published regularly (see also Internet: http:// www.bsi.bund.de). Further information can be obtained from BSI-Infoline +49 228 9582-111.

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[6] Information Technology Security Evaluation Facility

Further copies of this Certification Report can be requested from the sponsor[7] of the product. The Certification Report may also be obtained in electronic form at the internet address stated above.

[7] Samsung Electronics Co., Ltd.
San24, Nongseo-dong, Giheung-gu, Yongin-City, Gyeonggido
449-711, Korea

B Certification Results

The following results represent a summary of

- the security target of the sponsor for the target of evaluation,
- the relevant evaluation results from the evaluation facility, and
- complementary notes and stipulations of the certification body.

Contents of the certification results

1 Executive Summary

The Target of evaluation (TOE) is the S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0. For this evaluation specific results from the evaluation process based on BSI-DSZ-CC-0438-2007 were re-used. The Target of Evaluation (TOE), the S3CC91C Microcontroller featuring the TORNADO™ cryptographic coprocessor, is a smartcard integrated circuit which is composed of a processing unit, security components and 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, including a RSA asymmetric cryptography library and an AIS20 compliant random number generation library. All other software is called Smartcard Embedded Software and is not part of the TOE.

The TOE is intended to be used in a range of high security applications like 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) and multimedia applications and digital right management protection.

Regarding the RSA crypto library the user has the possibility to tailor this IC Dedicated Software part of the TOE during the manufacturing process by deselecting the RSA crypto library. Hence the TOE can be delivered with or without the functionality of the RSA crypto library what's resulting in two TOE configurations. This is considered in this Security Target [6] and corresponding notes (indicated by "optional") are added where required. If the user decides not to use the RSA crypto library the library is not delivered to the user and the accompanying "Additional Specific Security Functionality (O.Add-Functions)" Rivest-Shamir-Adleman (RSA) is not provided by the TOE. Deselecting the RSA crypto library means excluding the code implementing functionality, which the user decided not to use. Excluding the code of the deselected functionality has no impact on any other security policy of the TOE, it is exactly equivalent to the situation where the user decides just not to use the functionality.

The TOE S3CC91C is manufactured in theIC fabrication of Samsung in Giheung wafer line 6, Korea, indicated by the production line indicator "06" as hex (see part D, Annex A of this report).

The Security Target [6] is the basis for this certification. It is based on the certified Protection Profile BSI-PP-0002-2001 [9].

The hardware part of the TOE is the complete chip, composed of hardware and software parts.

- The TOE hardware consists of 72K bytes EEPROM, 8K bytes RAM, 2K bytes Crypto RAM, 384K User ROM, 12K Test ROM, 16-bit Central Processing Unit (CPU), Internal Voltage Regulator (IVR), Detectors & Security Logic, a non-deterministic random number generator (RNG, this non-deterministic part is only tested according to seed generation for conformance to AIS20 [4]), Memory Protection Unit (MPU), Triple DES cryptographic coprocessor with 112 or 168 bits key size, TORNADO™ modular multiplier supporting up to 2048-bit RSA, Hardware UART for contact I/O modes, Address & data buses, Internal Clock and Timers.
- The TOE firmware and software consist of Test ROM code (that is used for testing the chip during production), the TORNADO RSA secure cryptographic library v3.5S (optional), a Deterministic Random Number Generator (DRNG) that fulfils the requirements of AIS20 [4].

The TOE security assurance requirements are based entirely on the assurance components defined in part 3 of the Common Criteria (see part C or [1], part 3 for details). The TOE meets the assurance requirements of the Evaluation Assurance Level EAL 4 augmented by ALC_DVS.2, AVA_MSU.3, AVA_VLA.4, ADV_IMP.2.

The TOE Security Functional Requirements (SFR) relevant for the TOE are outlined in the Security Target [7], chapter 5.1. They are selected from Common Criteria Part 2 and some of them are newly defined. Thus the TOE is CC part 2 extended.

The Security Functional Requirements (SFR) relevant for the IT-Environment of the TOE are outlined in the Security Target [7], chapter 5.2.

The TOE Security Functional Requirements are implemented by the following TOE Security Functions:

TOE Security Function	**Addressed issue**
SF1	Environmental Security violation recording and reaction
SF2	Access Control
SF3	Non-reversibility of TEST and NORMAL modes
SF4	Hardware countermeasures for unobservability
SF5	Cryptography

Table 1: TOE Security Functions

For more details please refer to the Security Target [7], chapter 6.1.

The claimed TOE's strength of functions 'high (SOF-high) for specific functions as indicated in the Security Target [7], chapter 6.1 is confirmed. The rating of the strength of functions does not include the cryptoalgorithms suitable for encryption and decryption (see BSIG Section 4, Para. 3, Clause 2). For details see chapter 9 of this report.

