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Specification of the Security Target TCOS Smart Meter Security Module Version 1.0 Release 2/P60C144PVE

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Autor:	Ernst-G. Giessmann
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Contents

1 ST Introduction

1 This section provides document management and overview information that are required a potential user of the TOE to determine, whether the TOE fulfils her requirements.

1.1 ST Reference

2

Title:	Specification of the Security Target TCOS Smart Meter Security Module Version 1.0 Release 2
TOE:	TCOS Smart Meter Security Module Version 1.0 Release 2/ P60C144PVE
Sponsor:	T-Systems International GmbH
Editor(s):	Ernst-G. Giessmann, T-Systems TeleSec
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3 The TCOS is the operating system of smart cards developed at T-Systems International GmbH. They are used in different security environments and infrastructures and are therefore subject of Common Criteria evaluations.

1.2 TOE Reference

4 The Security Target refers to the Product “TCOS Smart Meter Security Module Version 1.0 Release 2” (TOE) of T-Systems for CC evaluation.

1.3 TOE Overview

5 The Target of Evaluation (TOE) addressed by the current Security Target is an composite product comprising hardware and software used by the Gateway of a Smart Metering System according to the Protection Profile [PP0077-SecMod] for the Security Module of a Smart Meter Gateway.

6 The Gateway that connects the LAN of the consumer and the outside world uses the TOE as a cryptographic service provider for different cryptographic functionalities based on elliptic curve cryptography as the generation and verification of digital signatures and key agreement in the TLS framework, for content data signature and content data encryption.

7 The Security Module (TOE) provides the cryptographic identity of the Gateway, and it serves as a reliable source for random numbers as well as a secure storage.

8 The intended use for the TOE is restricted to this application in the infrastructure for Smart Metering Systems and the reader should be familiar with the requirements given in the Technical Guideline for Smart Energy ([TR03109-SecMod]) as well as with the corresponding Protection Profile for the Gateway ([PP0073-SMGW]).

9 During operational use phase the Gateway, where the Security Module is integrated, is the default user. Additional users are the Gateway Administrator and the Security Module Manufacturer.

10 The TOE contains the cryptographic identity of the Gateway and serves as a cryptographic service provider for

- generation and verification of digital signatures,
- key agreement used by the Gateway for TLS,
- content data signature and content data encryption,
- secure storage for cryptographic keys and certificates, and
- random number generation.

11 To protect the user data the communication between Gateway's software and the TOE is encrypted and protected by means of secure messaging. This secure channel is established by the well known and proven as secure PACE protocol executed between the Gateway's software and the TOE. It requires the knowledge of a secret, that may be even weak, but it establishes strong session keys. The derived key[1] is called PACE key.

12 The PACE protocol provides also component authentication between the Gateway and the TOE with negotiation of session keys for secure messaging.

13 For CC evaluation only one application of corresponding product will be considered:

> *Security Module Application* containing data needed for cryptographic services provided by the Security Module.

14 The cryptographic algorithms and security parameters of these algorithms used by the TOE are defined outside the TOE in the Smart Metering Systems Infrastructure (cf. [TR03109-SecMod, part 3]). The TOE supports the standardized domain parameters brainpoolP256r1, brainpoolP384r1, brainpoolP512r1 (cf. [RFC5639]) and the NIST curves P-256, P-384 ([FIPS186]) listed in [TR03116-3, section 2.2 Table 3].

15 The Signature Module is integrated into a smart card of ID-000 format according to [ISO7810].

16 In some context the hardware base may be relevant, and, if so, the TOE will be identified in more detail as the “TCOS Smart Meter Security Module Version 1.0 Release 2/ P60C144PVE", otherwise the notion "TCOS Smart Meter Security Module Version 1.0 Release 2" will be used, indicating that this context applies to any realization regardless which hardware base is used

17 The TOE follows the composite evaluation aspects ([AIS36]). The Security Target of the underlying platform ([HWST]) claims conformance to Smartcard IC Platform Protection Profile ([PP0035-ICC]).

18 This composite ST is based on the ST of the underlying platform ([HWST]). Protection Profile [PP0077-SecMod] does not claim conformance to the Smartcard IC Platform Protection Profile ([PP0035-ICC]), therefore it will not be considered in this ST.

[1] denoted as K_{π}. in [TR03110-2, section 4.2]

1.4 TOE Description

1.4.1 TOE Definition

19 The TOE comprises of

- the circuitry of the chip including all IC Dedicated Software being active in the Operational Phase of the TOE (the integrated circuit, IC),
- the IC Embedded Software (operating system),
- the *Security Module* application, and
- the associated guidance documentation.

20 The components of the TOE are therefore the hardware (IC), the operating system TCOS (OS) and the dedicated files for the Security Module application in a file system. A detailed description of the parts of TOE will be given in TOE Design Specification covered by ADV_TDS.

21 The corresponding keys and authentication data used in life cycle phase 5 are delivered securely to the Integrator.

1.4.2 TOE security features for operational use

22 The following TOE security features are the most significant for its operational use:

- Digital Signature Generation,
- Digital Signature Verification,
- Key Agreement for TLS,
- Key Agreement for Content Data Encryption,
- Key Pair Generation,
- Random Number Generation,
- Component Authentication via the PACE-Protocol with Negotiation of Session Keys,
- Secure Messaging, and
- Secure Storage of Key Material and further data relevant for the Gateway.

1.4.3 Non-TOE hardware/software/firmware

23 The TOE is the Security Module intended to be used by a Smart Meter Gateway in a Smart Metering System. It is an independent product in the sense that it does not require any additional hardware, firmware or software to ensure its security.

24 In order to be powered up and to be able to communicate the TOE needs an appropriate device for power supply. For the regular communication, the TOE requires a device whose implementation matches the TOE's interface specification (refer to [TR03109-2]).

1.4.4 Life Cycle Phases Mapping

25 Following the protection profile PP-0077 [PP0077-SecMod, 1.5] the life cycle phases of a TCOS Security Module can be divided into the following six phases:

Phase 1: Security Module Embedded Software Development

Phase 2: IC Development

Phase 3: IC Manufacturing, Packaging and Testing

Phase 4: Security Module Product Finishing Process

Phase 5: Security Module Integration
Phase 6: Security Module End-Usage

Life cycle phase 1 "Security Module Embedded Software Development"

26 The TOE is developed in phase 1. The Platform Developer according to [AIS36] develops the integrated circuit, the IC Dedicated Software and the guidance documentation associated with these TOE components.

27 The Security Module Embedded Software Developer is in charge of the development of the Security Module Embedded Software of the TOE, the development of the TOE related Application, and the specification of the IC initialization and pre-personalization requirements.

28 The purpose of the Security Module Embedded Software and Application designed and implemented during phase 1 is to control and protect the TOE during the following phases (product usage). The global security requirements of the TOE are such that it is mandatory during the development phase to anticipate the security threats of the other phases.

Life cycle phase 2 "IC Development"

29 The IC Designer designs the IC, develops the IC Dedicated Software, provides information, software or tools to the Security Module Embedded Software Developer, and receives the Security Module Embedded Software from the developer through trusted delivery and verification procedures.

Life cycle phase 3 "IC Manufacturing, Packaging and Testing"

30 The IC Manufacturer is responsible for producing the IC including IC manufacturing, IC pre-personalization, implementing/installing the Security Module Embedded Software in the IC and IC testing.

31 The Protection Profile [PP0077-SecMod] allows for modifications in the processes performed in the life cycle phases 3 and 4. This applies to the TOE, i.e. the IC packaging will not be assigned to this phase, but will be performed in the next phase 4 after initialization.

32 As the packing is not finished in this phase there is no role of IC Packing Manufacturer foreseen in this phase.

Life cycle phase 4 "Security Module Product Finishing Process"

33 The Security Module Product Manufacturer is responsible for the initialization of the TOE, i.e. loading of the initialization data into the TOE, and testing of the TOE.

34 The initialization data is delivered securely to the Security Module Product Manufacturer.

35 After initialization, successful testing of the Operation System and loading a dedicated file system with security attributes the Security Module Product Manufacturer will act as the IC Packaging Manufacturer. According to the production processes the IC packing will be performed in this phase, which is allowed by the Protection Profile.

36 The Security Module product finishing process comprises the embedding of the IC modules of the TOE (manufactured in phase 3 and the first part of this phase 4) in a microcontroller embedded in a HVQFN package.

37 **This finishes the TOE.**

38 The form factor of the TOE is the HVQFN package. The TOE is ready made for the import of User Data.

Life cycle phase 5 "Security Module Integration"

39 The Integrator is responsible for the physical integration of the initialized Security Module (TOE) and the Gateway, and the logical integration of the initialized Security Module and the Gateway, i.e. the pre-personalisation of the Security Module covering the generation, installation and import of initial and preliminary key material and certificates on/to the Security Module.

40 The keys and authentication data (the FORMAT APDUs) for opening this phase 5 is delivered securely to the Integrator.

41 The integration process and its single steps follow the procedures decribed in the Technical Guidelines [TR03109-1] and [TR03109-2].

42 Result of this integration phase is the integrated Gateway, consisting of the Gateway and its assigned Security Module. The Gateway and the Security Module are physically and logically connected, the pairing between the Gateway and its Security Module has been carried out, and the Security Module is equipped with initial and preliminary key and certificate material.

Life cycle phase 6 "Security Module End-Usage"

43 At first operational key and certificate material is generated, installed and imported into the Security Module. This is the task of the Gateway Administrator and is secured by using the initial and preliminary key and certificate material that was set-up in the preceding integration phase (phase 5).

44 Afterwards, the Security Module is used by the Gateway in the Smart Metering System as a cryptographic service provider.

45 Administration of the integrated Gateway with its Security Module is performed by the Gateway Administrator. A detailed description of the TOE's end-usage and the TOE's collaboration and interaction with the Gateway in the operational phase (including personalization, administration and normal operation) can be found in [TR03109-1], [TR03109-2] and [PP0073-SMGW].

46 The security environment for the TOE and the ST of the underlying platform match, the Phases up to 5 are covered by a controlled environment as required in [HWCR, p. 41]. In Phase 6 (Operational Use) no restrictions apply.

1.4.5 TOE Boundaries

1.4.5.1 TOE Physical Boundaries

47 The TOE comprises a smart card that consists of hardware containing a microprocessor, (CPU), a coprocessor for special (cryptographic) operations, a random number generator, volatile and non-volatile memory, and associated software, packaged and embedded in a carrier.

48 The Security Module is physically embedded into the Gateway and protected by the same level of physical protection as assumed for and provided by the environment of the Gateway.

1.4.5.2 TOE Logical Boundaries

49 The logical boundaries of the TOE can be identified by its security functionalities:

- Digital Signature Generation,
- Digital Signature Verification,
- Key Agreement for Transport Layer Security (TLS),
- Key Agreement for Content Data Encryption,
- Key Pair Generation,
- Random Number Generation
- Component Authentication via the PACE-Protocol with Negotiation of Session Keys,
- Secure Messaging, and
- Secure Storage of Key Material and further data relevant for the Gateway.

50 All these security functionalities are used by the Gateway to uphold the overall security of the Smart Metering System.

51 TOE's security functionalities are specified from a technical point of view in [TR03109-2]. A detailed description of the security functionality provided by the TOE for use by the Gateway and in particular a detailed description of the TOE's collaboration and interaction with the Gateway can be found in [TR03109-1], [TR03109-2] and [PP0073-SMGW].

2 Conformance Claim

2.1 CC Conformance Claims

52 This Security Target claims conformance to Common Criteria for Information Technology Security Evaluation [CC],

Part 1: Introduction and General Model; CCMB-2012-09-001, Version 3.1, Revision 4, September 2012,

Part 2: Security Functional Components; CCMB-2012-09-002, Version 3.1, Revision 4, September 2012,

Part 3: Security Assurance Requirements; CCMB-2012-09-003, Version 3.1, Revision 4, September 2012

53 as follows:

Part 2 extended,

Part 3 conformant.

54 The Common Methodology for Information Technology Security Evaluation, Evaluation Methodology; CCMB-2012-09-004, Version 3.1, Revision 4, September 2012 ([CC]) has to be taken into account. The evaluation follows the Common Evaluation Methodology (CEM) with current final interpretations.

55 This ST is conformant to Common Criteria Part 2 ([CC]) extended due to the use of SFRs FCS_RNG.1, FMT_LIM.1, FMT_LIM.2, and FPT_EMS.1 defined in the Protection Profile [PP0077-SecMod].

2.2 PP Claims

56 This ST claims strict conformance to the ‘CC Protection Profile for the Security Module of a Smart Meter Gateway (Security Module PP)’, Version 1.03, BSI-CC-PP-0077-V2-2015, 2014-12 [PP0077-SecMod].

2.3 Package Claims

57 The evaluation of the TOE is a composite evaluation and uses the results of the CC evaluation provided by [HWCR]. The IC hardware platform and its primary embedded software are evaluated at level EAL 6+ (augmented by ASE_TSS.2 and ALC_FLR.1).

58 The evaluation assurance level of the TOE is EAL4 augmented with AVA_VAN.5 as defined in [CC].

2.4 Conformance Rationale

59 The ST claims *strict* conformance to the protection profile [PP0077-SecMod] as required there in sec. 2.5.

60 The **TOE type** as stated in [PP0077-SecMod, sec. 1.4.4] is '… a service provider for the Gateway for cryptographic functionality in type of a hardware security module with appropriate software installed'.

61 This required TOE type is commensurate with the current TOE type as a smart card.

62 All sections of this Security Target regarding the **Security Problem Definition**, **Security Objectives Statement** and **Security Requirements Statement** for the TOE are taken over from the [PP0077-SecMod].

63 The operations done for the SFRs taken from the PP [PP0077-SecMod] are clearly indicated.

64 The **Security Assurance Requirements** statement for the TOE in the current ST includes all the requirements for the TOE of the PP [PP0077-SecMod] as stated in chap. 6.2 below.

65 These considerations show that this Security Target correctly claims strict conformance to the Protection Profile [PP0077-SecMod].

3 Security Problem Definition

3.1 Introduction

Assets

66 The Security Module (TOE) of a Smart Metering System can be seen as a cryptographic service provider for the Smart Meter Gateway. It provides different cryptographic functionalities based on elliptic curve cryptography, implements the cryptographic identities of the Gateway, and serves as a secure storage for cryptographic keys and certificates. More detailed, the main cryptographic services provided by the TOE cover the following issues:

- Digital Signature Generation,
- Digital Signature Verification,
- Key Agreement for TLS,
- Key Agreement for Content Data Encryption,
- Key Pair Generation,
- Random Number Generation,
- Component Authentication via the PACE-Protocol with Negotiation of Session Keys,
- Secure Messaging, and
- Secure Storage of Key Material and further data relevant for the Gateway.

