Certification Report

NXP JCOP 6.2 on SN220 Secure Element

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Foreword

The Netherlands Scheme for Certification in the Area of IT Security (NSCIB) provides a third-party evaluation and certification service for determining the trustworthiness of Information Technology (IT) security products. Under this NSCIB, TÜV Rheinland Nederland B.V. has the task of issuing certificates for IT security products, as well as for protection profiles and sites.

Part of the procedure is the technical examination (evaluation) of the product, protection profile or site according to the Common Criteria assessment guidelines published by the NSCIB. Evaluations are performed by an IT Security Evaluation Facility (ITSEF) under the oversight of the NSCIB Certification Body, which is operated by TÜV Rheinland Nederland B.V. in cooperation with the Ministry of the Interior and Kingdom Relations.

An ITSEF in the Netherlands is a commercial facility that has been licensed by TÜV Rheinland Nederland B.V. to perform Common Criteria evaluations; a significant requirement for such a licence is accreditation to the requirements of ISO Standard 17025 “General requirements for the accreditation of calibration and testing laboratories”.

By awarding a Common Criteria certificate, TÜV Rheinland Nederland B.V. asserts that the product or site complies with the security requirements specified in the associated (site) security target, or that the protection profile (PP) complies with the requirements for PP evaluation specified in the Common Criteria for Information Security Evaluation. A (site) security target is a requirements specification document that defines the scope of the evaluation activities.

The consumer should review the (site) security target or protection profile, in addition to this certification report, to gain an understanding of any assumptions made during the evaluation, the IT product's intended environment, its security requirements, and the level of confidence (i.e., the evaluation assurance level) that the product or site satisfies the security requirements stated in the (site) security target.

Recognition of the Certificate

The presence of the Common Criteria Recognition Arrangement (CCRA) and the SOG-IS logos on the certificate indicates that this certificate is issued in accordance with the provisions of the CCRA and the SOG-IS Mutual Recognition Agreement (SOG-IS MRA) and will be recognised by the participating nations.

International recognition

The CCRA was signed by the Netherlands in May 2000 and provides mutual recognition of certificates based on the Common Criteria (CC). Since September 2014 the CCRA has been updated to provide mutual recognition of certificates based on cPPs (exact use) or STs with evaluation assurance components up to and including EAL2+ALC_FLR.

For details of the current list of signatory nations and approved certification schemes, see http://www.commoncriteriaportal.org.

European recognition

The SOG-IS MRA Version 3, effective since April 2010, provides mutual recognition in Europe of Common Criteria and ITSEC certificates at a basic evaluation level for all products. A higher recognition level for evaluation levels beyond EAL4 (respectively E3-basic) is provided for products related to specific technical domains. This agreement was signed initially by Finland, France, Germany, The Netherlands, Norway, Spain, Sweden and the United Kingdom. Italy joined the SOG-IS MRA in December 2010.

For details of the current list of signatory nations, approved certification schemes and the list of technical domains for which the higher recognition applies, see https://www.sogis.eu.

1 Executive Summary

This Certification Report states the outcome of the Common Criteria security evaluation of the NXP JCOP 6.2 on SN220 Secure Element. The developer of the NXP JCOP 6.2 on SN220 Secure Element is NXP Semiconductors Germany GmbH located in Hamburg, Germany and they also act as the sponsor of the evaluation and certification. A Certification Report is intended to assist prospective consumers when judging the suitability of the IT security properties of the product for their particular requirements.

The TOE is a Java Card with GP functionality, extended with eUICC and CSP functionality. It can be used to load, install, instantiate and execute off-card verified Java Card applets. The eUICC part is a UICC embedded in a consumer device and may be in a removable form factor or otherwise. It connects to a given mobile network, by means of its currently enabled MNO profile. The CSP part offers Cryptographic Service Provider functionality.

The TOE has been evaluated by SGS Brightsight B.V. located in Delft, The Netherlands. The evaluation was completed on 1 November 2021 with the approval of the ETR. The certification procedure has been conducted in accordance with the provisions of the Netherlands Scheme for Certification in the Area of IT Security *[NSCIB]*.