The assets to be protected by the TOE are defined in the Security Target [7], chapter 3.1. Based on these assets the security environment is defined in terms of assumptions, threats and policies. This is outlined in the Security Target [7], chapter 3.2 to 3.4.

The TOE has two different operating modes, normal mode and test mode. The application software being executed on the TOE can not use the test mode. The TOE has two evaluated configurations (see for more details chapter 8):

- Smartcard IC S3CC91C Version 0
- Smartcard IC S3CC91C Version 0 with Secure Crypto Library V3.5S.

The TOE is delivered as a hardware unit at the end of the IC manufacturing process (Phase 3). The Certification Results only apply to the version of the product indicated in the Certificate and on the condition that all the stipulations are kept as detailed in this Certification Report. This certificate is not an endorsement of the IT product by the Federal Office for Information Security (BSI) or any other organisation that recognises or gives effect to this certificate, and no warranty of the IT product by BSI or any other organisation that recognises or gives effect to this certificate, is either expressed or implied.

2 Identification of the TOE

The Target of Evaluation (TOE) is called:

S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0

The following table outlines the TOE deliverables:

No	Type	Identifier	Release	Form of Delivery
1	HW	S3CC91C	V0	Wafer
2	SW	DRNG	V2.0	Secure code in electronic form
3	SW	Secure Crypto Library (optional)	V3.5S	Secure code in electronic form
4	DOC	User's manual [12]	V5	In electronic form
5	DOC	Security Application Note [13]	V1.0	In electronic form
6	DOC	RSA Application Note [14]	V1.10	In electronic form
7	DOC	DRNG Application Note [15]	V2.0	In electronic form
8	DOC	S3CC9LC Delivery Specification [16]	V1	

Table 2: Deliverables of the TOE

The deliverables and the way of protection are described in [17, chapter 3.4.2]. The delivered chips contain the actual TOE and the embedded software. They are delivered in form of wafers from the TOE Manufacturer (logistics warehouse in Onyang) to the Card Manufacturer.

The TOE's confidentiality and availability should be protected during the delivery. The user software (operating system) will be loaded on the delivered TOE. Then the TOE is under the control of the user software and the TOE manufacturer (Samsung) can guarantee the integrity up to the delivery process.

A processing step during wafer testing incorporates the chip-individual features into the TOE. Each individual TOE is uniquely identified by its product code.

This product code in the EEPROM Security area is TOE specific as among others. It includes the core, application category, serial number, version, internal development code, and customer ROM code. It is described how the customer can retrieve this information. Each individual TOE can therefore be traced unambiguously and thus assigned to the entire development and production process (compare Table 6).

The TOE is identified by S3CC91C revision 0. Another characteristic of the TOE is the product code. This information is stored in the EEPROM and can be read out by the user of the card via the normal EEPROM read command. It contains the following information at which among others the production line indicator is part of the serial number. Here the hex value "06" at the beginning of the serial number indicates that the TOE is produced in Giheung wafer line 6:

Address	Contents	Data
80000h – 80001h	Chip status information	Samsung's internal management value
80002h – 80003h	ROM code number	ROM code number
80004h – 80005h	Device Type	010C h
80006h – 8000Fh	Available for customer	All FF h
80010h – 8001Bh	Serial number	Samsung's internal management value beginning with 06 h
8001Ch – 8001Dh	IC Fabricator	4250 h
8001Eh – 8001Fh	IC Fabrication Date	YDDD h (where Y is the last digit of the year and DDD is the number of the day within the year)
80020h – 80021h	IC Module Fabricator	4252 h
80022h– 80023h	IC Module Packaging date	YDDD h (where Y is the last digit of the year and DDD is the number of the day within the year)
80024h – 80027h	IC Serial Number	A proprietary binary number
80028h – 80029h	IC Batch number	A proprietary binary number
8002Ah	IC Version	02 h
8002Bh	Test ROM Code Version	10 h
8002Ch – 8002Dh	Crypto. Library Version	035C h
8002Eh	DRNG Library Version	02 h

80030h – 8007Fh	Available for customer	All FF h

Table 6: TOE version information

3 Security Policy

The security policy is expressed by the set of security functional requirements and implemented by the TOE. It covers the following issues:

The security policy of the TOE is to provide basic Security Functions to be used by the smart card operating system and the smart card application thus providing an overall smart card system security. Therefore, the TOE will implement a symmetric cryptographic block cipher algorithm to ensure the confidentiality of plain text data by encryption and to support secure authentication protocols and it will provide a deterministic random number generator. If the user decides not to use the RSA crypto library the library is not delivered to the user. Hence the TOE can be delivered with or without the functionality of the RSA crypto library what is resulting in two TOE configurations.

As the TOE is a hardware security platform, the security policy of the TOE is also to provide protection against leakage of information (e.g. to ensure the confidentiality of cryptographic keys during Triple-DES and RSA cryptographic functions performed by the TOE), against physical probing, against malfunctions, against physical manipulations and against abuse of functionality. Hence the TOE shall

- maintain the integrity and the confidentiality of data stored in the memory of the TOE and
- maintain the integrity, the correct operation and the confidentiality of Security Functions (security mechanisms and associated functions) provided by the TOE.