67 The primary assets to be protected by the TOE as long as they are in scope of the TOE are

Object No.	Asset	Definition	Generic security property to be maintained by the current security policy
1	Key Pair Object	Contains for the TOE's asymmetric cryptographic functionality the private key data and optionally the corresponding public key data of a key pair. In addition, the corresponding key attributes (as e.g. information on the related elliptic curve, on the key usage etc.) are stored. A key pair object can be used for the following purposes: • TLS • SIG (content data signature) • ENC (content data encryption)	Confidentiality Integrity Authenticity
2	Public Key Object	Contains for the TOE's asymmetric cryptographic functionality the public key data of a public key. In addition, the corresponding key attributes (as e.g. information on the related elliptic curve, on the key usage etc.) are stored. A public key object can be used for the following purposes: • TLS • SIG (content data signature) • ENC (content data encryption) • AUTH (external authentication)	Integrity Authenticity
3	Certificate of SM-PKI-Root	X.509 Certificate of the SM-PKI-Root. The Certificate and its contained Public Key is to be considered as a trust anchor.	Integrity Authenticity

Object No.	Asset	Definition	Generic security property to be maintained by the current security policy
4	Public Key of SM-PKI-Root	In addition to the Certificate of the SM-PKI-Root, the Public Key of the SM-PKI-Root is stored in a dedicated Public Key Object of the TOE. The Public Key is to be considered as a trust anchor.	Integrity Authenticity
5	Quality of Seal Certificates of the Gateway	X.509 Certificates of the Gateway for preliminary Key Pair Objects used for TLS, SIG and ENC.	Integrity Authenticity
6	GW-Key	Symmetric key used by the Gateway to secure its memory.	Confidentiality Integrity Authenticity

Table 1: Assets User Data

68 The secondary assets also having to be protected by the TOE in order to achieve a sufficient protection of the primary assets are:

Object No.	Asset	Definition	Property to be maintained by the current security policy
7	Ephemeral Keys	Negotiated during the PACE protocol between the Gateway and the TOE, during the DH key agreement protocol (ECKA-DH) respective during the ElGamal key agreement protocol (ECKA-EG).	Confidentiality Integrity Authenticity
8	Shared Secret Value / ECKA-DH	Value Z_{AB} negotiated in the framework of the DH key agreement protocol (ECKA-DH). Used by the Gateway for the TLS handshake.	Confidentiality Integrity Authenticity
9	Shared Secret Value / ECKA-EG	Value Z_{AB} negotiated in the framework of the ElGamal key agreement protocol (ECKA-EG). Used by the Gateway for content data encryption.	Confidentiality Integrity Authenticity
10	Session Keys	Negotiated during the PACE protocol between the Gateway and the TOE and used afterwards for a trusted channel (secure messaging) between the Gateway and the TOE.	Confidentiality Integrity Authenticity
11	Domain Parameters of Elliptic Curves	Domain Parameters of the elliptic curves that are used by the key objects (key pair objects, public key objects) respective by the cryptographic functionality provided by the TOE.	Integrity Authenticity
12	GW-PIN	Reference value of the system PACE-PIN of the Gateway for use in the PACE protocol between the Gateway and the TOE.	Confidentiality Integrity Authenticity

Table 2: Assets TSF Data

Subjects and external entities

69 The only external entity that directly interacts with the TOE in its operational phase is the corresponding Smart Meter Gateway of the Smart Metering System (called Gateway for short, in the following) as defined in [PP0073-SMGW]. In view of the TOE, the Gateway is responsible for sending and receiving TOE commands including the necessary data preparation and post-processing.

70 In addition, the Gateway Administrator who is in charge of the administration of the Gateway and its integrated Security Module (TOE), in particular the management of keys and certificates, is indirectly interacting with the TOE via the Gateway.

71 In the operational phase, there are further external entities communicating with the Gateway, as e.g.:

- Consumer: The individual or organization that “owns” the Meter Data. In most cases this will be tenants or house owners consuming electricity, water, gas or further commodities. However, it is also possible that the consumer produces or stores energy (e.g. with their own solar plant).
- Gateway Operator: Responsible for installing and maintaining the Gateway. Responsible for gathering Meter Data from the Gateway and for providing these data to the corresponding external entities.

72 As these external entities only indirectly interact with the TOE, these entities are out of scope for this ST.

73 During its pre-operational phases the TOE interacts with the Integrator and the Gateway Administrator. The Integrator is responsible for the integration of the Gateway and the TOE as well as for generating, installing and importing initial respective preliminary key and certificate material. The Gateway Administrator is in charge of preparing the initial key material as relevant for the integration phase. In addition, in the following personalization phase (part of the operational phase), the Gateway Administrator is responsible for the exchange of the preliminary key and certificate material by operational key and certificate material. Refer for details to the description of the TOE life cycle model in chapter 1.4.4 (p. 7) and [TR03109-1] and [TR03109-2].

74 For the operational phase, this ST considers the following external entities and subjects:

External Entity	Subject	Role	Definition
1	External World	User	Human or IT entity, possibly unauthenticated
2	Gateway	Authenticated Gateway	Successful authentication via PACE protocol between Gateway and TOE
3	Gateway Administrator	Authenticated Gateway Administrator	Successful external authentication of the Gateway Administrator against the TOE

Table 3: Subjects

75 This table defines external entities and subjects in the sense of [CC]. Subjects can be recognized by the TOE independent of their nature (human or technical user). As result of an appropriate identification and authentication process, the TOE creates – for each of the respective external entity – an ‘image’ inside and ‘works’ then with this TOE internal image (also called subject in [CC]). From this point of view, the TOE itself perceives only ‘subjects’ and, for them, does not differ between ‘subjects’ and ‘external entities’.

76 There is no dedicated subject with the role ‘attacker’ within the current security policy, whereby an attacker might ‘capture’ any subject role recognised by the TOE.

3.2 Threats

77 This section describes the threats to be averted by the TOE independently or in collaboration with its IT environment. These threats result from the assets protected by the TOE and the method of TOE’s use in the operational environment.

78 Those threats are the result of a threat model that has been developed for the whole Smart Metering System at first and then has been focused on the threats against the TOE.

79 The overall threat model for the Smart Metering System considers two different kinds of attackers to the Gateway and its integrated TOE, distinguishing between their different attack paths:

- Local attacker having physical access to the Gateway and its integrated TOE or a connection to these components.
- Attacker located in the WAN (WAN attacker) who uses the WAN connection for his attack.

80 Please note that the threat model assumes that the local attacker has less motivation than the WAN attacker (see below) as a successful attack of a local attacker will always only impact one Gateway respective its integrated TOE. Please further note that the local attacker includes the consumer.

81 Goal of the attack on the Gateway and its integrated TOE is to try to disclose or alter data while stored in the Gateway or TOE, while processed in the Gateway or TOE, while generated by the Gateway or TOE or while transmitted between the Gateway and the TOE. In particular, as the TOE serves as central cryptographic service provider and secure storage for key and certificate material for the Gateway, the assets stored, processed, generated and transmitted by the TOE are in focus of the attacker.

82 The threats to the TOE will be defined in the following manner:

T.Name Short title

The description of the threats.

83 Taking the preceding considerations into account, the following threats to the TOE are of relevance.

T.ForgeInternalData Forgery of User Data or TSF Data

84 An attacker with high attack potential tries to forge internal User Data or TSF Data via the regular communication interface of the TOE.

85 This threat comprises several attack scenarios of forgery of internal User Data or TSF Data. The attacker may try to alter User Data e.g. by deleting and replacing persistently stored key objects or adding data to data already stored in elementary files. The attacker may misuse the TSF management function to change the user authentication data (GW-PIN) to a known value.

T.CompromiseInternalData Compromise of confidential User Data or TSF Data

86 An attacker with high attack potential tries to compromise confidential User Data or TSF Data via the regular communication interface of the TOE.

87 This threat comprises several attack scenarios of revealing confidential internal User Data or TSF Data. The attacker may try to compromise the user authentication data (GW-PIN), to reconstruct a private signing key by using the regular command interface and the related response codes, or to compromise generated shared secret values or ephemeral keys.

T.Misuse Misuse of TOE functions

88 An attacker with high attack potential tries to use the TOE functions to gain access to access control protected assets without knowledge of user authentication data or any implicit authorization.

89 This threat comprises several attack scenarios. The attacker may try to circumvent the user authentication mechanism to access assets or functionality of the TOE that underlie the TOE's access control and require user authentication. The attacker may try to alter the TSF data e.g. to extend the user rights after successful authentication.

T.Intercept Interception of communication

90 An attacker with high attack potential tries to intercept the communication between the TOE and the Gateway to disclose, to forge or to delete transmitted (sensitive) data or to insert data in the data exchange.

91 This threat comprises several attack scenarios. An attacker may read data during data transmission in order to gain access to user authentication data (GW-PIN) or sensitive material as generated ephemeral keys or shared secret values. An attacker may try to forge public keys during their import to respective export from the TOE.

T.Leakage Leakage

92 An attacker with high attack potential tries to launch a cryptographic attack against the implementation of the cryptographic algorithms or tries to guess keys using a brute-force attack on the function inputs.

93 This threat comprises several attack scenarios. An attacker may try to predict the output of the random number generator in order to get information about a generated session key, shared secret value or ephemeral key. An attacker may try to exploit leakage during a cryptographic operation in order to use SPA, DPA, DFA, SEMA or DEMA techniques with the goal to compromise the processed keys, the GW-PIN or to get knowledge of other sensitive TSF or User data. Furthermore an attacker could try guessing the processed key by using a brute-force attack.

94 In addition, timing attacks have to be taken into account. The sources for this leakage information can be the measurement and analysis of the shape and amplitude of signals or the time between events found by measuring signals on the electromagnetic field, power consumption, clock, or I/O lines (side channels).

T.PhysicalTampering Physical tampering

95 An attacker with high attack potential tries to manipulate the TOE through physical tampering, probing or modification in order to extract or alter User Data or TSF Data stored in or processed by the TOE. Alternatively, the attacker tries to change TOE functions (as e.g. cryptographic functions provided by the TOE) by physical means (e.g. through fault injection).

T.AbuseFunctionality Abuse of functionality

96 An attacker with high attack potential tries to use functions of the TOE which shall not be used in TOE operational phase in order (i) to disclose or manipulate sensitive User Data or TSF Data, (ii) to manipulate the TOE's software or (iii) to manipulate (explore, bypass, deactivate or change) security features or functions of the TOE.

97 In particular, the TOE shall ensure that functionality that shall not be usable in the operational phase, but which is present during the phases of the TOE's manufacturing and initialization as well as during the integration phase of the Gateway and the TOE, is deactivated before the TOE enters the operational phase. Such functionality includes in particular testing, debugging and initialization functions.

T.Malfunction Malfunction of the TOE

98 An attacker with high attack potential tries to cause a malfunction of the TSF or of the IC Embedded Software by applying environmental stress in order to (i) deactivate or modify security features or functions of the TOE or (ii) circumvent or deactivate or modify security functions of the IC Embedded Software.

99 This may be achieved e.g. by operating the IC outside the normal operating conditions, exploiting errors in the IC Embedded Software or misuse of administration function. To exploit this an attacker needs information about the functional operation.

3.3 Organizational Security Policies

100 This section specifies the organizational security policies (OSP) that the TOE and its environment shall comply with in order to support the Gateway. These OSPs incorporate in particular the organizational security policy OSP.SM defined in the Gateway Protection Profile [PP0073-SMGW].

101 The organizational security policies for the TOE (P) will be defined in the following manner:

P.Name Short title

The description of the organizational security policy.

P.Sign Signature generation and verification

102 The TOE shall generate and verify digital signatures according to [TR03109-3] and [TR03109-2]. The explicit generation and verification of digital signatures is used by the Gateway especially in the framework of the TLS handshake, the content data signature and the verification of certificates and certificate chains.

P.KeyAgreementDH DH key agreement

103 The TOE and the Gateway shall implement the DH key agreement (ECKA-DH) according to [TR03109-3] and [TR03109-2]. The DH key agreement is used by the Gateway in the framework of the TLS handshake. The Gateway uses the generated shared secret value Z_{AB} for the generation of the pre-master secret and with random numbers as well generated by the TOE afterwards to create the master secret.

P.KeyAgreementEG ElGamal key agreement

104 The TOE and the Gateway shall implement the ElGamal key agreement (ECKA-EG) according to [TR03109-3] and [TR03109-2]. The ElGamal key agreement is used by the Gateway in the framework of the content data encryption. The Gateway uses the generated shared secret value Z_{AB} for the generation of the symmetric encryption keys (hybrid encryption/decryption scheme).

P.Random Random number generation

105 The TOE shall generate random numbers for its own use (e.g. for the generation of ECC key pairs and session keys) and for use by the Gateway itself according to [TR03109-3] and [TR03109-2].

P.PACE PACE

106 The TOE and the Gateway shall implement the PACE protocol according to [TR03110-2], [TR03109-3], [TR03109-2] for component authentication between the Gateway and the TOE. In the framework of the PACE protocol session keys for securing the data exchange between the Gateway and the TOE (trusted channel) are negotiated.

3.4 Assumptions

107 According to the threat model in the following assumptions about the environment of the TOE are listed, that need to be taken into account in order to ensure a secure operation of the TOE.

108 The assumptions for the TOE (A) will be defined in the following manner:

A.Name Short title

The description of the assumption.

A.Integration Integration phase of the Gateway and TOE

109 It is assumed that appropriate technical and/or organizational security measures in the phase of the integration of the Gateway and the TOE in the life cycle model guarantee for the confidentiality, integrity and authenticity of the assets of the TOE to be protected with respect to their protection need (cf. [PP0077-SecMod, Table 4 and Table 5]).

110 In particular, this holds for the generation, installation and import of initial key, certificate and PIN material.

A.OperationalPhase Operational phase of the integrated Gateway

111 It is assumed that appropriate technical and/or organizational measures in the operational phase of the integrated Gateway guarantee for the confidentiality, integrity and authenticity of the assets of the TOE to be protected with respect to their protection need (cf. [PP0077-SecMod, Table 4 and Table 5]). In particular, this holds for key and PIN objects stored, generated and processed in the operational phase of the integrated Gateway.

A.Administration Administration of the TOE

112 The administration of the integrated TOE, in particular related to the administration of the TOE's file and object system consisting of folders, data files and key objects, takes place under the control of the Gateway Administrator.

113 The Gateway Administrator is responsible for the key management on the integrated TOE and takes in particular care for consistency of key material in key objects and associated certificates.

A.TrustedAdmin Trustworthiness of the Gateway Administrator

114 It is assumed that the Gateway Administrator is trustworthy and well- trained, in particular in view of the correct and secure usage of the TOE.

A.PhysicalProtection Physical protection of the TOE

115 It is assumed that the TOE is physically and logically embedded into a Gateway that is certified according to [PP0073-SMGW] (whereby the integration is performed during the integration phase of the life cycle model).

116 It is further assumed that the Gateway is installed in a non-public environment within the premises of the consumer that provides a basic level of physical protection. This protection covers the Gateway, the TOE, the Meters that the Gateway communicates with and the communication channel between the Gateway and the TOE.

4 Security Objectives

117 This chapter describes the security objectives for the TOE and the security objectives for the TOE operational environment.

118 The security objectives for the TOE (O) and the security objectives for the operational environment (OE) will be defined in the following manner:

O/OE.Name Short title

The description of the objective.

4.1 Security Objectives for the TOE

119 The following TOE security objectives address the protection provided by the TOE *independently* of the TOE environment as well as the organizational security policies to be met by the TOE independently of the operational environment.

O.Integrity Integrity of User Data or TSF Data

120 The TOE shall ensure the integrity of the User Data, the security services provided by the TOE and the TSF Data under the TSF scope of control.

O.Confidentiality Confidentiality of User Data or TSF Data

121 The TOE shall ensure the confidentiality of private keys and other confidential User Data and confidential TSF Data (especially the user authentication data as the GW-PIN) under the TSF scope of control.

O.Authentication Authentication of external entities

122 The TOE shall support the authentication of human users (Gateway Administrator) and the Gateway. The TOE shall be able to authenticate itself to the Gateway.

O.AccessControl Access control for functionality and objects

123 The TOE shall provide and enforce the functionality of access right control. The access right control shall cover the functionality provided by the TOE (including its management functionality) and the objects stored in or processed by the TOE. The TOE shall enforce that only authenticated entities with sufficient access control rights can access restricted objects and services. The access control policy of the TOE shall bind the access control right to an object to authenticated entities.

O.KeyManagement Key management

124 The TOE shall enforce the secure generation, import, distribution, access control and destruction of cryptographic keys. The TOE shall support the public key import from and export to the Gateway.