The scope of the evaluation is defined by the security target *[ST]*, which identifies assumptions made during the evaluation, the intended environment for the NXP JCOP 6.2 on SN220 Secure Element, the security requirements, and the level of confidence (evaluation assurance level) at which the product is intended to satisfy the security requirements. Consumers of the NXP JCOP 6.2 on SN220 Secure Element are advised to verify that their own environment is consistent with the security target, and to give due consideration to the comments, observations and recommendations in this certification report.

The results documented in the evaluation technical report *[ETR]* [1] for this product provide sufficient evidence that the TOE meets the EAL5 augmented (EAL5+) assurance requirements for the evaluated security functionality. This assurance level is augmented with AVA_VAN.5 “Advanced methodical vulnerability analysis”, ALC_DVS.2 “Sufficiency of security measures”, ASE_TSS.2 “TOE summary specification with architectural design summary”, and ALC_FLR.1 “Basic flaw remediation”.

The evaluation was conducted using the Common Methodology for Information Technology Security Evaluation, Version 3.1 Revision 5 *[CEM]* for conformance to the Common Criteria for Information Technology Security Evaluation, Version 3.1 Revision 5 *[CC]* (Parts I, II and III).

TÜV Rheinland Nederland B.V., as the NSCIB Certification Body, declares that the evaluation meets all the conditions for international recognition of Common Criteria Certificates and that the product will be listed on the NSCIB Certified Products list. Note that the certification results apply only to the specific version of the product as evaluated.

[1] The Evaluation Technical Report contains information proprietary to the developer and/or the evaluator, and is not available for public review.

2 Certification Results

2.1 Identification of Target of Evaluation

The Target of Evaluation (TOE) for this evaluation is the NXP JCOP 6.2 on SN220 Secure Element from NXP Semiconductors Germany GmbH located in Hamburg, Germany.

The TOE is comprised of the following main components:

	Name	Version
Hardware (platform)	IC Hardware	B0.1
Data Configuration (platform)	Factory Page	21043
	System Page Common	21031
	BootOS Patch	9.0.3 PL1 v1
Software (platform)	Factory OS	9.0.4
	Boot OS	9.0.3
	Flash Driver Software:	9.0.2
	Services Software	9.17.4
	Crypto Library	2.2.0
Software	JCOP 6.2 on SN220.C13 R1.01.1 with plugin version 1.6.016	
	JCOP6.2 OS, native applications, OS Update Component, eUICC component and CSP component	R1.01.1
	eUICC plug-in	1.6.016

To ensure secure usage a set of guidance documents is provided, together with the NXP JCOP 6.2 on SN220 Secure Element. For details, see section 2.5 “Documentation” of this report.

For a detailed and precise description of the TOE lifecycle, see the *[ST]*, Chapter 1.3.3.

2.2 Security Policy

The TOE is a composite product on top of CC certified Hardware, Firmware and Crypto Library. The overall product consists of a Secure Micro-Controller and a software stack. The Micro-Controller provides an Integrated NFC controller and an embedded Secure Element core. The software stack creates 2 separate domains to provide a converged product consisting of a familiar Java Card Secure Element domain and an eUICC domain providing UICC functionality and external ISO-7816 connectivity.

The TOE has the following features:

- Cryptographic algorithms and functionality:
  - 3DES for en-/decryption (CBC and ECB) and MAC generation and verification (2-key 3DES, 3-key 3DES, Retail-MAC, CMAC and CBC-MAC).
  - AES (Advanced Encryption Standard) for en-/decryption (GCM, CBC and ECB) and MAC generation and verification (CMAC, CBC-MAC).
  - RSA and RSA CRT for en-/decryption and signature generation and verification.
  - RSA and RSA CRT key generation.
  - SHA-1, SHA-224, SHA-256, SHA-384, SHA-512 hash algorithm.
  - Secure SHA-1, Secure SHA-224, Secure SHA-256, Secure SHA-384, Secure SHA-512 hash algorithm.
  - HMAC

- ECC over GF(p) for signature generation and verification (ECDSA).
- ECC over GF(p) key generation for key agreement.
- Random number generation according to class DRG.3 of AIS 20