4 Assumptions and Clarification of Scope

The assumptions defined in the Security Target and some aspects of threats and organisational security policies are not covered by the TOE itself. These aspects lead to specific security objectives to be fulfilled by the TOE-Environment. The following topics are of relevance: Usage of Hardware Platform, Treatment of User Data, Protection during TOE Development and Production, Protection during Packaging, Finishing and Personalisation. Details can be found in the Security Target [7], chapter 4.2.

5 Architectural Information

The TOE S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0 is an integrated circuits (IC) providing a platform to a smart card operating system and smart card application software. A top level block diagram and a list of

subsystems can be found within the TOE description of the Security Target [6]. The complete hardware description and the complete instruction set of the TOE is to be found in guidance documents delivered to the customer, see table 5.

The TOE consists of the 18 subsystems (15 hardware / 3 software) as defined in evaluation documentation. For the implementation of the TOE Security Functions basically the components processing unit (CPU) with ROM, EEPROM, RAM, I/O, Deterministic Random Number Generator (DRNG), TORNADO, Clock, Timer / 16-bit Timer and 20-bit Watchdog, Detectors and Security Control, RESET, Address and Data Bus, DES, Power Control, MPU / Memory Protection Unit, Testrom_code, RSA Crypto Library and DRNG Library are used.

Security measures for physical protection are realised within the layout of the whole circuitry. The Special Function Registers, the CPU instructions and the various on-chip memories provide the interface to the software using the Security Functions of the TOE.

The subsystem Testrom_code stored on the chip, is used for testing purposes during production only and is completely separated from the use of the embedded software by disabling before TOE delivery.

6 Documentation

The evaluated documentation as outlined in table 2 is being provided with the product to the customer. This documentation contains the required information for secure usage of the TOE in accordance with the Security Target.

Additional obligations and notes for secure usage of the TOE as outlined in chapter 10 of this report have to be followed.

7 IT Product Testing

The tests performed by the developer were divided into five categories:

- Simulation tests: These tests are performed before starting the production to develop the technology for the production and to define the process parameters.
- Qualification tests: These tests are performed after the first production of chips. The tests are performed in test mode. With these tests the influence of temperature, frequency, and voltage on the security functions are tested in detail.
- Verification tests: These tests are performed in normal mode and check the functionality in the end user environment. The results of the qualification and verification tests are the basis on which it is decided, whether the TOE is released to production.
- Security evaluation tests: These tests are performed in normal mode and check the security mechanisms aiming on the security functionality and the

effectiveness of the mechanisms. The random numbers are tested as required by AIS 20 and fulfil the criteria.

- Production tests: These tests are performed at each TOE before delivery. The aim of the production tests is to check whether each chip is functioning correctly.
- Penetration Tests: Penetration Tests are performed to find security flaws in the product.

The developer tests cover all Security Functions and all security mechanisms as identified in the functional specification, the high level design and the low level design. Chips from the production site in Giheung (see part D, annex A of this report) were used for tests.

The evaluators testing effort can be summarised into the following classes of tests: Module tests, Simulation tests, Emulation tests, Tests in normal mode, Tests in test mode and Hardware tests. The evaluators performed independent tests to supplement, augment and to verify the tests performed by the developer by sampling. Besides repeating exactly the developers tests, test parameters were varied and additional analysis was done. With these kind of tests performed in the developer's testing environment the entire security functionality of the TOE was verified. Overall the evaluators have tested the TSF systematically against the functional specification, the high-level design and the low-level design.

The evaluators supplied evidence that the actual version of the TOE with production line indicator "06" as hex in Giheung provides the Security Functions as specified.

Intensive penetration testing was performed at that time to consider the physical tampering of the TOE using highly sophisticated equipment and expertised know-how. Specific additional penetration attacks were performed in the course of this evaluation.

8 Evaluated Configuration

This certification covers the following configurations of the TOE:

- Smartcard IC S3CC91C Version 0,
- Smartcard IC S3CC91C Version 0 with Secure Crypto Library V3.5S.

The TOE is delivered as a hardware unit at the end of the IC manufacturing process (Phase 3). At this point in time the operating system is already stored in the non-volatile memories of the chip and the test mode is disabled.

No further generation takes place after delivery to the customer. After delivery the TOE only features one fixed configuration (normal mode), which cannot be altered by the user. All the evaluation and certification results therefore are only effective for this version of the TOE. Every information of how to use the TOE and its Security Functions by the software is provided within the user documentation [11].

9 Results of the Evaluation

9.1 CC specific results

The Evaluation Technical Report (ETR), [8] was provided by the ITSEF according to the Common Criteria [1], the Methodology [2], the requirements of the Scheme [3] and all interpretations and guidelines of the Scheme (AIS) [4] as relevant for the TOE.