O.TrustedChannel Trusted channel

125 The TOE shall establish a trusted channel for protection of the confidentiality and the integrity of the transmitted data between the TOE and the successfully authenticated Gateway. The TOE shall enforce the use of a trusted channel if defined by the access condition of an object.

O.Leakage Leakage protection

126 The TOE shall be designed and built in such a way as to control the production of intelligible emanations within specified limits. The TOE shall provide side channel resistance, i.e. shall be able to prevent appropriately leakage of information, e.g. electrical characteristics like power consumption or electromagnetic emanations that would allow an attacker to learn about private key material, confidential results or intermediate results of cryptographic computations, the GW-PIN.

O.PhysicalTampering Protection against physical tampering

127 The TOE shall provide system features that detect physical tampering, probing and manipulation of its components against an attacker with high attack potential, and uses those features to limit security breaches.

128 The TOE shall prevent or resist physical tampering, probing and manipulation with specified system devices and components.

O.AbuseFunctionality Protection against abuse of functionality

129 The TOE shall prevent that functions intended for the testing and production of the TOE and which must not be accessible after TOE delivery can be abused in order (i) to disclose or manipulate sensitive User Data or TSF Data, (ii) to manipulate the TOE's software or (iii) to bypass, deactivate, change or explore security features or functions of the TOE.

130 *Application Note 1:* Details depend, for instance, on the capabilities of the Test Features provided by the IC Dedicated Test Software which are not specified here.

131 In particular, the TOE shall ensure that functionality that shall not be usable in the operational phase, but which is present during the phases of the TOE's manufacturing and initialization as well as during the integration phase of the Gateway and the TOE, is deactivated before the TOE enters the operational phase. Such functionality includes in particular testing, debugging and initialization functions.

O.Malfunction Protection against malfunction of the TOE

132 The TOE shall ensure its correct operation. The TOE shall prevent its operation outside the normal operating conditions where reliability and secure operation has not been proven or tested. The TOE shall preserve a secure state to prevent errors and deactivation of security features of functions. The environmental conditions include external energy (esp. electromagnetic) fields, voltage (on any contacts), clock frequency, and temperature.

O.Sign Signature generation and verification

133 The TOE shall securely generate and verify digital signatures according to [TR-03109-3], [TR-03109-2]. The explicit generation and verification of digital signatures is used by the

Gateway especially in the framework of the TLS handshake, the content data signature and the verification of certificates and certificate chains.

O.KeyAgreementDH DH key agreement

134 The TOE shall securely implement the DH key agreement (ECKA-DH) according to [TR03109-3] and [TR03109-2]. The DH key agreement is used by the Gateway in the framework of the TLS handshake. The Gateway uses the generated shared secret value Z_{AB} for the generation of the pre-master secret and with random numbers as well generated by the TOE afterwards to create the master secret.

O.KeyAgreementEG ElGamal key agreement

135 The TOE shall securely implement the ElGamal key agreement (ECKA-EG) according to [TR03109-3] and [TR03109-2]. The ElGamal key agreement is used by the Gateway in the framework of the content data encryption. The Gateway uses the generated shared secret value Z_{AB} for the generation of the symmetric encryption keys (hybrid encryption/ decryption scheme).

O.Random Random number generation

136 The TOE shall securely generate random numbers for its own use (e.g. for the generation of ECC key pairs and session keys) and for use by the Gateway itself according to [TR03109-3] and [TR03109-2].

O.PACE PACE

137 The TOE shall securely implement the PACE protocol according to [TR03110-2], [TR03109-3] and [TR03109-2] for component authentication between the Gateway and the TOE. In the framework of the PACE protocol session keys for securing the data exchange between the Gateway and the TOE (trusted channel) are negotiated.

4.2 Security Objectives for the Operational Environment

138 The following security objectives for the operational environment of the TOE are defined:

OE.Integration Integration phase of the Gateway and TOE

139 Appropriate technical and/or organizational security measures in the phase of the integration of the Gateway and the TOE in the life cycle model shall be applied in order to guarantee for the confidentiality, integrity and authenticity of the assets of the TOE to be protected with respect to their protection need (see also tables of User and TSF Data in chapter 3.1, p. 13).

140 In particular, for the TOE, this shall hold for the generation, installation and import of initial key, certificate and PIN material.

141 The Integrator shall in particular take care for consistency of key material in key objects and associated certificates as far as handled in the framework of the integration of the Gateway and the TOE.

OE.OperationalPhase Operational phase of the integrated Gateway

142 Appropriate technical and/or organizational measures in the operational phase of the integrated Gateway shall be applied in order to guarantee for the confidentiality, integrity and authenticity of the assets of the TOE to be protected with respect to their protection need (see also tables of User and TSF Data in [PP0077-SecMod, chap. 3.2]).

143 In particular, this shall hold for key and PIN objects stored, generated and processed in the operational phase of the integrated Gateway.

OE.Administration Administration of the TOE

144 The administration of the integrated TOE, in particular related to the administration of the TOE's file and object system consisting of folders, data files and key objects, shall take place under the control of the Gateway Administrator.

145 The Gateway Administrator shall be responsible for the key management on the integrated TOE and shall in particular take care for consistency of key material in key objects and associated certificates.

OE.TrustedAdmin Trustworthiness of the Gateway Administrator

146 The Gateway Administrator shall be trustworthy and well-trained, in particular in view of the correct and secure usage of the TOE.

OE.PhysicalProtection Physical protection of the TOE

147 The TOE shall be physically and logically embedded into a Gateway that is certified according to [PP0073-SMGW] (whereby the integration is performed during the integration phase of the life cycle model).

148 The Gateway shall be installed in a non-public environment within the premises of the consumer that provides a basic level of physical protection. This protection shall cover the Gateway, the TOE, the Meters that the Gateway communicates with and the communication channel between the Gateway and the TOE.

OE.KeyAgreementDH DH key agreement

149 The Gateway shall securely implement the Diffie-Hellman key agreement (ECKA-DH) according to [TR03109-2] and [TR03109-3].

150 The DH key agreement is used by the Gateway in the framework of the TLS handshake. The Gateway uses the generated shared secret value Z_{AB} for the generation of the pre-master secret and with random numbers as well generated by the TOE afterwards to create the master secret.

OE.KeyAgreementEG ElGamal key agreement

151 The Gateway shall securely implement the ElGamal key agreement (ECKA-EG) according to [TR03109-2] and [TR03109-3].

152 The ElGamal key agreement is used by the Gateway in the framework of the content data encryption. The Gateway uses the generated shared secret value Z_{AB} for the generation of the symmetric encryption keys (hybrid encryption/decryption scheme).

OE. PACE PACE

153 The Gateway shall securely implement the PACE protocol according to [TR03110-2], [TR03109-2], [TR03109-3] for component authentication between the Gateway and the TOE. In the framework of the PACE protocol session keys for securing the data exchange between the Gateway and the TOE (trusted channel) are negotiated.

OE.TrustedChannel Trusted channel

154 The Gateway shall perform a trusted channel between the Gateway and the TOE for protection of the confidentiality and integrity of the sensitive data transmitted between the authenticated Gateway and the TOE.

4.3 Security Objective Rationale

155 The following table is taken over from the Protection Profile [PP0077-SecMod]. It gives give an overview how the assumptions, threats and organizational security policies are addressed by the security objectives for the TOE and its environment.

156 The table provides an overview for the security objectives coverage (TOE and its environment), also giving evidence for sufficiency and necessity of the security objectives defined for the TOE and its environment. It shows that all threats are addressed by the security objectives for the TOE and its environment, that all organizational security policies are addressed by the security objectives for the TOE and its environment, and that all assumptions are addressed by the security objectives for the TOE environment.

	O.Integrity	O.Confidentiality	O.Authentication	O.AccessControl	O.KeyManagement	O.TrustedChannel	O.Leakage	O.PhysicalTampering	O.AbuseFunctionality	O.Malfunction	O.Sign	O.KeyAgreementDH	O.KeyAgreementEG	O.Random	O.PACE	OE.Integration	OE.OperationalPhase	OE.Administratio	OE.TrustedAdmin	OE.PhysicalProtection	OE.KeyAgreementDH	OE.KeyAgreementEG	OE.PACE	OE.TrustedChannel
T.ForgeInternalData	x																							
T.CompromiseInternalData		x																						
T.Misuse	x	x	x	x																				
T.Intercept				x		x									x								x	x
T.Leakage							x		x															
T.PhysicalTampering								x	x															
T.AbuseFunctionality									x															
T.Malfunction										x														
P.Sign						x					x													
P.KeyAgreementDH						x						x									x			
P.KeyAgreementEG						x							x									x		
P.Random														x										
P.PACE															x								x	
A.Integration																x								
A.OperationalPhase																	x							
A.Administration																		x						
A.TrustedAdmin																			x					
A.PhysicalProtection																				x				

Table 4: Security Objectives Rationale

157 A detailed justification required for suitability of the security objectives to coup with the security problem definition is given in the chapters 4.3.2 “Countering the Threats”, 4.3.3 “Coverage of Organizational Security Policies” and 4.3.4 “Coverage of Assumptions” in the Protection Profile [PP0077-SecMod] and will be therefore not repeated here.

158 The following Security Objectives for the Hardware Platform are based on [PP0035-ICC]:

O.Leak-Inherent	(Protection against Inherent Information Leakage)
O.Phys-Probing	(Protection against Physical Probing)
O.Malfunction	(Protection against Malfunctions)
O.Phys-Manipulation	(Protection against Physical Manipulation)
O.Leak-Forced	(Protection against Forced Information Leakage)
O.Abuse-Func	(Protection against Abuse of Functionality)
O.RND	(Random Numbers)

159 They are all relevant and do not contradict Security Objectives of the TOE. All they can be mapped to corresponding similar named objectives of the TOE.

160 The remaining objective O.Identification is related to the manufacturing phase. Its support by the TOE is considered in more detail in the Guidance Documentation and is subject to evaluation within the assurance components ALC_DEL.1 and AGD_PRE.1.

161 The detailed analysis of Security Objectives derived from the hardware platform ST [HWST] and the environment of the Hardware Platform is made separately in chapter 7.11 (Statement of Compatibility).

5 Extended Components Definition

162 This protection profile uses components defined as extensions to CC part 2. All these extended components are drawn from Definitions of chapter 5 of [PP0077-SecMod]. The components FCS_RNG, FMT_LIM and FPT_EMS are common in Protection Profiles for smart cards and similar devices.

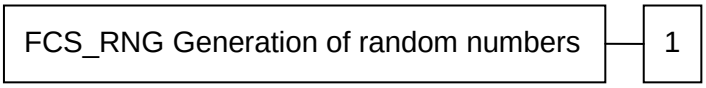
5.1 FCS_RNG Generation of random numbers

The family “Generation of random numbers (FCS_RNG)” is specified as follows.

Family behavior

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

Component leveling:



FCS_RNG.1 Generation of random numbers requires that the random number generator implements defined security capabilities and that the random numbers meet a defined quality metric.

Management: FCS_RNG.1

There are no management activities foreseen.

Audit: FCS_RNG.1

There are no actions defined to be auditable.

FCS_RNG.1 Random number generation

Hierarchical to: No other components.

Dependencies: No dependencies.

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

FCS_RNG.1.2 The TSF shall provide random numbers that meet [assignment: *a defined quality metric*].

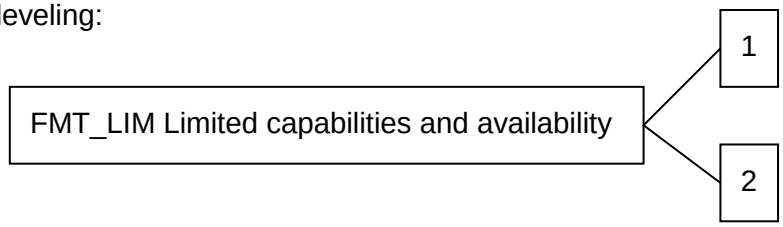
5.2 FMT_LIM Limited capabilities and availability

163 The family “Limited capabilities and availability (FMT_LIM)” is specified as follows.

Family behavior:

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

Component leveling:



FMT_LIM.1 Limited capabilities require 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 lifecycle.

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.

164 **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 [assignment: *Limited capability and availability policy*].

Dependencies: FMT_LIM.2 Limited availability.

165 **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.

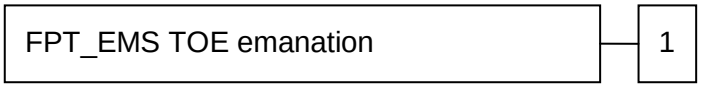
5.3 FPT_EMS TOE Emanation

166 The family “TOE Emanation (FPT_EMS)” is specified as follows.

Family behavior:

This family defines requirements to mitigate intelligible emanations.

Component leveling:



FPT_EMS.1 TOE Emanation defines limits of TOE emanation related to TSF and user data.

Management: FPT_EMS.1

There are no management activities foreseen.

Audit: FPT_EMS.1

There are no actions defined to be auditable.

167 **FPT_EMS.1 TOE Emanation**

Hierarchical to: No other components.

Dependencies: No dependencies.

FPT_EMS.1.1 The TOE shall not emit [assignment: *types of emissions*] in excess of [assignment: *specified limits*] enabling access to [assignment: *list of types of TSF data*] and [assignment: *list of types of user data*].

FPT_EMS.1.2 The TSF shall ensure [assignment: *type of users*] are unable to use the following interface [assignment: *type of connection*] to gain access to [assignment: *list of types of TSF data*] and [assignment: *list of types of user data*].

6 Security Requirements

168 This part of the ST defines the detailed security requirements that shall be satisfied by the TOE. The statement of **TOE security requirements** shall define the *functional* and *assurance* security requirements that the TOE needs to satisfy in order to meet the security objectives for the TOE.

169 The CC allows several operations to be performed on functional requirements; *refinement*, *selection*, *assignment*, and *iteration* are defined in section 8.1 of Part 1 of the Common Criteria [CC]. Each of these operations is used in this ST.

170 The **refinement** operation is used to add detail to a requirement, and thus further restricts a requirement. Refinements of security requirements are denoted in such a way that added words are in **bold text** and removed are ~~crossed out~~. In some cases an interpretation refinement is given. In such a case an extra paragraph starting with "Refinement" is given. Refinements made by the ST author appear ***slanted, bold and underlined***.

171 The **selection** operation is used to select one or more options provided by the CC in stating a requirement. Selections having been made by the PP author are denoted as underlined text. Selections made by the ST author appear *slanted and underlined*.

172 The **assignment** operation is used to assign a specific value to an unspecified parameter, such as the length of a password. Assignments having been made by the PP author are denoted by showing as underlined text. Assignments made by the ST author appear *slanted and underlined*.

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

174 For the sake of a better readability, the iteration operation may also be applied to some single components (being not repeated) in order to indicate belonging of such SFRs to same functional cluster. In such a case, the iteration operation is applied to only one single component.

6.1 Security Functional Requirements for the TOE

6.1.1 Overview

175 This part defines the detailed security requirements that are satisfied by the TOE. These requirements comprise functional components from CC Part 2 [CC], extended components as defined in Chapter 5, and the assurance components as defined for the Evaluation Assurance Level EAL 4 from CC Part 3 [CC], augmented by AVA_VAN.5.