- Java Card 3.0.5 functionality
- GlobalPlatform 2.3 functionality including Amendments A,B,C,D,E,F,H and I and is compliant with the Common Implementation Configuration
- GSMA 'Remote SIM Provisioning Architecture for consumer Devices' version 2.2.1 [29] and v2.2.2 [30]
- 5G features as per SIM Alliance 2.3 – no security functionality is claimed
- 5th Logical Channel
- Cryptographic Service Provider (CSP) features
- NXP Proprietary Functionality
  - MiFare functionality accessible via Applets using the MiFare API – no security functionality is claimed
  - OSCCA (Chinese Crypto) functionality accessible via Applets using the OSSCA API – No security functionality is claimed
  - FeliCa functionality accessible via Applets using the FeliCa API - no security functionality is claimed for this functionality.
  - Config Applet: JCOP6.2 OS includes a Config Applet that can be used for configuration of the TOE.
  - OS Update Component: Proprietary functionality that can update JCOP6.2 OS or UpdaterOS
  - UAI update component: Proprietary functionality that is can update JCOP6.2 OS- no security functionality is claimed
  - Restricted Mode: In Restricted Mode only very limited functionality of the TOE is available such as, e.g.: reading logging information or resetting the Attack Counter.
  - Error Detection Code (EDC) API

2.3 Assumptions and Clarification of Scope

2.3.1 Assumptions

The assumptions defined in the Security Target are not covered by the TOE itself. These aspects lead to specific Security Objectives to be fulfilled by the TOE-Environment. For detailed information on the security objectives that must be fulfilled by the TOE environment, see section 5.2 of the *[ST]*.

2.3.2 Clarification of scope

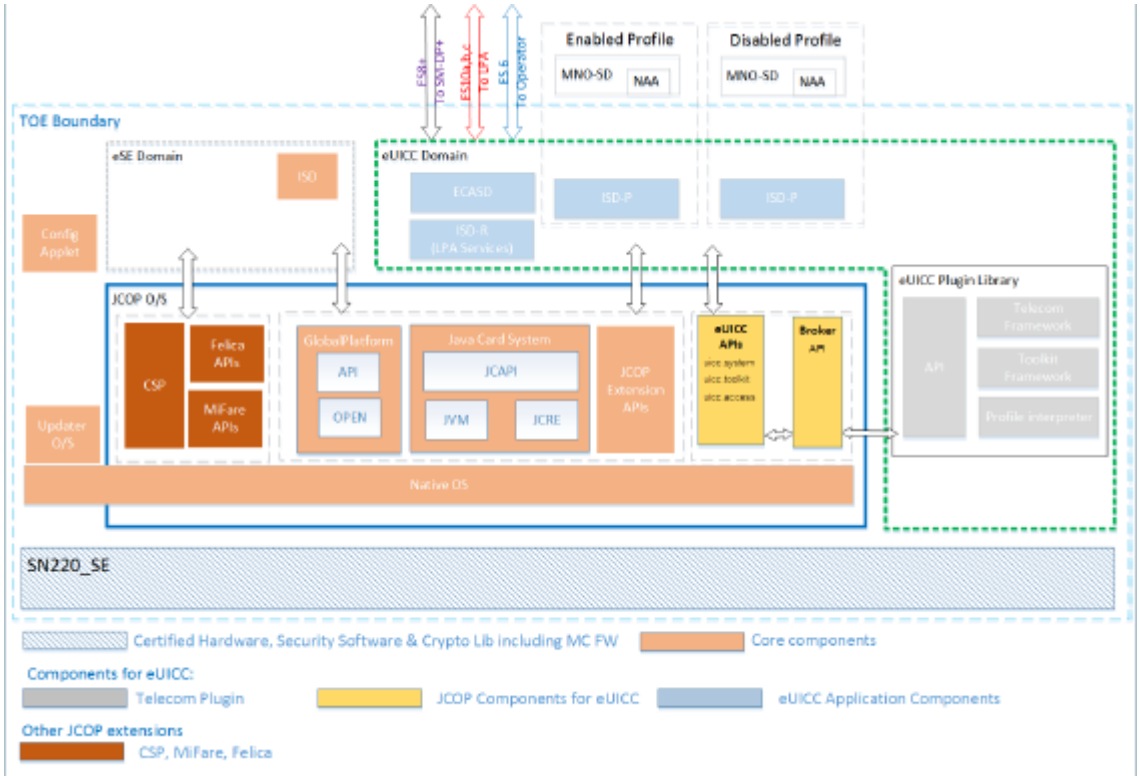
The evaluation did not reveal any threats to the TOE that are not countered by the evaluated security functions of the product.