For components beyond EAL 4 the evaluation methodology applied was defined in co-ordination with the Certification Body [4] (AIS 34).

The evaluation methodology CEM [2] was used for those components used up to EAL 4 extended by advice of the Certification Body for components beyond EAL 4 and guidance specific for the technology of the product.

The following guidance specific for the technology was used:

(i) The Application of CC to Integrated Circuits

(ii) Application of Attack Potential to Smart Cards and

(see [4, AIS 25 and AIS 26]) and [4, AIS 20] (Functionality classes and evaluation methodology for deterministic random number generators) were used. The assurance refinements outlined in the Security Target were followed in the course of the evaluation of the TOE.

As a result of the evaluation the verdict PASS is confirmed for the following assurance components:

- All components of the class ASE
- All components of the EAL 4 package as defined in the CC (see also part C of this report)
- The components ALC_DVS.2, AVA_MSU.3, AVA_VLA.4, ADV_IMP.2 augmented for this TOE evaluation.

As the evaluation work performed for this certification procedure was carried out as a re-evaluation based on the certificate BSI-DSZ-CC-0438-2007 , re-use of specific evaluation tasks was possible. The focus of this re-evaluation was on changed hardware and technology.

The evaluation has confirmed:

- Conformance to the PP: Protection Profile BSI-PP-0002-2001 [9]
- For the functionality: BSI-PP-0002-2001 conformant
plus product specific extensions
Common Criteria Part 2 extended
- for the assurance: Common Criteria Part 3 conformant
EAL4 augmented by
ALC_DVS.2, AVA_MSU.3, AVA_VLA.4, ADV_IMP.2

- The following TOE Security Functions fulfil the claimed Strength of Function high :
  SF3 – Non-reversibility of TEST and NORMAL modes.
  SF5 – Deterministic Random Number Generator.

The scheme interpretations AIS 26 and AIS 20 (see [4]) were used.

For specific evaluation results regarding the development and production environment see annex B in part D of this report.

The results of the evaluation are only applicable to the TOE as defined in chapter 2 and the configuration as outlined in chapter 8 above.

9.2 Results of cryptographic assessment

The rating of the strength of functions does not include the cryptoalgorithms suitable for encryption and decryption (see BSIG Section 4, Para. 3, Clause 2). This holds for

- the TOE Security Function SF5 which is the Triple DES encryption and decryption by the hardware co-processor and TORNADO™ coprocessor for RSA Asymmetric Cryptographic Support including RSA Library.
- other usage of encryption and decryption within the TOE.

10 Obligations and notes for the usage of the TOE

The operational documents as outlined in table 2 contain necessary information about the usage of the TOE and all security hints therein have to be considered.

The TOE is delivered to Card Manufacturer and the Smartcard Embedded Software Developer. The actual end user obtains the TOE from the operating system producer together with the application which runs on the TOE.

The Smartcard Embedded Software Developer receives all necessary recommendations and hints to develop his software in form of the delivered documentation.

- All security hints described in [12] and the delivered documents [13], [14], [15] have to be considered.

In addition the following assumptions and requirements concerning external security measures, explicitly documented in the singles evaluation reports, have to be fulfilled:

- Requirement resulting from ADV_LLD:

Since the hardware can not guarantee the storage of correct data in case of power loss during memory write operations the software has to implement appropriate measures to check if security relevant data are correctly written.

- Requirement resulting from ADO_DEL:
  - As the TOE is under control of the user software, the chip manufacturer can only guarantee the integrity up to the delivery procedure. It is in the

responsibility of the Smartcard Embedded Software Developer to include mechanisms in the implemented software which allows detection of modifications after the delivery.

- TOEs which failed the production tests are also delivered, as they are inked (marked my black dots) and remain physically on the wafer. The Card Manufacturer has to follow the procedure described in [16] to handle these chips in a secure manner.

All security hints described in [16] have to be considered. The Card Manufacturer receives all necessary recommendations and hints to develop his software in form of the delivered documentation.

- TOEs which failed the production tests are also delivered, as they are inked (marked my black dots) and remain physically on the wafer. The Card Manufacturer has to follow the procedure described in [16] to handle these chips in a secure manner.

- Requirement resulting from AVA_MSU:

During an evaluation of the Smartcard Embedded Software the following has to be checked:

- Application of the security advices given in [13] especially the recommendations for secure usage in [13, chapter 4].

- Requirement resulting from AVA_VLA:

  - The TOE is protected by light sensors against light injection attacks (e.g. with laser) and voltage glitch sensor against voltage glitch attacks. Nevertheless the performed penetration tests show that it is still possible to manipulate a running program with a focussed laser or voltage glitch. The Smartcard Embedded Software Developer has to implement sufficient countermeasures in his software to counter such attacks, too.