176 The following table summarizes all TOE security functional requirements of this ST:

Class FCS: Cryptographic Support	
FCS_CKM.1/ECC	Cryptographic key generation/ECC-Key Pairs
FCS_CKM.1/ECKA-DH	Cryptographic key generation/DH key agreement (for TLS)
FCS_CKM.1/ECKA-EG	Cryptographic key generation/ElGamal key agreement (for content data encryption)
FCS_CKM.1/PACE	Cryptographic key generation/PACE
FCS_CKM.4	Cryptographic key destruction
FCS_COP.1/SIG-ECDSA	Cryptographic operation/ECDSA Signature generation
FCS_COP.1/VER-ECDSA	Cryptographic operation/ECDSA Signature verification
FCS_COP.1/AUTH	Cryptographic operation/External authentication
FCS_COP.1/IMP	Cryptographic operation/Import of Public Keys
FCS_COP.1/PACE-ENC	Cryptographic operation/AES in CBC mode for secure messaging
FCS_COP.1/PACE-MAC	Cryptographic operation/AES-CMAC for secure messaging
FCS_RNG.1	Random number generation
Class FDP: User Data Protection	
FDP_ACC.2	Complete access control
FDP_ACF.1	Security attribute based access control
FDP_SDI.2	Stored data integrity monitoring and action
FDP_RIP.1	Subset residual information protection
FDP_ETC.1	Export of user data without security attributes
FDP_ITC.1	Import of user data without security attributes
FDP_UCT.1	Basic data exchange confidentiality
FDP_UIT.1	Data exchange integrity
Class FIA: Identification and Authentication	
FIA_ATD.1	User attribute definition
FIA_SOS.1	Specification of Secrets
FIA_UAU.1/GW	Timing of authentication (for Gateway)
FIA_UAU.1/GWA	Timing of authentication (for Gateway Administrator)
FIA_UAU.4	Single-use authentication mechanisms
FIA_UAU.5	Multiple authentication mechanisms
FIA_UID.1	Timing of identification
FIA_USB.1	User-subject binding
Class FMT: Security Management	
FMT_LIM.1	Limited capabilities
FMT_LIM.2	Limited availability
FMT_SMF.1	Specification of management functions
FMT_SMR.1	Security roles
Class FPT: Protection of the TSF	
FPT_EMS.1	TOE emanation
FPT_FLS.1	Failure with preservation of secure state
FPT_PHP.3	Resistance to physical attack
FPT_TST.1	TSF testing
Class FTP: Trusted path/channels	
FTP_ITC.1	Inter-TSF trusted channel

Table 5: SFR Overview

6.1.2 Class FCS Cryptographic Support

177 The Security Module serves as a cryptographic service provider for the Smart Meter Gateway and provides services in the following cryptographic services:

- Signature Generation (ECDSA),
- Signature Verification (ECDSA),
- Key Agreement for TLS (ECKA-DH),
- Key Agreement for Content Data Encryption (ECKA-EG),
- Key Pair Generation,
- Random Number Generation,
- Component Authentication via the PACE-Protocol with Negotiation of Session Keys (PACE),
- Secure Messaging, and
- Secure Storage of Key Material and further data relevant for the Gateway.

178 The cryptographic algorithms that shall be supported by the Gateway and its Security Module are defined in [TR03109-3] respective in [TR03116-3].

179 [TR03109-3] respective [TR03116-3] distinguish between mandatory key sizes and domain parameters for elliptic curves, and key sizes and domain parameters for elliptic curves that are optional to support. The Security Module supports for ECC key generation, ECDSA signature generation and verification, ECKA-DH, ECKA-EG and PACE all the key sizes and domain parameters for elliptic curves that are defined in [TR03109-3] respective in [TR03116-3].

6.1.2.1 Cryptographic key generation (FCS_CKM.1)

180 The following iterations are caused by different cryptographic key generation algorithms to be implemented and keys to be generated by the TOE.

181 FCS_CKM.1/ECC Cryptographic key generation/ECC-Key Pairs

Hierarchical to:	No other components.
Dependencies:	[FCS_CKM.2 Cryptographic key distribution or FCS_COP.1 Cryptographic operation]: fulfilled by FCS_COP.1/SIG-ECDSA FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_CKM.1.1/ ECC	The TSF shall generate cryptographic **ECC** keys in accordance with a specified cryptographic key generation algorithm *ECKeyPair*[2] and specified cryptographic key sizes *256, 384 and 512 bit length group order*[3] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][4].

182 *Refinement:* The cryptographic key generation algorithm ECKeyPair is defined in the Technical Guideline TR-03111 [TR03111-ECC, 4.1.3].

183 *Application Note 2:* [TR03109-2] requires the TOE to implement the command GENERATE ASYMMETRIC KEY PAIR. The generated key pairs are used by the Gateway for TLS as well

2 [assignment: *cryptographic key generation algorithm*]

3 [assignment: *cryptographic key sizes*]

4 [assignment: *list of standards*]

as for content data encryption and signature. The refinement for ECC keys is made by the Protection Profile [PP0077-SecMod].

184 *Application Note 3:* The TOE supports the following standardized elliptic curve domain parameters (cf. [TR03116-3, 2.2 Table 3]) for the cryptographic SFR FCS_CKM.1 and the SFRs of the family FCS_COP:

Name	Size	Reference
brainpoolP256r1	256	[RFC5639, 3.4]
brainpoolP384r1	384	[RFC5639, 3.6]
brainpoolP512r1	512	[RFC5639, 3.7]
NIST P-256 (secp256r1)	256	[FIPS186, D.1.2.3]
NIST P-384 (secp384r1)	384	[FIPS186, D.1.2.4]

185 **FCS_CKM.1/ECKA-DH Cryptographic key generation – DH key agreement**

Hierarchical to:	No other components.
Dependencies:	[FCS_CKM.2 Cryptographic key distribution or FCS_COP.1 Cryptographic operation]: not fulfilled but justified (cf. chapter 6.9.1.4 of the PP [PP0077-SecMod]) FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_CKM.1.1/ ECKA-DH	The TSF shall generate cryptographic keys in accordance with a specified cryptographic key generation algorithm ECKA-DH ***according to* [TR03111-ECC]**[5] and specified cryptographic key sizes *256, 384 and 512 bit*[6] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][7].

186 *Refinement:* The cryptographic key generation algorithm ECKA-DH is implemented according to [TR03111-ECC, 4.3.2.1]. The cryptographic key sizes specified here are those of shared secret which serve as input for the subsequent key derivation outside the TOE.

187 *Application Note 4:* The TOE generates a shared secret value according to [TR03111-ECC]. This is a refinement to the generic reference given in the PP.

188 *Application Note 5:* [TR03109-2] requires the TOE to implement the command GENERAL AUTHENTICATE / variant ECKA-DH. Please note that the TOE is used by the Gateway for parts of the TLS key negotiation between the Gateway and the external world as outlined in [PP0073-SMGW]. The TOE creates on behalf of the Gateway the so-called shared secret value Z_{AB} for the pre-master secret. The key derivation function is not part of the TOE.

5 [assignment: *cryptographic key generation algorithm*]

6 [assignment: *cryptographic key sizes*]

7 [assignment: *list of standards*]

189 **FCS_CKM.1/ECKA-EG Cryptographic key generation – ElGamal key agreement**

Hierarchical to:	No other components.
Dependencies:	[FCS_CKM.2 Cryptographic key distribution or FCS_COP.1 Cryptographic operation]: not fulfilled but justified (cf. chapter 6.9.1.4 of the PP [PP0077-SecMod]) FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_CKM.1.1/ ECKA-EG	The TSF shall generate cryptographic keys in accordance with a specified cryptographic key generation algorithm ECKA-EG ***according to* [TR03111-ECC]**[8] and specified cryptographic key sizes *256, 384 and 512 bit*[9] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][10].

190 *Refinement:* The cryptographic key generation algorithm ECKA-EG is implemented according to [TR03111-ECC, 4.3.2.2]. The cryptographic key sizes specified here are those of shared secret which serve as input for the subsequent key derivation outside the TOE.

191 *Application Note 6:* The TOE generates a shared secret value according to [TR03111-ECC]. This is a refinement to the generic reference given in the PP.

192 *Application Note 7:* [TR03109-2] requires the TOE to implement the command GENERAL AUTHENTICATE/variant ECKA-EG. Please note that the TOE is used by the Gateway for parts of the TLS key negotiation between the Gateway and the external world as outlined in [PP0073-SMGW]. The TOE creates on behalf of the Gateway the so-called shared secret value Z_{AB} for the pre-master secret. The key derivation function is not part of the TOE.

193 **FCS_CKM.1/PACE Cryptographic key generation – PACE**

Hierarchical to:	No other components.
Dependencies:	[FCS_CKM.2 Cryptographic key distribution or FCS_COP.1 Cryptographic operation]: not fulfilled but justified (cf. chapter 6.9.1.4 of the PP [PP0077-SecMod]) FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_CKM.1.1/ PACE	The TSF shall generate cryptographic keys in accordance with a specified cryptographic key generation algorithm PACE ***according to* [TR03111-ECC]**[11] and specified cryptographic key sizes *128, 192 and 256 bit*[12] that meet the following: [TR03110-2], [TR03109-3] respective [TR03116-3], [TR03109-2][13].

194 *Refinement:* The cryptographic key generation algorithm used for PACE keys is implemented according to [TR03111-ECC, 4.4]. The key derivation function KDF is selected according to [ibid., 4.3.3], the mapping function is GMap() as defined there in 4.4.1.

8 [assignment: *cryptographic key generation algorithm*]

9 [assignment: *cryptographic key sizes*]

10 [assignment: *list of standards*]

11 [assignment: *cryptographic key generation algorithm*]

12 [assignment: *cryptographic key sizes*]

13 [assignment: *list of standards*]

195 *Application Note 8:* The TOE generates a shared secret value according to PACEv2 defined in [TR03110-2, part 1-3]. This is a refinement to the generic reference given in the PP.

196 *Application Note 9:* [TR03109-2] requires the TOE to implement the command GENERAL AUTHENTICATE/variant PACE. The TOE exchanges a shared secret with the Gateway during the PACE protocol. The shared secret is used for deriving the AES session keys for message encryption and authentication (secure messaging) as required by FCS_\ COP.1/PACE-ENC and FCS_COP.1/PACE-MAC. Secure messaging is carried out for the main data exchange between the Gateway and the TOE.

197 *Application Note 10:* This SFR implicitly contains the requirements for the hashing functions used for the key derivation by demanding compliance to [TR03110-2], [TR03109-3] respective [TR03116-3], [TR03109-2].

198 **FCS_CKM.4 Cryptographic key destruction**

Hierarchical to:	No other components.
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]: fulfilled by FCS_CKM.1/ECC, FCS_CKM.1/ECKA-DH, FCS_CKM.1/ECKA-EG, FCS_CKM.1/PACE, FDP_ITC.1
FCS_CKM.4.1	The TSF shall destroy cryptographic keys in accordance with a specified cryptographic key destruction method *physical deletion by overwriting the memory data with zeros, random numbers or the new key*[14] that meets the following: *none*[15].

199 *Application Note 11:* This SFR applies to the Session Keys, i.e. the TOE destroys the PACE session keys (ENC- and MAC-keys) after detection of an MAC error in a received command. The TOE clears the memory area of any session keys before starting the communication with the Gateway in a new after-reset-session as required by FDP_RIP.1. This SFR applies also to signature or decryption keys. The TOE will overwrite the assigned to the key memory data with the new key.

200 *Application Note 12:* The TOE provides the command DELETE KEY which overwrites explicitly the memory area of a key with zeros.

201 *Application Note 13:* The TOE provides shared secret negotiation in FCS_CKM.1/ECKA-DH and FCS_CKM.1/ECKA-EG. The TOE will overwrite the assigned to the key memory data with the new key. After de-allocation of the resource the memory data of the shared secret is overwritten by zero bytes.

6.1.2.2 Cryptographic operation (FCS_COP.1)

202 The following iterations are caused by different cryptographic algorithms to be implemented by the TOE.

14 [assignment: *cryptographic key destruction method*]

15 [assignment: *list of standards*]

203 FCS_COP.1/SIG-ECDSA Cryptographic operation – ECDSA Signature generation

Hierarchical to:	No other components.
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]: fulfilled by FCS_CKM.1/ECC. FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4.
FCS_COP.1.1/ SIG-ECDSA	The TSF shall perform signature generation for the commands PSO COMPUTE DIGITAL SIGNATURE and INTERNAL AUTHENTICATE[16] in accordance with a specified cryptographic algorithm ECDSA ***according to* [TR03111-ECC]**[17] and cryptographic key sizes *256, 384 and 512 bit*[18] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][19].

204 *Refinement:* The signature algorithm ECDSA is defined in [TR03111-ECC] in clause 4.2.1. This Technical Guideline is the reference for ECDSA given in [TR03109-3] respective [TR03116-3]. Note that the TOE supports secure standardized domain parameters listed in Application Note 3 as required by [TR03116-3, clause 2.2].

205 *Application Note 14:* The algorithm ECDSA is conformant with the algorithm EC-DSA defined in the ISO/IEC Standard [ISO14888-3].

206 FCS_COP.1/VER-ECDSA Cryptographic operation – Signature verification

Hierarchical to:	No other components.
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]: fulfilled by FCS_CKM.1/ECC FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4.
FCS_COP.1.1/ VER-ECDSA	The TSF shall perform PSO VERIFY DIGITAL SIGNATURE[20] in accordance with a specified cryptographic algorithm ECDSA ***according to* [TR03111-ECC]**[21] and cryptographic key sizes *256, 384 and 512 bit length group order*[22] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][23].

16 [assignment: *list of cryptographic operations*]

17 [assignment: *cryptographic algorithm*]

18 [assignment: *cryptographic key sizes*]

19 [assignment: *list of standards*]

20 [assignment: *list of cryptographic operations*]

21 [assignment: *cryptographic algorithm*]

22 [assignment: *cryptographic key sizes*]

23 [assignment: *list of standards*]

207 *Refinement:* The signature algorithm ECDSA is defined in [TR03111-ECC] in clause 4.2.1. The TOE verifies ECDSA signatures according to [TR03111-ECC, 4.2.1.2]. This Technical Guideline is the reference for ECDSA given in [TR03109-3] and [TR03116-3]. Note that the TOE supports secure standardized domain parameters listed in Application Note 3 as required by [TR03116-3, clause 2.2].

208 FCS_COP.1/AUTH Cryptographic operation – External Authentication

Hierarchical to:	No other components.
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]: fulfilled by FDP_ITC.1 FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_COP.1.1/ AUTH	The TSF shall perform signature verification for external authentication for the command EXTERNAL AUTHENTICATE[24] in accordance with a specified cryptographic algorithm ECDSA[25] and cryptographic key sizes *256, 384, 512 bit*[26] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][27].

209 *Refinement:* The signature algorithm ECDSA implemented in the command EXTERNAL AUTHENTICATE is defined in [TR03111-ECC] in clause 4.2.1. This Technical Guideline is the reference for ECDSA given in [TR03116-3]. Note that the TOE supports secure standardized domain parameters listed in Application Note 3 as required by [TR03116-3, clause 2.2].

210 FCS_COP.1/IMP Cryptographic operation – Import of Public Keys

Hierarchical to:	No other components.
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]: fulfilled by FDP_ITC.1 FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_COP.1.1/ IMP	The TSF shall perform signature verification for import of public keys for the command PSO VERIFY CERTIFICATE[28] in accordance with a specified cryptographic algorithm ECDSA[29] and cryptographic key sizes *256, 384, 512 bit*[30] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][31].

211 *Refinement:* The signature verification algorithm ECDSA implemented in the command PSO VERIFY CERTIFICATE is defined in [TR03111-ECC] in clause 4.2.1. This Technical Guideline is the reference for ECDSA given in [TR03116-3]. Note that the TOE supports

24 [assignment: *list of cryptographic operations*]

25 [assignment: *cryptographic algorithm*]

26 [assignment: *cryptographic key sizes*]/[selection: 128, 192, 256]

27 [assignment: *list of standards*]

28 [assignment: *list of cryptographic operations*]

29 [assignment: *cryptographic algorithm*]

30 [assignment: *cryptographic key sizes*]/[selection: 128, 192, 256]

31 [assignment: *list of standards*]

secure standardized domain parameters listed in Application Note 3 as required by [TR03116-3, clause 2.2].