Note that proprietary applications have been included in the TOE, but as there are no security claims on these functionalities, this application functionality has not been assessed, only the self-protection of the TSF.

2.4 Architectural Information

The TOE consists of a certified Hardware IC, with Micro-controller Firmware (Boot OS, Factory OS and Flash driver software) and certified security software library consisting of a crypto library and services software. All the parts are depicting in the figure below with the shaded box marked

SN220_SE. Since this TOE is a composite on top of this certified platform, this block is not depicted in more detail.



The Software stack consists of the JCOP Core parts marked in the salmon coloured blocks implementing the Native OS, Global Platform functionality and the Java Card 3.0.5 functionality. The TOE also implements a Cryptographic Service Provider marked with orange coloured block. It also implements a number of NXP proprietary features like the JCOP extension APIs for MiFare, FeliCa, Updater OS and Config applet (note there are no security claims relating to MiFare and FeliCa).

Furthermore the TOE implements GSMA 'Remote SIM Provisioning Architecture for consumer Devices', referred to as eUICC. The JCOP OS supports the eUICC APIs and uses the Broker API to forward to the eSIM/SIM/UICC/ISIM commands to the eUICC Plugin Library.

The TOE supports two domains, the eSE for the Java Card Secure Element domain and an eUICC domain providing UICC functionality in accordance with the GSMA Specification.

2.5 Documentation

The following documentation is provided with the product by the developer to the customer:

Reference	Name	Version	Date
[AGD_UGM]	JCOP 6.2 R1.01.1, User Guidance Manual, User documentation	Rev. 1.6	2021-09-28
[AGD_UGMSEMS]	JCOP 6.2 R1.01.1, AMD I SEMS Application User Manual Addendum, User documentation	Rev 1.0	2021-06-16
[AGD_CSP]	JCOP 6.2 R1.01.1, CSP User Manual Addendum	Rev. 1.0	2021-06-16
[AGD_eUICC]	JCOP 6.2 R1.01.1, eUICC Profile Package Interpreter Guide, Addendum	Rev. 1.1	2021-07-30

2.6 IT Product Testing

Testing (depth, coverage, functional tests, independent testing): The evaluators examined the developer's testing activities documentation and verified that the developer has met their testing responsibilities.

2.6.1 Testing approach and depth

The developer performed extensive testing on functional specification, subsystem and module level. All parameter choices were addressed at least once. All boundary cases identified were tested explicitly, and additionally the near-boundary conditions were covered probabilistically. The testing was largely automated using industry standard and proprietary test suites. Test scripts were used extensively to verify that the functions return the expected values.

The TOE is tested both in its physical implementation and using simulator and emulator platforms in order to cover all relevant aspects. During testing, the TOE is identified by its SVN number.

Code coverage analysis is used by NXP to verify overall test completeness. Test benches for the various TOE parts are executed using code coverage measurement and analysis tools to determine the code coverate (i.e. lines, branches and/or instructions, depending on tool) of each test bench. Cases with incomplete coverage are analysed. For each tool, the developer has investigated and documented inherent limitations that can lead to coverage being reported as less than 100%. In such cases the developer provided a "gap" analysis with rationales (e.g. attack counter not hit due to redundancy checks).

The underlying hardware and crypto-library test results are extendable to composite evaluations, because the underlying platform is operated according to its guidance and the composite evaluation requirements are met.

The developer tests witnessed by the evaluators were selected to cover various aspects of the TOE, as well as areas where the code coverage approach has limitations. The tests were executed in the test environment of the developer. The evaluator tested on the TOE version to be certified but also on intermediate versions and re-used test results of earlier versions of the TOE. The evaluator provided an analysis to demonstrate that the tests performed on earlier and intermediate versions also hold on this TOE.