  - The TOE does not implement a padding scheme for the RSA signature creation/verification. This has to be implemented by the embedded software. To counter known attacks against incorrect padding a complete check of padding regarding correctness is mandatory.

11 Security Target

For the purpose of publishing, the security target [7] of the target of evaluation (TOE) is provided within a separate document as Annex A of this report. It is a sanitised version of the complete security target [6] used for the evaluation performed. Sanitisation was performed according to the rules as outlined in the relevant CCRA policy (see AIS 35 [4]).

12 Definitions

12.1 Acronyms

ACE	Advanced Crypto Engine
API	Application Programming Interface
BSI	Bundesamt für Sicherheit in der Informationstechnik / Federal Office for Information Security, Bonn, Germany
CBC	Cipher Block Chaining
CC	Common Criteria for IT Security Evaluation
DES	Data Encryption Standard; symmetric block cipher algorithm
DPA	Differential Power Analysis
EAL	Evaluation Assurance Level
ECB	Electrical Code Block
EEPROM	Electrically Erasable Programmable Read Only Memory
EMA	Electro magnetic analysis
ETR	Evaluation Technical Report
IC	Integrated Circuit
IT	Information Technology
ITSEF	Information Technology Security Evaluation Facility
PP	Protection Profile
RAM	Random Access Memory
RNG	Random Number Generator
ROM	Read Only Memory
RSA	Rivest, Shamir, Adelmann – a public key encryption algorithm
SF	Security Function
SFP	Security Function Policy
SFR	Security Functional Requirement
SOF	Strength of Function
ST	Security Target
TOE	Target of Evaluation
Triple-DES	Symmetric block cipher algorithm based on the DES
TSC	TSF Scope of Control
TSF	TOE Security Functions

TSP TOE Security Policy

TSS TOE Summary Specification

12.2 Glossary

Augmentation - The addition of one or more assurance component(s) from CC Part 3 to an EAL or assurance package.

Extension - The addition to an ST or PP of functional requirements not contained in part 2 and/or assurance requirements not contained in part 3 of the CC.

Formal - Expressed in a restricted syntax language with defined semantics based on well-established mathematical concepts.

Informal - Expressed in natural language.

Object - An entity within the TSC that contains or receives information and upon which subjects perform operations.

Protection Profile - An implementation-independent set of security requirements for a category of TOEs that meet specific consumer needs.

Security Function - A part or parts of the TOE that have to be relied upon for enforcing a closely related subset of the rules from the TSP.

Security Target - A set of security requirements and specifications to be used as the basis for evaluation of an identified TOE.

Semiformal - Expressed in a restricted syntax language with defined semantics.

Strength of Function - A qualification of a TOE security function expressing the minimum efforts assumed necessary to defeat its expected security behaviour by directly attacking its underlying security mechanisms.

SOF-basic - A level of the TOE strength of function where analysis shows that the function provides adequate protection against casual breach of TOE security by attackers possessing a low attack potential.

SOF-medium - A level of the TOE strength of function where analysis shows that the function provides adequate protection against straightforward or intentional breach of TOE security by attackers possessing a moderate attack potential.

SOF-high - A level of the TOE strength of function where analysis shows that the function provides adequate protection against deliberately planned or organised breach of TOE security by attackers possessing a high attack potential.

Subject - An entity within the TSC that causes operations to be performed.

Target of Evaluation - An IT product or system and its associated administrator and user guidance documentation that is the subject of an evaluation.

TOE Security Functions - A set consisting of all hardware, software, and firmware of the TOE that must be relied upon for the correct enforcement of the TSP.

TOE Security Policy - A set of rules that regulate how assets are managed, protected and distributed within a TOE.

TSF Scope of Control - The set of interactions that can occur with or within a TOE and are subject to the rules of the TSP.

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C Excerpts from the Criteria

CC Part1:

Conformance results (chapter 7.4)

„The conformance result indicates the source of the collection of requirements that is met by a TOE or PP that passes its evaluation. This conformance result is presented with respect to CC Part 2 (functional requirements), CC Part 3 (assurance requirements) and, if applicable, to a pre-defined set of requirements (e.g., EAL, Protection Profile).

The conformance result consists of one of the following:

- **CC Part 2 conformant** - A PP or TOE is CC Part 2 conformant if the functional requirements are based only upon functional components in CC Part 2.
- **CC Part 2 extended** - A PP or TOE is CC Part 2 extended if the functional requirements include functional components not in CC Part 2.

plus one of the following:

- **CC Part 3 conformant** - A PP or TOE is CC Part 3 conformant if the assurance requirements are based only upon assurance components in CC Part 3.
- **CC Part 3 extended** - A PP or TOE is CC Part 3 extended if the assurance requirements include assurance requirements not in CC Part 3.