212 FCS_COP.1/PACE-ENC Cryptographic operation – AES in CBC for secure messaging

Hierarchical to:	No other components.
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]: fulfilled by FCS_CKM.1/PACE FCS_CKM.4 Cryptographic key destruction: fulfilled by FCS_CKM.4
FCS_COP.1.1/ PACE-ENC	The TSF shall perform decryption and encryption for secure messaging and PACE encryption[32] in accordance with a specified cryptographic algorithm AES in CBC mode[33] and cryptographic key sizes *128, 192 and 256 bit*[34] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][35].

213 *Refinement:* The cryptographic algorithm AES is defined in [FIPS197], the corresponding mode of operation CBC is defined in the NIST Special Publication [SP800-38A]. These are the references given in [TR03116-3, clause 2.1].

214 *Application Note 15:* This SFR requires the TOE to implement the cryptographic primitive AES for secure messaging with encryption of transmitted data and for encrypting the nonce in the first step of PACE. The related session keys (for secure messaging) and key for encryption of the PACE nonce are agreed between the TOE and the Gateway as part of the PACE protocol according to the FCS_CKM.1/PACE.

215 FCS_COP.1/PACE-MAC Cryptographic operation – AES-CMAC for secure messaging

Hierarchical to:	No other components.
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]; fulfilled by FCS_CKM.1/PACE, FCS_CKM.4 Cryptographic key destruction:]; fulfilled by FCS_CKM.4.

32 [assignment: *list of cryptographic operations*]

33 [assignment: *cryptographic algorithm*]

34 [assignment: *cryptographic key sizes*]/[selection: 128, 192, 256]

35 [assignment: *list of standards*]

FCS_COP.1.1/ PACE-MAC	The TSF shall perform computation and verification of cryptographic checksum for secure messaging[36] in accordance with a specified cryptographic algorithm AES-CMAC[37] and cryptographic key sizes *128, 192 and 256 bit*[38] that meet the following: [TR03109-3] respective [TR03116-3], [TR03109-2][39].

216 *Refinement:* The cryptographic algorithm AES is defined in [FIPS197], the corresponding mode of operation CMAC is defined in the NIST Special Publication [SP800-38B]. These are the references given in [TR03116-3, clause 2.1].

217 *Application Note 16*: This SFR requires the TOE to implement the cryptographic primitive for secure messaging with message authentication code over transmitted data. The related session keys (for secure messaging) are agreed between the TOE and the Gateway as part of the PACE protocol according to the FCS_CKM.1/PACE.

6.1.2.3 Random Number Generation (FCS_RNG.1)

218 FCS_RNG.1 Quality metric for random numbers

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FCS_RNG.1.1	The TSF shall provide a *hybrid deterministic*[40] random number generator that implements *DRG.4 capabilities according to* [AIS20/31][41]:
	(DRG.4.1) The internal state of the RNG shall *use PTRNG of class PTG.2 as random source*[42].
	(DRG.4.2) The RNG provides forward secrecy.
	(DRG.4.3) The RNG provides backward secrecy even if the current internal state is known.
	(DRG.4.4) The RNG provides enhanced forward secrecy *on condition "session closed or aborted"*[43].
	(DRG.4.5) The internal state of the RNG is seeded by *a PTRNG of class PTG.2*[44].

36 [assignment: *list of cryptographic operations*]

37 [assignment: *cryptographic algorithm*]

38 [assignment: *cryptographic key sizes*]/[selection: 128, 192, 256] bit

39 [assignment: *list of standards*]

40 [selection: *physical, non-physical true, deterministic, hybrid physical, hybrid deterministic*]

41 [assignment: *list of security capabilities*]

42 [selection: *use PTRNG of class PTG.2 as random source*, *have* [assignment: *work factor*], *require* [assignment: *guess work*]

43 [selection: *on demand, on condition* [assignment: *condition*], *after* [assignment: *time*]]

44 [selection: *internal entropy source, PTRNG of class PTG.2, PTRNG of class PTG.3,* [other selection]]

FCS_RNG.1.2 The TSF shall provide random numbers that meet[45]

(DRG.4.6) The RNG generates output for which $k > 2^{34}$ [46] strings of bit length 128 are mutually different with probability $1-\varepsilon$, with $\varepsilon < 2^{-16}$ [47].

(DRG.4.7) Statistical test suites cannot practically distinguish the random numbers from output sequences of an ideal RNG. The random numbers must pass test procedure A, *the NIST and the dieharder*[48] *tests*[49].

219 *Application Note 17:* Random numbers are generated for the Gateway and for TOE internal use, in particular for

- support of the TLS handshake (prevention of replay attacks),
- enabling the external authentication of the Gateway,
- PACE protocol,
- DH key agreement,
- ElGamal key agreement,
- generation of ECC key pairs.

220 In particular, [TR03109-2] requires the TOE to implement the command GET CHALLENGE for the generation of random numbers that are exported to the external world (here the GW respective the Gateway Administrator) and if desired are in addition available in the TOE for further use. TOE's RNG is a hybrid generator, which implies a regular refresh to guarantee a sufficient entropy of the generated numbers.

6.1.3 Class FDP User Data Protection

221 Access Control Smart Meter SFP

222 The Access Control Smart Meter SFP for the Smart Meter Security Module (TOE) in its operational phase is based on the specification of access rules in [TR03109-2]. The SFP takes the following subjects, objects, security attributes and operations into account:

223 Subjects:

- external world
- Gateway
- Gateway Administrator

224 Security attributes for subjects:

- "authenticated via PACE protocol"
- "authenticated via key-based external authentication"

225 Objects:

- key pair objects
- public key objects
- certificates

45 [assignment: *a defined quality metric*]

46 [assignment: *number of strings*]

47 [assignment: *probability*]

48 The selected test suites http://csrc.nist.gov/groups/ST/toolkit/rng/documents/sts-2.1.1.zip and http://www.phy.duke.edu/~rgb/General/dieharder/dieharder-3.31.0.tgz are available at NIST and Dieharder web sites. Note that the dieharder tests include Marsaglia's "Diehard battery of tests" and NIST tests.

49 [assignment: *additional test suites*]

- symmetric keys (GW-keys)

as presented in Table 2.

226 Security attributes for objects:
- "access rule" (see below)

227 Operations:
- TOE commands as specified in [TR03109-2]

228 The Access Control Smart Meter SFP controls the access of subjects to objects on the basis of security attributes as for subjects and objects described above. An access rule defines the conditions under which a TOE command sent by a subject is allowed to access the demanded object. Hence, an access rule bound to an object specifies for the TOE commands the necessary permission for their execution on this object.

229 For the Access Control Smart Meter SFP, the access rules are defined as prescribed in [TR03109-2].

230 FDP_ACC.2 Complete access control – Access Control Policy

Hierarchical to:	FDP_ACC.1 Subset Access control
Dependencies:	FDP_ACF.1 Security attribute based access control: fulfilled by FDF_ACF.1
FDP_ACC.2.1	The TSF shall enforce the Access Control Smart Meter SFP[50] on[51]: 1. Subjects: a. external world b. Gateway c. Gateway Administrator d. *none*[52], 2. Objects: a. key pair objects, public key objects, certificates, and symmetric keys (GW-keys) as presented in Table 2 b. *none*[53] and all operations among subjects and objects covered by the SFP.
FDP_ACC.2.2	The TSF shall ensure that all operations between any subject controlled by the TSF and any object controlled by the TSF are covered by an access control SFP.

231 FDP_ACF.1 Security attribute based access control – Access Control Functions

Hierarchical to:	No other components.
Dependencies:	FDP_ACC.1 Subset access control: fulfilled by FDP_ACC.2 FMT_MSA.3 Static attribute initialization: not fulfilled, but justified.
FDP_ACF.1.1	The TSF shall enforce the Access Control Smart Meter SFP[54] to ob-

50 [assignment: *access control SFP*]

51 [assignment: *list of subjects and objects*]

52 [assignment: *list of further subjects, or none*]

53 [assignment: *list of further objects, or none*]

jects based on the following[55]:

1. Subjects:
   a. external world
   b. Gateway with security attribute “authenticated via PACE protocol”
   c. Gateway Administrator with security attribute “authenticated via key-based external authentication”
   d. *none* [56],
2. Objects:
   a. key pair objects, public key objects, certificates, and symmetric keys (GW-keys) as presented in Table 2 each with security attribute “access rule”
   b. *none* [57].

FDP_ACF.1.2 The TSF shall enforce the following rules to determine if an operation among controlled subjects and controlled objects is allowed Access rules defined in the Access Control Smart Meter SFP (refer to the definition of the SFP above)[58].

FDP_ACF.1.3 The TSF shall explicitly authorize access of subjects to objects based on the following additional rules: none[59].

FDP_ACF.1.4 The TSF shall explicitly deny access of subjects to objects based on the following additional rules: No entity shall be able to read out private keys from the TOE[60].

232 **FDP_SDI.2 Stored data integrity monitoring and action**

Hierarchical to: FDP_SDI.1 Stored data integrity monitoring
Dependencies: No dependencies

FDP_SDI.2.1 The TSF shall monitor user data stored in containers controlled by the TSF for integrity errors[61] on all objects, based on the following attributes: *integrity checked stored data*[62].

FDP_SDI.2.2 Upon detection of a data integrity error, the TSF shall not use the data and stop the corresponding process accessing the data, warn the entity connected, *enter the hardware security reset state*[63].

54 [assignment: *access control SFP*]

55 [assignment: *list of subjects and objects controlled under the indicated SFP, and for each, the SFP-relevant security attributes, or named groups of SFP-relevant security attributes*]

56 [assignment: *list of further subjects, or none*]

57 [assignment: *list of further objects, or none*]

58 [assignment: *rules governing access among controlled subjects and controlled objects using controlled operations on controlled objects*]

59 [assignment: *rules, based on security attributes, that explicitly authorize access of subjects to objects*]

60 [assignment: *rules, based on security attributes, that explicitly deny access of subjects to objects*]

61 [assignment: *integrity errors*]

62 [assignment: *user data attributes*]

63 [assignment: *other action to be taken, or none*]

233 *Application Note 18*: Stored data in memory may be flagged by the TOE with the integrity check attribute. Any data with this attribute is always checked for integrity errors as soon as it is accessed by the TOE. This data includes the secret and public key objects as well as the GW-PIN.

234 FDP_RIP.1 Subset residual information protection

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FDP_RIP.1.1	The TSF shall ensure that any previous information content of a resource is made unavailable upon the *de-allocation of the resource from*[64] the following objects[65]: 1. PIN, 2. session keys (immediately after closing related communication session), 3. private cryptographic keys, 4. shared secret value Z_{AB}, 5. ephemeral keys, 6. *none*[66].

235 *Application Note 19*: Upon de-allocation old key objects will be overwritten with the new key or zeros according to FCS_CKM.4.

236 FDP_ETC.1 Export from the TOE

Hierarchical to:	No other components
Dependencies:	[FDP_ACC.1 Subset access control or FDP_IFC Subset information flow control] fulfilled by FP_ACC.2
FDP_ETC.1.1	The TSF shall enforce the Access Control Smart Meter SFP[67] when exporting user data, controlled under the SFP, outside of the TOE.
FDP_ETC.1.2	The TSF shall export the user data without the user data's associated security attributes.

237 FDP_ITC.1 Import from outside of the TOE

Hierarchical to:	No other components.
Dependencies:	[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] fulfilled by FDP_ACC.2 FMT_MSA.3 Static attribute initialization not fulfilled but justified
FDP_ITC.1.1	The TSF shall enforce the Access Control Smart Meter SFP[68] when importing user data, controlled under the SFP, outside of the TOE.
FDP_ITC.1.2	The TSF shall ignore any security attributes associated with the user

64 [selection: *allocation of the resource to, de-allocation of the resource from*]

65 [assignment: *list of objects*]

66 [assignment: *other data objects or none*]

67 [assignment: *access control SFP(s) and/or information flow control SFP(s)*]

68 [assignment: *access control SFP(s) and/or information flow control SFP(s)*]

data when imported from outside the TOE.

FDP_ITC.1.3 The TSF shall enforce the following rules when importing user data controlled under the SFP from outside the TOE: none[69].

238 **FDP_UCT.1 Basic data exchange confidentiality**

Hierarchical to: No other components
Dependencies: [FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] fulfilled by FTP_ITC.1
[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] fulfilled by FDP_ACC.2

FDP_UCT.1.1 The TSF shall enforce the Access Control Smart Meter SFP[70] to transmit, receive[71] user data in a manner protected from unauthorized disclosure.

239 **FDP_UIT.1 Inter-TSF user data integrity transfer protection**

Hierarchical to: No other components.
Dependencies: [FTP_ITC.1 Inter-TSF trusted channel, or FTP_TRP.1 Trusted path] fulfilled by FTP_ITC.1
[FDP_ACC.1 Subset access control, or FDP_IFC.1 Subset information flow control] fulfilled by FDP_ACC.2

FDP_UIT.1.1 The TSF shall enforce the Access Control Smart Meter SFP[72] to transmit, receive[73] user data in a manner protected from modification, deletion, insertion, replay[74] errors.

FDP_UIT.1.2 The TSF shall be able to determine on receipt of user data, whether modification, deletion, insertion, replay[75] has occurred.

6.1.4 Class FIA Identification and Authentication

240 **FIA_ATD.1 User attribute definition**

Hierarchical to: No other components.
Dependencies: No dependencies.

69 [assignment: *additional importation control rules*]

70 [selection: *transmit, receive*]

71 [assignment: *access control SFP(s) and/or information flow control SFP(s)*]

72 [selection: *transmit, receive*]

73 [assignment: *access control SFP(s) and/or information flow control SFP(s)*]

74 [selection: *modification, deletion, insertion, replay*]

75 [selection: *modification, deletion, insertion, replay*]

FIA_ATD.1.1 The TSF shall maintain the following list of security attributes belonging to individual users[76]:

1. for device (Gateway): authentication state gained via PIN (PACE-respective GW-PIN used within the PACE protocol),
2. for human user (Gateway Administrator): authentication state gained via asymmetric authentication key (used within the external authentication).

241 *Application Note 20:* Mutual authentication of the Gateway and the TOE is performed via the PACE protocol between the Gateway and the TOE (refer to the SFR FCS_CKM.1/ PACE). Authentication of the Gateway Administrator is performed via a key-based external authentication of the Gateway Administrator against the TOE (refer to the SFR FCS_COP.1/AUTH).

242 FIA_SOS.1 Specification of secrets

Hierarchical to: No other components.
Dependencies: No dependencies.

FIA_SOS.1.1 The TSF shall provide a mechanism to verify that secrets **provided by the Gateway for the PACE-PIN respective GW-PIN** meet *a minimal length of 10 octets*[77].

243 *Application Note 21:* Mutual authentication of the Gateway and the TOE is performed via the PACE protocol between the Gateway and the TOE (refer to the SFR FCS_CKM.1/ PACE)..

244 FIA_UAU.1/GW Timing of authentication (for Gateway)

Hierarchical to: No other components.
Dependencies: FIA_UID.1 Timing of identification: fulfilled by FIA_UID.1.

FIA_UAU.1.1/GW The TSF shall allow[78]

1. establishing a communication channel between the TOE and the external world,
2. Reading the ATR/ATS,
3. Reading of data fields containing technical information,
4. *none*[79]

on behalf of the user to be performed before the user is authenticated.