2.6.2 Independent penetration testing

The methodical analysis performed was conducted along the following steps:

- When evaluating the evidence in the classes ASE, ADV and AGD the evaluator considers whether potential vulnerabilities can already be identified due to the TOE type and/or specified behaviour in such an early stage of the evaluation.
- For ADV_IMP a thorough implementation representation review is performed on the TOE. During this attack oriented analysis the protection of the TOE is analysed using the knowledge gained from all previous evaluation classes. This results in the identification of (additional) potential vulnerabilities. For this analysis will be performed according to the attack methods in *[JIL-AM]*. An important source for assurance in this step is the technical report *[ETRfC_HW]* of the underlying platform.
- All potential vulnerabilities are analysed using the knowledge gained from all evaluation classes and information from the public domain. A judgment was made on how to assure that these potential vulnerabilities are not exploitable. The potential vulnerabilities are addressed by penetration testing, a guidance update or in other ways that are deemed appropriate

The total test effort expended by the evaluators was 25 weeks. During that test campaign, 36% of the total time was spent on Perturbation attacks, 22% on side-channel testing, and 41% on logical tests.

2.6.3 Test configuration

The configuration of the sample used for independent evaluator testing and penetration testing was the same as described in the *[ST]*.

2.6.4 Test results

The testing activities, including configurations, procedures, test cases, expected results and observed results are summarised in the *[ETR]*, with references to the documents containing the full details.

The developer's tests and the independent functional tests produced the expected results, giving assurance that the TOE behaves as specified in its *[ST]* and functional specification.

No exploitable vulnerabilities were found with the independent penetration tests.

The algorithmic security level of cryptographic functionality has not been rated in this certification process, but the current consensus on the algorithmic security level in the open domain, i.e., from the current best cryptanalytic attacks published, has been taken into account.

Not all key sizes specified in the *[ST]* have sufficient cryptographic strength for satisfying the AVA_VAN.5 "high attack potential". The TOE supports a wider range of key sizes (see *[ST]*), including those with sufficient algorithmic security level to exceed 100 bits as required for high attack potential (AVA_VAN.5).

These activities revealed that for some cryptographic functionality the security level could be reduced from an algorithmic security level above 100 bits to a practical remaining security level lower than 100 bits. The remaining security level still exceeds 80 bits, so this is considered sufficient. Therefore, no exploitable vulnerabilities were found with the independent penetration tests.

For composite evaluations, please consult the *[ETRfC]* for details.

2.7 Reused Evaluation Results

There has been extensive reuse of the ALC aspects for the sites involved in the development and production of the TOE, by use of 6 Site Technical Audit Reuse reports.

No sites have been visited as part of this evaluation

2.8 Evaluated Configuration

The TOE is defined uniquely by its name and version number NXP JCOP 6.2 on SN220 Secure Element.

2.9 Evaluation Results

The evaluation lab documented their evaluation results in the *[ETR]*, which references an ASE Intermediate Report and other evaluator documents. To support composite evaluations according to *[COMP]* a derived document *[ETRfC]* was provided and approved. This document provides details of the TOE evaluation that must be considered when this TOE is used as platform in a composite evaluation.

The verdict of each claimed assurance requirement is "**Pass**".

Based on the above evaluation results the evaluation lab concluded the NXP JCOP 6.2 on SN220 Secure Element, to be **CC Part 2 extended, CC Part 3 conformant**, and to meet the requirements of **EAL 5 augmented with AVA_VAN.5, ALC_DVS.2, ASE_TSS.2 and ALC_FLR.1**. This implies that the product satisfies the security requirements specified in Security Target *[ST]*.

The Security Target claims 'strict' conformance to the Protection Profiles *[PP-0099], [PP-0100] and [PP-0104]*.

2.10 Comments/Recommendations

The user guidance as outlined in section 2.5 "Documentation" contains necessary information about the usage of the TOE. Certain aspects of the TOE's security functionality, in particular the countermeasures against attacks, depend on accurate conformance to the user guidance of both the

software and the hardware part of the TOE. There are no particular obligations or recommendations for the user apart from following the user guidance. Please note that the documents contain relevant details concerning the resistance against certain attacks.

In addition, all aspects of assumptions, threats and policies as outlined in the Security Target not covered by the TOE itself must be fulfilled by the operational environment of the TOE.

The customer or user of the product shall consider the results of the certification within his system risk management process. For the evolution of attack methods and techniques to be covered, the customer should define the period of time until a re-assessment for the TOE is required and thus requested from the sponsor of the certificate.

The strength of the cryptographic algorithms and protocols was not rated in the course of this evaluation. This specifically applies to the following proprietary or non-standard algorithms, protocols and implementations: none (of the SFR claimed crypto algorithms).