Additionally, the conformance result may include a statement made with respect to sets of defined requirements, in which case it consists of one of the following:

- **Package name Conformant** - A PP or TOE is conformant to a pre-defined named functional and/or assurance package (e.g. EAL) if the requirements (functions or assurance) include all components in the packages listed as part of the conformance result.
- **Package name Augmented** - A PP or TOE is an augmentation of a pre-defined named functional and/or assurance package (e.g. EAL) if the requirements (functions or assurance) are a proper superset of all components in the packages listed as part of the conformance result.

Finally, the conformance result may also include a statement made with respect to Protection Profiles, in which case it includes the following:

- **PP Conformant** - A TOE meets specific PP(s), which are listed as part of the conformance result.“

CC Part 3:

Protection Profile criteria overview (chapter 8.2)

“The goal of a PP evaluation is to demonstrate that the PP is complete, consistent, technically sound, and hence suitable for use as a statement of requirements for one or more evaluatable TOEs. Such a PP may be eligible for inclusion within a PP registry.”

“Assurance Class	**Assurance Family**
Class APE: Protection Profile evaluation	TOE description (APE_DES)
	Security environment (APE_ENV)
	PP introduction (APE_INT)
	Security objectives (APE_OBJ)
	IT security requirements (APE_REQ)
	Explicitly stated IT security requirements (APE_SRE)

Table 3 - Protection Profile families - CC extended requirements ”

Security Target criteria overview (Chapter 8.3)

“The goal of an ST evaluation is to demonstrate that the ST is complete, consistent, technically sound, and hence suitable for use as the basis for the corresponding TOE evaluation.”

“Assurance Class	**Assurance Family**
Class ASE: Security Target evaluation	TOE description (ASE_DES)
	Security environment (ASE_ENV)
	ST introduction (ASE_INT)
	Security objectives (ASE_OBJ)
	PP claims (ASE_PPC)
	IT security requirements (ASE_REQ)
	Explicitly stated IT security requirements (ASE_SRE)
	TOE summary specification (ASE_TSS)

Table 5 - Security Target families - CC extended requirements ”

Assurance categorisation (chapter 7.5)

"The assurance classes, families, and the abbreviation for each family are shown in Table 1.

Assurance Class	Assurance Family
ACM: Configuration management	CM automation (ACM_AUT)
	CM capabilities (ACM_CAP)
	CM scope (ACM_SCP)
ADO: Delivery and operation	Delivery (ADO_DEL)
	Installation, generation and start-up (ADO_IGS)
ADV: Development	Functional specification (ADV_FSP)
	High-level design (ADV_HLD)
	Implementation representation (ADV_IMP)
	TSF internals (ADV_INT)
	Low-level design (ADV_LLD)
	Representation correspondence (ADV_RCR)
	Security policy modeling (ADV_SPM)
AGD: Guidance documents	Administrator guidance (AGD_ADM)
	User guidance (AGD_USR)
ALC: Life cycle support	Development security (ALC_DVS)
	Flaw remediation (ALC_FLR)
	Life cycle definition (ALC_LCD)
	Tools and techniques (ALC_TAT)
ATE: Tests	Coverage (ATE_COV)
	Depth (ATE_DPT)
	Functional tests (ATE_FUN)
	Independent testing (ATE_IND)
AVA: Vulnerability assessment	Covert channel analysis (AVA_CCA)
	Misuse (AVA_MSU)
	Strength of TOE security functions (AVA_SOF)
	Vulnerability analysis (AVA_VLA)

Table 1: Assurance family breakdown and mapping"

Evaluation assurance levels (chapter 11)

“The Evaluation Assurance Levels (EALs) provide an increasing scale that balances the level of assurance obtained with the cost and feasibility of acquiring that degree of assurance. The CC approach identifies the separate concepts of assurance in a TOE at the end of the evaluation, and of maintenance of that assurance during the operational use of the TOE.

It is important to note that not all families and components from CC Part 3 are included in the EALs. This is not to say that these do not provide meaningful and desirable assurances. Instead, it is expected that these families and components will be considered for augmentation of an EAL in those PPs and STs for which they provide utility.”

Evaluation assurance level (EAL) overview (chapter 11.1)

“Table 6 represents a summary of the EALs. The columns represent a hierarchically ordered set of EALs, while the rows represent assurance families. Each number in the resulting matrix identifies a specific assurance component where applicable.

As outlined in the next section, seven hierarchically ordered evaluation assurance levels are defined in the CC for the rating of a TOE's assurance. They are hierarchically ordered inasmuch as each EAL represents more assurance than all lower EALs. The increase in assurance from EAL to EAL is accomplished by substitution of a hierarchically higher assurance component from the same assurance family (i.e. increasing rigour, scope, and/or depth) and from the addition of assurance components from other assurance families (i.e. adding new requirements).

These EALs consist of an appropriate combination of assurance components as described in chapter 7 of this Part 3. More precisely, each EAL includes no more than one component of each assurance family and all assurance dependencies of every component are addressed.