FIA_UAU.1.2/GW The TSF shall require each user to be successfully authenticated before allowing any other TSF-mediated actions on behalf of that user.

245 *Application Note 22:* Authentication of the Gateway is performed via the PACE protocol between the Gateway and the TOE, refer to the SFR FCS_CKM.1/PACE.

76 [assignment: *authentication mechanism*]

77 [assignment: *a defined quality metric*]

78 [assignment: *list of TSF-mediated actions*]

79 [assignment: *list of TSF-mediated actions, or none*]

246 *Application Note 23:* Please note that the requirement in FIA_UAU.1/GW defines that the user (here: the Gateway) has to be successfully authenticated before allowing use of the TOE's cryptographic functionality or access to the assets stored in and processed by the TOE. The Access Control Smart Meter SFP (see chapter 6.1.3) prescribes in detail the access rules for the objects stored in and processed by the TOE. In particular, it is defined for which objects and functions authentication of the Gateway is required by the TOE.

247 FIA_UAU.1/GWA Timing of authentication (for Gateway Administrator)

Hierarchical to:	No other components.
Dependencies:	FIA_UID.1 Timing of identification: fulfilled by FIA_UID.1.
FIA_UAU.1.1/ GWA	The TSF shall allow[80]: 1. establishing a communication channel between the TOE and the external world, 2. Reading the ATR/ATS, 3. Reading of data fields containing technical information, 4. Carrying out the PACE protocol according to [TR03110-2], [TR03109-3], [TR03109-2] (by means of command GENERAL AUTHENTICATE), 5. *none*[81] on behalf of the user to be performed before the user is authenticated.
FIA_UAU.1.2/ GWA	The TSF shall require each user to be successfully authenticated before allowing any other TSF-mediated actions on behalf of that user.

248 *Application Note 24:* Authentication of the Gateway Administrator is performed via a key-based external authentication of the Gateway Administrator against the TOE, refer to the SFR FCS_COP.1/AUTH.

249 *Application Note 25:* Please note that the requirement in FIA_UAU.1/GWA defines that the Gateway is successfully authenticated and that the user (here: the Gateway Administrator) has to be successfully authenticated before allowing administrative tasks as related e.g. to key management or update of certificates. Refer in addition to the SFR FMT_SMF.1. The Access Control Smart Meter SFP (see chapter 6.1.3) prescribes in detail the access rules for the objects stored in and processed by the TOE. In particular, it is defined for which objects and functions authentication of the Gateway Administrator is required by the TOE.

250 FIA_UAU.4 Single-use authentication mechanisms

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FIA_UAU.4.1	The TSF shall prevent reuse of authentication data related to 1. PACE authentication mechanism, 2. key-based external authentication mechanism [82].

80 [assignment: *list of TSF-mediated actions*]

81 [assignment: *list of TSF-mediated actions, or none*]

82 [assignment: *identified authentication mechanism(s)*]

251 FIA_UAU.5 Multiple authentication mechanisms

Hierarchical to: No other components.
Dependencies: No dependencies.

FIA_UAU.5.1 The TSF shall provide
1. authentication via the PACE protocol,
2. secure messaging in encrypt-then-authenticate mode using PACE session keys,
3. key-based external authentication[83]

to support user authentication.

FIA_UAU.5.2 The TSF shall authenticate any user's claimed identity according to the following rules[84]:
1. PACE/PIN based authentication shall be used for authenticating a device (Gateway) and secure messaging in encrypt-then-authenticate mode using PACE session keys shall be used to authenticate its commands if required by the Access Control Smart Meter SFP,
2. key-based authentication shall be used for authenticating a human user (Gateway Administrator).

252 FIA_UID.1 Timing of identification

Hierarchical to: No other components.
Dependencies: No dependencies.

FIA_UID.1.1 The TSF shall allow[85]:
1. Establishing a communication channel between the TOE and the external world,
2. Reading the ATR/ATS,
3. Reading of data fields containing technical information,
4. Carrying out the PACE protocol according to [TR03110-1], [TR03110-2], [TR03110-3], [TR03109-2] [TR03109-3] (by means of command GENERAL AUTHENTICATE),
5. *none*

on behalf of the user to be performed before the user is identified.

FIA_UID.1.2 The TSF shall require each user to be successfully identified before allowing any other TSF-mediated actions on behalf of that user.

253 FIA_USB.1 User-subject binding

Hierarchical to: No other components.
Dependencies: FIA_ATD.1 User attribute definition: fulfilled

FIA_USB.1.1 The TSF shall associate the following user security attributes with subjects acting on the behalf of that user[86]:

83 [assignment: *list of multiple authentication mechanisms*]

84 [assignment: *rules describing how the multiple authentication mechanisms provide authentication*]

85 [assignment: *list of additional TSF-mediated actions*]

86 [assignment: *list of user security attributes*]

1. authentication state for the Gateway,
2. authentication state for the Gateway Administrator.

FIA_USB.1.2 The TSF shall enforce the following rules on the initial association of user security attributes with subjects acting on the behalf of users: initial authentication state is “not authenticated”[87].

FIA_USB.1.3 The TSF shall enforce the following rules governing changes to the user security attributes associated with subjects acting on the behalf of users[88]:

1. for device (Gateway): the authentication state is changed to “authenticated Gateway” when the device has successfully authenticated himself by the PACE protocol,
2. for human user (Gateway Administrator): the authentication state is changed to “authenticated Gateway Administrator” when the user has successfully authenticated himself by the key-based authentication mechanism.

6.1.5 Class FMT Security Management

254 FMT_LIM.1 Limited capabilities

Hierarchical to: No other components.
Dependencies: FMT_LIM.2 Limited availability: fulfilled by FMT_LIM.2.

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:

Deploying Test Features after TOE Delivery does not allow User Data to be disclosed or manipulated, TSF data to be disclosed or manipulated, software to be reconstructed and no substantial information about construction of TSF to be gathered which may enable other attacks[89].

255 FMT_LIM.2 Limited availability

Hierarchical to: No other components.
Dependencies: FMT_LIM.1 Limited capabilities: fulfilled by FMT_LIM.1.

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:

Deploying Test Features after TOE Delivery does not allow User Data to be disclosed or manipulated, TSF data to be disclosed or manipulated, software to be reconstructed and no substantial information about construction of TSF to be gathered which may enable other attacks[90].

87 [assignment: *rules for the initial association of attributes*]

88 [assignment: *rules for the changing of attributes*]

89 [assignment: *Limited capability and availability policy*]

90 [assignment: *Limited capability and availability policy*]

256 *Application Note 26:* The SFRs FMT_LIM.1 and FMT_LIM.2 address the management of the TSF and TSF Data to prevent misuse of test features of the TOE over the life cycle phases. 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

(1) 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

(2) the TSF is designed with high functionality but is removed or disabled in the product in its user environment.

257 The combination of both requirements shall enforce the policy.

258 FMT_SMF.1 Specification of Management Functions

Hierarchical to: No other components.
Dependencies: No dependencies

FMT_SMF.1.1 The TSF shall be capable of performing the following management functions:

1. Management of key objects by means of commands CREATE KEY, DELETE KEY, ACTIVATE KEY, DEACTIVATE KEY, GENERATE ASYMMETRIC KEY PAIR, PSO VERIFY CERTIFICATE,
2. Management of DFs and EFs by means of commands CREATE DF/EF, ACTIVATE DF/EF, DEACTIVATE DF/EF, DELETE DF/EF, TERMINATE DF/EF,
3. Management of PIN objects by means of command CHANGE REFERENCE DATA,
4. Life cycle management of the TOE by means of command TERMINATE CARD USAGE,
5. Update of keys by means of commands GENERATE ASYMMETRIC KEY PAIR, PSO VERIFY CERTIFICATE,
6. Update of certificates by means of command UPDATE BINARY,
7. Update of symmetric keys (GW-keys) by means of command UPDATE BINARY,
8. *none* [91].

259 *Application Note 27*: A detailed description of the commands that have to be implemented in the TOE is given in [TR03109-2].

260 FMT_SMR.1 Security roles

Hierarchical to: No other components.
Dependencies: FIA_UID.1 Timing of identification: fulfilled

FMT_SMR.1.1 The TSF shall maintain the roles

1. user,
2. authenticated Gateway
3. authenticated Gateway Administrator
4. *none* [92].

91 [assignment: *list of further management functions to be provided by the TSF, or none*]

92 [assignment: *additional authorized identified roles, or none*]

FMT_SMR.1.2 The TSF shall be able to associate users with roles.

6.1.6 Class FPT Protection of the Security Functions

261 FPT_EMS.1 TOE Emanation

Hierarchical to: No other components.
Dependencies: No dependencies.

FPT_EMS.1.1 The TOE shall not emit *power variations, timing variations during command execution* [93] in excess of *non-useful information* [94] enabling access to

1. PIN,
2. session keys,
3. shared secret value Z_{AB},
4. ephemeral keys[95]
5. *none*[96]

and

6. private asymmetric keys of the user,
7. symmetric keys of the user (GW-keys)[97]
8. *none*[98]

FPT_EMS.1.2 The TSF shall ensure any users[99] are unable to use the following interface circuit interface[100] to gain access to

1. PIN,
2. session keys,
3. shared secret value Z_{AB},
4. ephemeral keys[101]
5. *none*[102]

and

6. private asymmetric keys of the user,
7. symmetric keys of the user (GW-keys)[103]
8. *none*[104]

262 *Application Note 28*: The TOE prevents attacks against the listed secret data where the attack is based on external observable physical phenomena of the TOE. Such attacks may be observable at the interfaces of the TOE or may be originated from internal

93 [assignment: *types of emissions*]

94 [assignment: *specified limits*]

95 [assignment: *list of types of TSF data*]

96 [assignment: *list of types of (further) TSF data*]

97 [assignment: *list of types of user data*]

98 [assignment: *list of types of (further) user data*]

99 [assignment: *type of users*]

100 [assignment: *type of connection*]

101 [assignment: *list of types of TSF data*]

102 [assignment: *list of types of (further) TSF data*]

103 [assignment: *list of types of user data*]

104 [assignment: *list of types of (further) user data*]

operation of the TOE or may be caused by an attacker that varies the physical environment under which the TOE operates. The set of measurable physical phenomena is influenced by the technology employed to implement the security module.

263 FPT_FLS.1 Failure with preservation of secure state

Hierarchical to: No other components.
Dependencies: No dependencies.

FPT_FLS.1.1 The TSF shall preserve a secure state when the following types of failures occur:

1. power loss,
2. exposure to operating conditions where therefore a malfunction could occur,
3. detection of physical manipulation or physical probing,
4. integrity errors according to FDP_SDI.2,
5. insufficient entropy during random number generation,
6. failure detected by the TSF according to FPT_TST.1,
7. errors during processing cryptographic operations,
8. errors during evaluation of access control rules, and
9. *none* [105].

264 FPT_PHP.3 Resistance to physical attack

Hierarchical to: No other components.
Dependencies: No dependencies

FPT_PHP.3.1 The TSF shall resist physical manipulation and physical probing[106] to the TSF[107] by responding automatically such that the SFRs are always enforced.

265 *Application Note 29*: The TOE implements appropriate measures to continuously counter physical manipulation and physical probing. Due to the nature of these attacks (especially manipulation) the TOE can by no means detect attacks on all of its elements. Therefore, permanent protection against these attacks is required ensuring that the TSP could not be violated at any time. Hence, “automatic response” means here (i) assuming that there might be an attack at any time and (ii) countermeasures are provided at any time.

266 FPT_TST.1 TSF testing

Hierarchical to: No other components.
Dependencies: No dependencies

FPT_TST.1.1 The TSF shall run a suite of self tests during initial start-up, periodically during normal operation[108] to demonstrate the correct operation of the TSF[109].

105 [assignment: *list of types of failures in the TSF*]

106 [assignment: *physical tampering scenarios*]

107 [assignment: *list of TSF devices/elements*]

108 [selection: *during initial start-up, periodically during normal operation, at the request of the authorized user, at the conditions* [assignment: *conditions under which self test should occur*]]

109 [selection: [assignment: *parts of TSF*], *the TSF*]

FPT_TST.1.2	The TSF shall provide authorized users with the capability to verify the integrity of TSF data[110].
FPT_TST.1.3	The TSF shall provide authorized users with the capability to verify the integrity of TSF[111].

6.1.7 Class FTP Trusted Path/Channels

267 **FTP_ITC.1 Inter-TSF trusted channel**

Hierarchical to:	No other components.
Dependencies:	No dependencies.
FTP_ITC.1.1	The TSF shall provide a communication channel between itself and another trusted IT product that is logically distinct from other communication channels and provides assured identification of its end points and protection of the channel data from modification or disclosure.
FTP_ITC.1.2	The TSF shall permit another trusted IT product [112] to initiate communication via the trusted channel.
FTP_ITC.1.3	The TSF shall ~~initiate~~ **enforce** communication via the trusted channel for any data exchange between the TOE and the Gateway except reading out the data fields with technical information[113].

6.2 Security Assurance Requirements for the TOE

268 The assurance requirements for the evaluation of the TOE, its development and operating environment are to choose as the predefined assurance package EAL4 augmented by the following component:

- AVA_VAN.5 (Advanced methodical vulnerability analysis).

269 The Protection Profile [PP0077-SecMod] provides an overview on the assurance requirements for the evaluation of the TOE. Note that the component AVA_VAN.5 has a refinement, which is applied to the evaluation of the TOE.

6.3 Security Requirements Rationale

6.3.1 Security Functional Requirements Rationale

270 The following table provides an overview for security functional requirements coverage.

110 [selection: [assignment: *parts of TSF*], *TSF data*]

111 [selection: [assignment: *parts of TSF*], *TSF*]

112 [selection: *the TSF, another trusted IT product*]

113 [assignment: *list of functions for which a trusted channel is required*]

	O.Integrity	O.Confidentiality	O.Authentication	O.AccessControl	O.KeyManagement	O.TrustedChannel	O.Leakage	O.PhysicalTampering	O.AbuseFunctionality	O.Malfunction	O.Sign	O.KeyAgreementDH	O.KeyAgreementEG	O.Random	O.PACE
FCS_CKM.1/ECC					x						x			x	
FCS_CKM.1/ECKA-DH												x		x	
FCS_CKM.1/ECKA-EG													x	x	
FCS_CKM.1/PACE	x	x	x	x		x								x	x
FCS_CKM.4					x						x	x	x		x
FCS_COP.1/SIG-ECDSA											x				
FCS_COP.1/VER-ECDSA											x				
FCS_COP.1/AUTH			x	x											
FCS_COP.1/IMP				x	x						x				
FCS_COP.1/PACE-ENC		x				x									x
FCS_COP.1/PACE-MAC	x					x									
FCS_RNG.1												x	x	x	x
FDP_ACC.2		x		x											
FDP_ACF.1		x		x											
FDP_SDI.2	x										x	x	x		x
FDP_RIP.1					x						x	x	x	x	x
FDP_ETC.1					x										
FDP_ITC.1					x										
FDP_UCT.1		x				x									
FDP_UIT.1	x					x									
FIA_ATD.1				x											
FIA_SOS.1			x												
FIA_UAU.1/GW				x											
FIA_UAU.1/GWA				x											
FIA_UAU.4			x												
FIA_UAU.5			x												
FIA_UID.1				x											
FIA_USB.1				x											
FMT_LIM.1									x						
FMT_LIM.2									x						
FMT_SMF.1				x	x										
FMT_SMR.1				x											
FPT_EMS.1		x					x	x			x	x	x	x	x
FPT_FLS.1	x						x	x		x	x	x	x	x	x
FPT_PHP.3		x					x	x		x	x	x	x	x	x

	O.Integrity	O.Confidentiality	O.Authentication	O.AccessControl	O.KeyManagement	O.TrustedChannel	O.Leakage	O.PhysicalTampering	O.AbuseFunctionality	O.Malfunction	O.Sign	O.KeyAgreementDH	O.KeyAgreementEG	O.Random	O.PACE
FPT_TST.1	x						x	x		x	x	x	x	x	x
FTP_ITC.1	x	x				x									

Table 6: Coverage of Security Objectives for the TOE by SFR

271 A detailed justification required for suitability of the security functional requirements to achieve the security objectives is given in the Protection Profile [PP0077-SecMod] and therefore not repeated here.