Not all key sizes specified in the *[ST]* have sufficient cryptographic strength to satisfy the AVA_VAN.5 “high attack potential”. To be protected against attackers with a "high attack potential", appropriate cryptographic algorithms with sufficiently large cryptographic key sizes shall be used (references can be found in national and international documents and standards).

3 Security Target

The NXP JCOP 6.2 on SN220 Secure Element, Security Target, Rev. 1.0 — 28 September 2021 *[ST]* is included here by reference.

Please note that, to satisfy the need for publication, a public version *[ST-lite]* has been created and verified according to *[ST-SAN]*.

4 Definitions

This list of acronyms and definitions contains elements that are not already defined by the CC or CEM:

AES	Advanced Encryption Standard
CBC	Cipher Block Chaining (a block cipher mode of operation)
CBC-MAC	Cipher Block Chaining Message Authentication Code
CRT	Chinese Remainder Theorem
CSP	Cryptographic Service Provider
DES	Data Encryption Standard
DFA	Differential Fault Analysis
ECB	Electronic Code Book (a block-cipher mode of operation)
ECC	Elliptic Curve Cryptography
ECDSA	Elliptic Curve Digital Signature Algorithm
EMA	Electromagnetic Analysis
eUICC	Embedded Universal Integrated Circuit Card
IC	Integrated Circuit
IT	Information Technology
ITSEF	IT Security Evaluation Facility
JIL	Joint Interpretation Library
MAC	Message Authentication Code
MNO	Mobile Network Operator
NSCIB	Netherlands Scheme for Certification in the area of IT security
PP	Protection Profile
RSA	Rivest-Shamir-Adleman Algorithm
SHA	Secure Hash Algorithm
SM	Secure Messaging
SPA/DPA	Simple/Differential Power Analysis
TOE	Target of Evaluation

5 Bibliography

This section lists all referenced documentation used as source material in the compilation of this report.

[CC]	Common Criteria for Information Technology Security Evaluation, Parts I, II and III, Version 3.1 Revision 5, April 2017
[CEM]	Common Methodology for Information Technology Security Evaluation, Version 3.1 Revision 5, April 2017
[COMP]	Joint Interpretation Library, Composite product evaluation for Smart Cards and similar devices, Version 1.5.1, May 2018
[ETR]	Evaluation Technical Report “JCOP 6.2 on SN220” – EAL5+, 21-RPT-733, version 4.0, dated 1 November 2021
[ETRfC]	Evaluation Technical Report for Composition “NXP JCOP 6.2 on SN220 Secure Element” – EAL5+, 21-RPT-0966, version 3.0, dated 1 November 2021
[HW-CERT]	CC-21-0258298 SN220 Series – Secure Element with Crypto Library SN220 SE B0.1 C13
[HW-ETRfC]	ETR for composite evaluation,SN220 Series - Secure Element, with Crypto Library B0.1 C13, v1.3, 13 August 2021
[HW-ST]	SN220 Series - Secure Element with Crypto Library, Security Target, Rev. 1.0. — 12 July 2021
[JIL-AAPS]	JIL Application of Attack Potential to Smartcards, Version 3.1, June 2020
[JIL-AM]	Attack Methods for Smartcards and Similar Devices, Version 2.4, January 2020 (sensitive with controlled distribution)
[NSCIB]	Netherlands Scheme for Certification in the Area of IT Security, Version 2.5, 28 March 2019
[PP-0099]	Java card protection profile - open configuration, version 3.0.5 (dec 2017), published by Oracle inc., registered under the reference BSI-CC-PP-0099-2017).
[PP-0100]	GSMA SGP.25 Embedded UICC for Consumer Devices, GSMA Association, 05 June 2018, registered under the reference BSI-CC-PP-0100-2018).
[PP-0104]	Common Criteria Protection Profile Cryptographic Service Provider, 19 February 2019, registered under the reference BSI-CC-PP-0104
[ST]	NXP JCOP 6.2 on SN220 Secure Element, Security Target, Rev. 1.0 — 28 September 2021
[ST-lite]	NXP JCOP 6.2 on SN220 Secure Element, Security Target Lite, Rev 1.0— 28 September 2021
[ST-SAN]	ST sanitising for publication, CC Supporting Document CCDB-2006-04-004, April 2006

(This is the end of this report.)