While the EALs are defined in the CC, it is possible to represent other combinations of assurance. Specifically, the notion of “augmentation” allows the addition of assurance components (from assurance families not already included in the EAL) or the substitution of assurance components (with another hierarchically higher assurance component in the same assurance family) to an EAL. Of the assurance constructs defined in the CC, only EALs may be augmented. The notion of an “EAL minus a constituent assurance component” is not recognised by the standard as a valid claim. Augmentation carries with it the obligation on the part of the claimant to justify the utility and added value of the added assurance component to the EAL. An EAL may also be extended with explicitly stated assurance requirements.

Assurance Class	Assurance Family	Assurance Components by Evaluation Assurance Level						
		EAL1	EAL2	EAL3	EAL4	EAL5	EAL6	EAL7
Configuration management	ACM_AUT				1	1	2	2
	ACM_CAP	1	2	3	4	4	5	5
	ACM_SCP			1	2	3	3	3
Delivery and operation	ADO_DEL		1	1	2	2	2	3
	ADO_IGS	1	1	1	1	1	1	1
Development	ADV_FSP	1	1	1	2	3	3	4
	ADV_HLD		1	2	2	3	4	5
	ADV_IMP				1	2	3	3
	ADV_INT					1	2	3
	ADV_LLD				1	1	2	2
	ADV_RCR	1	1	1	1	2	2	3
	ADV_SPM				1	3	3	3
Guidance documents	AGD_ADM	1	1	1	1	1	1	1
	AGD_USR	1	1	1	1	1	1	1
Life cycle support	ALC_DVS			1	1	1	2	2
	ALC_FLR							
	ALC_LCD				1	2	2	3
	ALC_TAT				1	2	3	3
Tests	ATE_COV		1	2	2	2	3	3
	ATE_DPT			1	1	2	2	3
	ATE_FUN		1	1	1	1	2	2
	ATE_IND	1	2	2	2	2	2	3
Vulnerability assessment	AVA_CCA					1	2	2
	AVA_MSU			1	2	2	3	3
	AVA_SOF		1	1	1	1	1	1
	AVA_VLA		1	1	2	3	4	4

Table 6: Evaluation assurance level summary”

Evaluation assurance level 1 (EAL1) - functionally tested (chapter 11.3)

“Objectives

EAL1 is applicable where some confidence in correct operation is required, but the threats to security are not viewed as serious. It will be of value where independent assurance is required to support the contention that due care has been exercised with respect to the protection of personal or similar information.

EAL1 provides an evaluation of the TOE as made available to the customer, including independent testing against a specification, and an examination of the guidance documentation provided. It is intended that an EAL1 evaluation could be successfully conducted without assistance from the developer of the TOE, and for minimal outlay.

An evaluation at this level should provide evidence that the TOE functions in a manner consistent with its documentation, and that it provides useful protection against identified threats.”

Evaluation assurance level 2 (EAL2) - structurally tested (chapter 11.4)

“Objectives

EAL2 requires the co-operation of the developer in terms of the delivery of design information and test results, but should not demand more effort on the part of the developer than is consistent with good commercial practice. As such it should not require a substantially increased investment of cost or time.

EAL2 is therefore applicable in those circumstances where developers or users require a low to moderate level of independently assured security in the absence of ready availability of the complete development record. Such a situation may arise when securing legacy systems, or where access to the developer may be limited.”

Evaluation assurance level 3 (EAL3) - methodically tested and checked (chapter 11.5)

“Objectives

EAL3 permits a conscientious developer to gain maximum assurance from positive security engineering at the design stage without substantial alteration of existing sound development practices.

EAL3 is applicable in those circumstances where developers or users require a moderate level of independently assured security, and require a thorough investigation of the TOE and its development without substantial re-engineering.”

Evaluation assurance level 4 (EAL4) - methodically designed, tested, and reviewed (chapter 11.6)

“Objectives

EAL4 permits a developer to gain maximum assurance from positive security engineering based on good commercial development practices which, though rigorous, do not require substantial specialist knowledge, skills, and other resources. EAL4 is the highest level at which it is likely to be economically feasible to retrofit to an existing product line.

EAL4 is therefore applicable in those circumstances where developers or users require a moderate to high level of independently assured security in conventional commodity TOEs and are prepared to incur additional security-specific engineering costs.”

Evaluation assurance level 5 (EAL5) - semiformally designed and tested (chapter 11.7)

“Objectives

EAL5 permits a developer to gain maximum assurance from security engineering based upon rigorous commercial development practices supported by moderate application of specialist security engineering techniques. Such a TOE will probably be designed and developed with the intent of achieving EAL5 assurance. It is likely that the additional costs attributable to the EAL5 requirements, relative to rigorous development without the application of specialised techniques, will not be large.

EAL5 is therefore applicable in those circumstances where developers or users require a high level of independently assured security in a planned development and require a rigorous development approach without incurring unreasonable costs attributable to specialist security engineering techniques.”