6.3.2 Rationale for SFR's Dependencies

272 The dependency analysis for the security functional requirements shows that the basis for mutual support and internal consistency between all defined functional requirements is satisfied. All dependencies between the chosen functional components are analyzed, and non-dissolved dependencies are appropriately explained.

273 The table below shows the dependencies between the SFR of the TOE.

No.	SFR-component from the PP	Dependencies assumed	Fulfilled by SFR
1	FCS_CKM.1/ECC	[FCS_CKM.2 or FCS_COP.1] FCS_CKM.4	FCS_COP.1/SIG-ECDSA FCS_CKM.4 Please refer to [PP0077-SecMod, chapter 6.9.1.4] for missing dependencies
2	FCS_CKM.1/ECKA-DH	[FCS_CKM.2 or FCS_COP.1] FCS_CKM.4	FCS_CKM.4 Please refer to [PP0077-SecMod, chapter 6.9.1.4] for missing dependencies
3	FCS_CKM.1/ECKA-EG	[FCS_CKM.2 or FCS_COP.1] FCS_CKM.4	FCS_CKM.4 Please refer to [PP0077-SecMod, chapter 6.9.1.4] for missing dependencies
4	FCS_CKM.1/PACE	[FCS_CKM.2 or FCS_COP.1] FCS_CKM.4	FCS_COP.1/PACE_ENC FCS_COP.1/PACE_MAC FCS_CKM.4
5	FCS_CKM.4	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1]	FCS_CKM.1/ECC FCS_CKM.1/ECKA-DH FCS_CKM.1/ECKA-EG FCS_CKM.1/PACE FDP_ITC.1
6	FCS_COP.1/SIG-ECDSA	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	FCS_CKM.1/ECC FCS_CKM.4
7	FCS_COP.1/VER-ECDSA	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	FDP_ITC.1 FCS_CKM.4
8	FCS_COP.1/AUTH	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	FDP_ITC.1 FCS_CKM.4
9	FCS_COP.1/IMP	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	FDP_ITC.1 FCS_CKM.4
10	FCS_COP.1/PACE-ENC	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1]	FCS_CKM.1/PACE FCS_CKM.4

No.	SFR-component from the PP	Dependencies assumed	Fulfilled by SFR
		FCS_CKM.4	
11	FCS_COP.1/PACE-MAC	[FDP_ITC.1or FDP_ITC.2 or FCS_CKM.1] FCS_CKM.4	FCS_CKM.1/PACE FCS_CKM.4
12	FCS_RNG.1	–	–
13	FDP_ACC.2	FDP_ACF.1	FDP_ACF.1
14	FDP_ACF.1	FDP_ACC.1 FMT_MSA.3	FDP_ACC.2 Please refer to [PP0077-SecMod, chapter 6.9.1.4] for missing dependencies
15	FDP_SDI.2	–	–
16	FDP_RIP.1	–	–
17	FDP_ETC.1	[FDP_ACC.1 or FDP_IFC.1]	FDP_ACC.2
18	FDP_ITC.1	[FDP_ACC.1 or FDP_IFC.1] FMT_MSA.3	FDP_ACC.2 Please refer to [PP0077-SecMod, chapter 6.9.1.4] for missing dependencies
19	FDP_UCT.1	[FDP_ACC.1 or FDP_IFC.1] [FTP_ICT.1 or FTP_TRP.1]	FDP_ACC.2 FTP_ICT.1
20	FDP_UIT.1	[FDP_ACC.1 or FDP_IFC.1] [FTP_ICT.1 or FTP_TRP.1]	FDP_ACC.2 FTP_ICT.1
21	FIA_ATD.1	–	–
22	FIA_UAU.1/GW	FIA_UID.1	FIA_UID.1
23	FIA_UAU.1/GWA	FIA_UID.1	FIA_UID.1
24	FIA_UAU.4	–	–
25	FIA_UAU.5	–	–
26	FIA_UID.1	–	–
27	FIA_USB.1	FIA_ATD.1	FIA_ATD.1
28	FMT_LIM.1	FMT_LIM.2	FMT_LIM.2
29	FMT_LIM.2	FMT_LIM.1	FMT_LIM.1
30	FMT_SMF.1	–	–
31	FMT_SMR.1	FIA_UID.1	FIA_UID.1
32	FPT_EMS.1	–	–
33	FPT_FLS.1	–	–
34	FPT_PHP.3	–	–
35	FPT_TST.1	–	–
36	FTP_ITC.1	–	–

Table 7: Dependencies between the SFRs

274 For the justification of non-satisfied dependencies see the detailed description in the Protection Profile [PP0077-SecMod, chapter 6.9.1.4] for missing dependencies of the corresponding SFRs.

275 The dependency analysis shows that all dependencies being expected by CC part 2 and by extended components definition (chapter 5) are either fulfilled or their non-fulfillment is justified.

276

6.3.3 Security Assurance Requirements Rationale

Reasoning for Choice of Assurance Level

277 The decision on the assurance level has been mainly driven by the assumed attack potential.

278 As outlined in the Gateway Protection Profile [PP0073-SMGW] it is assumed that – at least from the WAN side – a high attack potential is posed against the security functions of the TOE. This leads to the use of AVA_VAN.5 (Resistance against high attack potential).

279 In order to keep evaluations according to this Protection Profile commercially feasible EAL 4 has been chosen as assurance level as this is the lowest level that provides the prerequisites for the use of AVA_VAN.5.

Dependencies of Assurance Components

280 The dependencies of the assurance requirements taken from EAL 4 are fulfilled automatically.

281 The augmentation by AVA_VAN.5 does not introduce additional functionalities that are not contained in EAL 4.

Security Requirements – Internal Consistency

282 The following part of the security requirements rationale shows that the set of security requirements for the TOE consisting of the security functional requirements (SFRs) and the security assurance requirements (SARs) together form an internally consistent whole.

283 The dependency analysis for the security functional requirements SFRs shows that the basis for internal consistency between all defined functional requirements is satisfied. All dependencies between the chosen functional components are analyzed and non-satisfied dependencies are appropriately explained.

284 All subjects and objects addressed by more than one SFR are also treated in a consistent way: The SFRs impacting them do not require any contradictory property and behavior of these ‘shared’ items.

285 The assurance package EAL 4 is a pre-defined set of internally consistent assurance requirements. The dependency analysis for the sensitive assurance components shows that the assurance requirements SARs are internally consistent, because all (additional) dependencies are satisfied and no inconsistency appears.

286 Inconsistency between functional and assurance requirements could only arise, if there are functional-assurance dependencies being not met – an opportunity having been shown not to arise in the Protection Profile [PP0077-SecMod]. Furthermore, as also discussed in the PP, the chosen assurance components are adequate for the functionality of the TOE. So, there are no inconsistencies between the goals of these two groups of security requirements.

6.3.4 Security Requirements – Internal Consistency

287 The following part of the security requirements rationale shows that the set of security requirements for the TOE consisting of the security functional requirements (SFRs) and the security assurance requirements (SARs) together form an internally consistent whole.

288 The analysis of the TOE's security requirements with regard to their mutual support and internal consistency demonstrates:

- The dependency analysis in section 6.3.2 Rationale for SFR's Dependencies for the security functional requirements shows that the basis for internal consistency between all defined functional requirements is satisfied. All dependencies between the chosen functional components are analyzed and non-satisfied dependencies are appropriately explained.
- All subjects and objects addressed by more than one SFR in sec. 6.1 are also treated in a consistent way: the SFRs impacting them do not require any contradictory property and behavior of these 'shared' items.
- The assurance package EAL4 is a pre-defined set of internally consistent assurance requirements. The dependency analysis for the sensitive assurance components in section 6.3.3 Security Assurance Requirements Rationale shows that the assurance requirements are internally consistent as all (additional) dependencies are satisfied and no inconsistency appears.

289 Inconsistency between functional and assurance requirements could only arise, if there are functional-assurance dependencies being not met, a possibility having been shown not to arise in sections 6.3.2 Rationale for SFR's Dependencies and 6.3.3 Security Assurance Requirements Rationale. Furthermore, as also discussed in section 6.3.3 Security Assurance Requirements Rationale, the chosen assurance components are adequate for the functionality of the TOE. So, there are no inconsistencies between the goals of these two groups of security requirements.

7 TOE Summary Specification

290 This section presents an overview of the security functionalities implemented by the TOE and the assurance measures applied to ensure their correct implementation.

291 According to the SFRs the TOE provides the following security functionalities

- Digital Signature Generation
- Digital Signature Verification
- Key Agreement for TLS
- Key Agreement for Content Data Encryption
- Key Pair Generation
- Random Number Generation
- Component Authentication via the PACE-Protocol with Negotiation of Session Keys
- Secure Messaging
- Secure Storage of Key Material and further data relevant for the Gateway

292 They are already mentioned in section 6.1.1 and represent the functional description of the feature overview in section 1.4.2. The TOE Summary Specification will be given in more detail in the following sections. Further technical information how the security functions actually implement the TOE security functional requirements, which TOE modules realize which functions is contained in the Security architecture Description (ADV_ARC), the Functional Specification (ADV_FSP) and the TOE Design Specification (ADV_TDS).

7.1 Digital Signature Generation

293 Security Module serves as a cryptographic service provider for the Gateway. It generates digital signatures based on elliptic curve cryptography according to the ECDSA specification in [TR03111-ECC] (FCS_RNG.1, FCS_COP.1/SIG-ECDSA). The TOE uses the strong brainpool curves [RFC5639] with 256, 384 and 512 bits and the NIST curves P-256 and P-384 [FIPS186] with corresponding key lengths.

294 Digital signatures are used in the framework of TLS as well as for content authentication. The Security Module contains the “cryptographic identity” of the Gateway and generates Gateway’s signatures (FCS_COP.1/SIG-ECDSA). There is no security gap between different types of digital signatures generated by the Security Module.

295 In case keys must be destroyed the Security Module deletes the relevant information by overwriting the memory data with zeros or random data of the new key (FCS_CKM.4). Ephemeral keys are made unavailable upon the de-allocation (FDP_RIP.1).

7.2 Digital Signature Verification

296 The Security Module provides signature verification service to the Gateway for different purposes. It verifies digital signatures based on elliptic curve cryptography according to the ECDSA specification in [TR03111-ECC] (FCS_RNG.1, FCS_COP.1/SIG-ECDSA). The TOE uses the strong brainpool curves [RFC5639] with 256, 384 and 512 bits and the NIST curves P-256 and P-384 [FIPS186] with corresponding key lengths.

297 This is important for the import of public keys through certificates into the Gateway. Successful digital signature verification of certificates transfers the trust to certificate data, the public key of an external entity. This is supported by FCS_COP.1/IMP.

298 Reliable signature verification provided to the Gateway allows to check the authenticity and integrity of transmitted data in the TLS framework and the data transfer inside the TLS channel (FCS_COP.1/VER-ECDSA).

299 Signature verification is also required as part of external authentication. The external entity authenticates against the Security Module, which checks the signature of the transmitted security token (FCS_COP.1/AUTH).

300 The reliability of signature verification result is supported by the trusted channel provided by the PACE protocol (FCS_CKM.1/PACE, FCS_COP.1/PACE-MAC, FDP_UIT.1).

7.3 Key Agreement for TLS

301 During the TLS handshake a shared secret is derived. It is generated by the ECKA-DH protocol which is supported by the SFR FCS_CKM.1/ECKA-DH. The corresponding session keys are generated from the shared secret by the Gateway. The established by PACE protocol (FCS_COP.1/PACE-ENC, FCS_COP.1/PACE-MAC) trusted channel guarantees the confidentiality and the authenticity of the shared secret.

302 The Security Module uses elliptic curve cryptography according to [TR03111-ECC] based the strong brainpool curves [RFC5639] with 256, 384 and 512 bits and the NIST curves P-256 and P-384 [FIPS186] with corresponding key lengths.

7.4 Key Agreement for Content Data Encryption

303 Asymmetric content data encryption uses an ephemeral shared value, from which the symmetric algorithm key is derived. It is generated by the ECKA-EG protocol. The key derivation is performed by the Gateway. The confidentiality and the authenticity of the shared ephemeral value is guaranteed by the trusted channel provided by the PACE protocol (FCS_COP.1/PACE-ENC, FCS_COP.1/PACE-MAC).

304 The Security Module uses elliptic curve cryptography according to [TR03111-ECC] based the strong brainpool curves [RFC5639] with 256, 384 and 512 bits and the NIST curves P-256 and P-384 [FIPS186] with corresponding key lengths.

7.5 Key Pair Generation

305 Asymmetric key pairs based on elliptic curve cryptography keys can be generated by the Security Module (FCS_CKM.1/ECC, FCS_RNG.1) for different purposes. These keys can be used for signature generation and verification (FCS_COP.1/SIG-ECDSA, FCS_\ COP.1/VER-ECDSA), Diffie-Hellman (FCS_CKM.1/ECKA-DH) and ElGamal (FCS_\ CKM.1/ECKA-EG) key agreement. The quality of random numbers guarantees (see next chapter 7.6 Random Number Generation) the security level of the keys and therefore the security of the signatures and the derived keys for symmetric encryption or MAC.

306 The Security Module uses elliptic curve cryptography according to [TR03111-ECC] based the strong brainpool curves [RFC5639] with 256, 384 and 512 bits and the NIST curves P-256 and P-384 [FIPS186] with corresponding key lengths.

7.6 Random Number Generation

307 Random numbers are used by the Security Module internally and are also provided to the Gateway. The Random Number Generator implemented in the TOE is a hybrid deterministic of level DRG.4 according to [AIS20/31], supporting enhanced backward and forward secrecy.

308 For the internal ephemeral and static key generation the TOE refreshes the internal Random Number Generator accordingly.

7.7 Component Authentication via the PACE-Protocol with Negotiation of Session Keys

309 The PACE protocol provides component and user authentication and even if the authentication data has small entropy the negotiated session keys carry high entropy (FCS_CKM.1/PACE, FDP_UCT.1, FDP_UIT.1, FIA_ATD.1). Using the session keys provides re-authentication, confidentiality and integrity of the trusted channel established in the PACE protocol (FIA_UAU.5, FIA_UID.1, FIA_USB.1). Only authenticated components are allowed to establish the trusted channel (FIA_UAU.1/GW, FIA_UAU.1/GWA). Authentication data will be protected by the TOE, the PACE protocol requires fresh data for a new authentication (FIA_UAU.4).

310 The TSF requires a minimal length of 10 octets (usually decimal digits) for the PACE-PIN and the GW-PIN. This provides enough space for passwords with high entropy (FIA_\ SOS.1).

7.8 Secure Messaging

311 The TOE provides a trusted channel protected against disclosure, deletion, modification or insertion, and the re-usage of old communication data. Secure Messaging is implemented according to [ISO7816] based on the strong symmetric cipher AES (FCS_COP.1/ PACE-ENC) and CMAC authentication method (FCS_COP.1/PACE-MAC).