Evaluation assurance level 6 (EAL6) - semiformally verified design and tested (chapter 11.8)

“Objectives

EAL6 permits developers to gain high assurance from application of security engineering techniques to a rigorous development environment in order to produce a premium TOE for protecting high value assets against significant risks.

EAL6 is therefore applicable to the development of security TOEs for application in high risk situations where the value of the protected assets justifies the additional costs.”

Evaluation assurance level 7 (EAL7) - formally verified design and tested (chapter 11.9)

“Objectives

EAL7 is applicable to the development of security TOEs for application in extremely high risk situations and/or where the high value of the assets justifies the higher costs. Practical application of EAL7 is currently limited to TOEs with tightly focused security functionality that is amenable to extensive formal analysis.“

Strength of TOE security functions (AVA_SOF) (chapter 19.3)

“Objectives

Even if a TOE security function cannot be bypassed, deactivated, or corrupted, it may still be possible to defeat it because there is a vulnerability in the concept of its underlying security mechanisms. For those functions a qualification of their security behaviour can be made using the results of a quantitative or statistical analysis of the security behaviour of these mechanisms and the effort required to overcome them. The qualification is made in the form of a strength of TOE security function claim.”

Vulnerability analysis (AVA_VLA) (chapter 19.4)

"Objectives

Vulnerability analysis is an assessment to determine whether vulnerabilities identified, during the evaluation of the construction and anticipated operation of the TOE or by other methods (e.g. by flaw hypotheses), could allow users to violate the TSP.

Vulnerability analysis deals with the threats that a user will be able to discover flaws that will allow unauthorised access to resources (e.g. data), allow the ability to interfere with or alter the TSF, or interfere with the authorised capabilities of other users.”

"Application notes

A vulnerability analysis is performed by the developer in order to ascertain the presence of security vulnerabilities, and should consider at least the contents of all the TOE deliverables including the ST for the targeted evaluation assurance level. The developer is required to document the disposition of identified vulnerabilities to allow the evaluator to make use of that information if it is found useful as a support for the evaluator's independent vulnerability analysis.”

“Independent vulnerability analysis goes beyond the vulnerabilities identified by the developer. The main intent of the evaluator analysis is to determine that the TOE is resistant to penetration attacks performed by an attacker possessing a low (for AVA_VLA.2 Independent vulnerability analysis), moderate (for AVA_VLA.3 Moderately resistant) or high (for AVA_VLA.4 Highly resistant) attack potential.”

D Annexes

List of annexes of this certification report

Annex A: Security Target provided within a separate document.

Annex B: Evaluation results regarding development and production environment D-3

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Annex B of Certification Report BSI-DSZ-CC-0451-2007

Evaluation results regarding development and production environment

The IT product S3CC91C 16-Bit RISC Microcontroller for Smart Card, Version 0 (Target of Evaluation, TOE) has been evaluated at an accredited and licensed/ approved evaluation facility using the *Common Methodology for IT Security Evaluation, Version 2.3* extended by advice of the Certification Body for components beyond EAL 4 and guidance specific for the technology of the product for conformance to the *Common Criteria for IT Security Evaluation (CC), Version 2.3 (ISO/IEC 15408:2005)* .

As a result of the TOE certification, dated 10. September 2007 , the following results regarding the development and production environment apply. The Common Criteria assurance requirements

- **ACM – Configuration management (i.e. ACM_AUT.1, ACM_CAP.4, ACM_SCP.2),**
- **ADO – Delivery and operation (i.e. ADO_DEL.2, ADO_IGS.1) and**
- **ALC – Life cycle support (i.e. ALC_DVS.2, ALC_LCD.1, ALC_TAT.1),**

are fulfiled for the development and production sites of the TOE listed below:

a) Samsung Electronics Co., Ltd. San24, Nongseo-dong, Giheung-gu, Yongin-City, Gyeonggido , 449-711, Korea (Development, Production, Mask House)

b) Samsung Electronics Co., Ltd. San #16, Banwol-Ri, Hwasung-Eup, Gyeonggi-Do, 445-701, Korea (Development)

c) Samsung Electronics Co., Ltd., San #74, Buksoo-Ri, Baebang-Myun, Asan-City, Choongcheongnam-Do, 336-711, Korea (Onyang plant, Delivery)

d) PKL Co., Ltd. Plant, 493-3 Sungsung-Dong, Cheonan-City, Choongcheongnam-Do, 330-300, Korea (Mask House)

The hardware part of the TOE produced in the semiconductor factory in Giheung, Korea, is labelled by the production line indicator „06“ as hex.

For the sites listed above, the requirements have been specifically applied in accordance with the Security Target Security Target of S3CC91C 16-bit RISC Microcontroller for Smart Cards – Project Cheyenne, Version 1.0, 21 March 2007 [6]). The evaluators verified, that the threats, security objectives and

requirements for the TOE life cycle phases up to delivery (as stated in the Security Target [6]) are fulfilled by the procedures of these sites.