312 The TOE enforces the usage of the trusted communication except reading of public technical information (FTP_ITC.1).

7.9 Secure Storage of Key Material and further data relevant for the Gateway

313 The access to User Data is restricted according to the SFRs FDP_ACC.1 and FDP_\ ACF.1. The access control provided by this security function includes also the integrity check required by FDP_SDI.2. The TOE software is implemented such that test features after TOE delivery cannot be deployed for data access (disclosure and modification of user and TOE data) and other information about the embedded software (TSF implementation (FMT_LIM.1, FMT_LIM.2).

314 The access to key material and management of user data is restricted to the conformant to [ISO7816] command set (FMT_SMF.1), which can be executed only after authentication (FDP_ACC.2) by the defined roles (FMT_SMR.1) using the PACE protocol or asymmetric authentication key (FIA_ATD.1).

315 The TOE enforces the Access Control Smart Meter Policy (FDP_ACC.2) on export and import of user data (FDP_ETC.1, FDP_ITC.1).

316 The TOE provides a high level of resistance to physical attack (FPT_PHP.3) and prevents emitting of usable information on key material and user data over side-channels like power or timing variations (FPT_EMS.1).

317 In case of power loss, detection of physical manipulation, integrity check failures or TSF functional errors the TOE enters and preserves a secure state (FPT_FLS.1). During initial start-up and continuously during normal operation self tests are run to guarantee the claimed security level and to demonstrate the correctness of the TSF output (FPT_TST.1).

7.10 TOE SFR Statements

318 For the sake of completeness the TOE Summary Specification of the previous sections is re-ordered once again. All the TOE SFR statements are listed and it is described how they are fulfilled by the TOE. If appropriate requirements are handled together to avoid non-necessary text duplication.

319 FCS_CKM.1/ECC: The key pair generation algorithm is compliant to the Technical Specification [TR03111-ECC]. The available parameters can be chosen such that they are suitable for the near and the long future. The standardized prime curves of 256, 384 and 512 bit key lengths are supported by the TOE. The private key is generatated using the strong Random Number Generator implemented by the TOE.

320 FCS_CKM.1/ECKA-DH, FCS_CKM.1/ECKA-EG: The TOE implements operations on points of elliptic curves with prime characteristic. Addition and doubling of points is the base for Diffie-Hellman key agreement and the ElGamal operation. The TOE uses the strong brainpool curves [RFC5639] with 256, 384 and 512 bits and the NIST curves P-256 and P-384 [FIPS186] with corresponding key lengths. The COS ensures the correctness of the generated key using different checks during the computation.

321 FCS_CKM.1/PACE: The PACE (Password Authenticated Connection Establishment) protocol is based on asymmetric cryptography and provides session keys which strength is independent of the entropy of the input. It is proven to be secure, provides a secure communication channel based on explicit password-based authentication. Ephemeral keys are generated using the strong Random Number Generator implemented by he TOE.

322 FCS_CKM.4: Each session key is used only by the authenticated user and is destroyed if the authentication fails or is restarted again. Additionally in case of loss of power the keys are also erased, because they are not stored permanently.

323 FCS_COP.1/SIG-ECDSA, FCS_COP.1/VER-ECDSA: The TOE implements the standard signature algorithm EC-DSA for the strong elliptic curves mentioned in paragraph 320. The signature creation function uses strong ephemeral keys provided by the internal Random Number Generator. The COS ensures the correctness of the operation using different checks during the computation.

324 FCS_COP.1/AUTH: The TOE provides digital signature verification for the user authentication of the Gateway Administrator (external authentication). The Gateway receives messages signed by the Gateway Administrator. The signature validation service of the Security Module is supported by this SFR. Only if the signature could be verified, the content of the message will be analyzed by the Gateway. Note that only signatures based on curves listed in paragraph 320 can be verified.

325 FCS_COP.1/IMP: The signature verification is based on the PKI supported by the TOE. The TOE will import public keys by verification of certificates. Only keys with the domain parameters of implemented curves (cf. paragraph 326) can be imported.

326 FCS_COP.1/PACE-ENC, FCS_COP.1/PACE-MAC: The secure channel established in the PACE protocol uses Secure Messaging conformant to ISO7816 in encrypt-then-authenticate mode. The cryptographic operation is based on the strong cipher AES with key lengths of 128, 192 and 256 bits, and the CMAC authentication mode. The COS ensures the correctness of the operation using different checks during the computation.

327 FCS_RNG.1: The randomness of values for challenges or ephemeral or permanent keys bases on the underlying hardware TSF. Its Random Number Generator claims the functionality class PTG.2 according to [AIS20/31]. This includes also the fulfillment of the online test requirements. For generating random nonces in the PACE protocol and the Gateway Authentication a cryptographic post-processing in the TOE guarantees that statistical tests practically cannot distinguish between generated values and an ideal random number generator. The random number generator provided by the TOE fulfills the requirements of a DRG.4 according to [AIS20/31].

328 FDP_ACC.2, FDP_ACF.1: These SFRs define the **Access Control Smart Meter Policy**. It provides complete access control of the subjects External World, Gateway, Gateway Administrator to key pair objects, public key objects, certificates and symmetric keys. Enforcing these access rules defined in the Protection Profile is essential for the security functionality of the TOE. The access rule enforcement is implemented in the COS and cannot be changed.

329 FDP_ETC.1, FDP_ITC.1: The TOE enforces the **Access Control Smart Meter Policy** when exporting or importing user data. Note that this implies a protection against unauthorized disclosure, insertion, modification and replay of the data (cf. FDP_UCT.1, FDP_\ UIT.1). The access rule enforcement is implemented in the COS and cannot be changed.

330 FDP_SDI.2: The TOE controls user and TOE data for integrity errors, if an error occurs the corresponding data is no more accessible and a warning will be issued on any access. The data attribute “integrity checked” is defined in the operating system and cannot be changed.

331 FDP_RIP.1: This SFR protects sensitive user and TOE data after de-allocation. Ephemeral key material is overwritten by zero bytes after finishing the cryptographic operation and de-allocation of the resources or after closing the session. Persistently stored objects are deleted with a roll-forward procedure, i.e. the TOE will finish first the de-allocation and overwriting with zero bytes before any other operation is allowed.

332 FDP_UCT.1, FDP_UIT.1: The TOE enforces the protection of transmitted user data according to the **Access Control Smart Meter Policy** against unauthorized disclosure and modification, deletion, insertion and replay. This is supported by the Secure Messaging according to ISO7816 and cannot be avoided.

333 FIA_ATD.1, FIA_SOS.1: This SFR defines the data to be used for authentication. The device (Gateway) will be authenticated by the Gateway PIN during the PACE protocol, whereas human user’s authentication (Gateway Administrator) is based on asymmetric key or a strong PACE-PIN used for external authentication. The TOE enforces a minimal length of 10 octets of the GW-PIN and the PACE-PIN, which ensures that a password with high entropy can be chosen for authentication.

334 FIA_UAU.1/GW, FIA_UAU.1/GWA: This SFRs define the rules for using TOE’s cryptographic functions or access to user data. The Gateway is authenticated via the PACE protocol, the Gateway Administrator by key-based external authentication. Note that this

requires already an authenticated Gateway. The access rules are implemented by the COS and cannot be changed by a user.

335 FIA_UAU.4: Any authentication data shall be unusable in a later authentication protocol. This is supported by the TOE using fresh generated random numbers. The authentication state achieved by PACE or key-based external authentication is maintained by secure messaging channel. If an authentication error occurs the authentication state will be reset. This is implemented in the COS and cannot be changed.

336 FIA_UAU.5: The authentication of the Manufacturer, a Gateway Administrator, a Gateway and a User is controlled by the Access Rules laid down in the Operating System in a very early stage of the life cycle. Even if the file system is not available, the Initialization Data can only be written by a successfully authenticated user (in a Manufacturer's role). This SFR restricts the authentication mechanisms to PACE and key based protocols. The authentication state is maintained by secure messaging channel. If an authentication error occurs the authentication state will be reset. This is implemented in the COS and cannot be changed.

337 FIA_UID.1: Similar to FIA_UAU.1 this SFR defines the access rules before the user is identified. Only the access to public data, as ATR/ATS bytes or data fields containing purely technical information is allowed. All other actions require an authentication over an established communication channel. The access rules are implemented by the COS and cannot be changed by a user.

338 FIA_USB.1: The actual authentication state of user is bound to the user, and must be achieved by the corresponding protocol. All users are required to execute the authentication protocol successfully, since the initial state is always "not authenticated". This is implemented by the COS and cannot be changed by a user.

339 FMT_LIM.1, FMT_LIM.2: Limitations of capabilities or availability are enforced by the Operating System of the TOE controlling the integrity of the stored access rules and the used functions. After Initialization all data testing-specific commands and actions are disabled. It is not possible to override these controls and restore them for use.

340 FMT_SMF.1, FMT_SMR.1: Maintaining the different roles and TSFs of the TOE using dedicated access rules cannot be changed or disabled in the Operating System. The assignment of a specific role is supported by a successful authentication and the following-up Secure Messaging. The embedded software (i.e. the operating system) enforces the application of the access rules before any function is allowed to proceed.

341 FPT_EMS.1: The Operating System of the TOE monitors the regular execution of commands, and if variations occur with test failures or integrity mismatch the communication is closed. The strict care of uniformity and non-overloading single components is implemented in the Operating System and will be described detailed in ADV and AVA documentation. This implies the leakage of any information about the private keys. This is supported by the Security Feature "Control of Operating Conditions" of the Hardware (cf. [HWST, SF.OPC).

342 FPT_FLS.1: The Operating System of the TOE guarantees that the TOE preserves a secure state if a test failure or integrity check mismatch occur. If the TOE is exposed to the external operating conditions out of range or if a failure, e.g. entropy loss of the random number generator, the TOE enters and preserves a secure state. This is supported by chip's hardware too.

343 FPT_PHP.3: The Operating System of the TOE monitors the regular execution of commands, and if variations, test failures or integrity mismatch occur the communication will be closed immediately. This is supported on the lower level by chip's hardware too.

344 FPT_TST.1: The self tests of the underlying hardware and additional test maintained by the TOE provide the means for demonstrating that the TSF operation is correct and that the data is not manipulated. In addition, the TOE's hardware provides an automated continuous user transparent testing of certain functions. This includes, e.g. the entropy check of the hardware based random number generation.

345 FTP_ITC.1: The TOE enforces the communication via the trusted channel by access rules for the commands, which cannot be changed. Only data fields with purely technical information can be accessed outside the trusted channel. The channel will be closed if an error occurred; the session keys are invalidated immediately and cannot be used furthermore.

7.11 Statement of Compatibility

346 This is the statement of compatibility between this Composite Security Target and the Security Target Chip of the underlying hardware [HWST].

7.11.1 Relevance of Hardware TSFs

347 In the following lists the relevance of the hardware security services (SS) and functions (SF) for the composite security target is considered.

Relevant:

- SS.RNG: Random Number Generator
- SS.HW_DES: Triple-DES Co-processor
- SS.HW_AES: AES Co-processor
- SF.OPC: Control of Operating Conditions
- SF.PHY: Protection against Physical Manipulation
- SF.LOG: Logical Protection
- SF.SFR_ACC: Special Function Register Access Control
- SF.MEM_ACC: Memory Access Control

348 Note that the DES algorithm of the Security Service SS.HW_DES is used by the TOE in the algorithmic post-processing of the Random Number Generator. Nevertheless the Triple DES TDES is not used which implies that the reletated Security Objectives are not relevant (cf. p. 66).

Not relevant:

- SS.RECONFIG: Customer Reconfiguration
- SF.COMP: Protection of Mode Control
- SF.FFW: Firmware Firewall
- SF.FIRMWARE: Firmware Support

7.11.2 Security Requirements

349 The relevant Security Requirements of the TOE and the hardware can be mapped or are not relevant. They show no conflict between each other.

Security Requirements of the TOE related to the Composite ST:

350 The following Security Requirements of the TOE are specific for the Applications of the Security Module and have no conflicts with the underlying hardware.

- FCS_CKM.1/ECC
- FCS_CKM.1/ECKA-DH
- FCS_CKM.1/ECKA-EG
- FCS_CKM.1/PACE
- FCS_CKM.4
- FCS_COP.1/SIG-ECDSA
- FCS_COP.1/VER-ECDSA
- FCS_COP.1/AUTH
- FCS_COP.1/IMP
- FCS_COP.1/PACE-ENC
- FCS_COP.1/PACE-MAC
- FCS_RNG.1
- FDP_ACC.2
- FDP_ACF.1
- FDP_SDI.2
- FDP_RIP.1
- FDP_ETC.1
- FDP_ITC.1
- FDP_UCT.1
- FDP_UIT.1
- FIA_ATD.1
- FIA_UAU.1/GW
- FIA_UAU.1/GWA
- FIA_UAU.4
- FIA_UAU.5
- FIA_UID.1
- FIA_USB.1
- FMT_LIM.1
- FMT_LIM.2
- FMT_SMF.1
- FMT_SMR.1
- FPT_EMS.1
- FPT_FLS.1
- FPT_PHP.3
- FPT_TST.1

- FTP_ITC.1

351 Note that some of these requirements, e.g., FCS_CKM.1/DH_PACE rely also on requirements of the hardware as FCS_RNG.1(HW). Nevertheless it is considered as not relevant, because the latter is already covered by FCS_RNG.1 of the TOE.

352 The remaining Security Requirements of the TOE can be mapped to Security Requirements of the hardware. They show no conflict between each other.

- FCS_COP.1/PACE-ENC and FCS_COP.1/PACE-MAC are AES-based and matches FCS_COP.1[AES](HW) of [HWST]
- FCS_RNG.1 matches FCS_RNG.1(HW) of [HWST]
- FMT_LIM.1 matches FMT_LIM.1(HW) of [HWST]
- FMT_LIM.2 matches FMT_LIM.2(HW) of [HWST]
- FPT_EMS.1 is supported by the Security Feature SF.OPC of the hardware ([HWST]) and the AVA_VAN.5 evaluation
- FPT_FLS.1 matches FPT_FLS.1(HW) of [HWST]
- FPT_PHP.3 matches FPT_PHP.3(HW) of [HWST]

Security Requirements of the hardware

- FAU_SAS.1(HW) is related to the manufacturing phase and therefore not relevant for the TOE
- FCS_COP.1[AES](HW) is covered by FCS_COP.1/PACE-ENC and FCS_COP.1/PACE-MAC of the Composite ST both using the AES co-processor
- FCS_COP.1[DES](HW) is not relevant, TDES is not used in the OS
- FCS_RNG.1(HW) matches FCS_RNG.1 of the Composite ST
- FDP_ACC.1[MEM](HW) and FDP_ACC.1[SFR](HW) (Subset access control) is not relevant for the TOE, but for the implementation of the OS, therefore it is covered by ADV_IMP.1 (Implementation representation of the TSF)
- FDP_ACF.1[MEM](HW) and FDP_ACF.1[SFR](HW) (Security attribute based access control) is not relevant for the TOE, but for the implementation of the OS, therefore it is covered by ADV_IMP.1 (Implementation representation of the TSF
- FDP_ITT.1(HW) (Basic internal transfer protection) is covered by FPT_EMS.1 of the Composite ST
- FDP_IFC.1(HW) (Subset information flow control) is covered by FPT_EMS.1 of the Composite ST
- FMT_SMF.1(HW) (Specification of Management Functions) is covered by FMT_SMF.1 of the Composite ST
- FMT_LIM.1(HW) (Limited capabilities) is covered by FMT_LIM.1 of Composite ST
- FMT_LIM.2(HW) (Limited availability) is covered by FMT_LIM.2 of Composite ST
- FMT_MSA.1[MEM](HW) and FMT_MSA.1[SFR](HW) (Management of security attributes) no conflicts
- FMT_MSA.3[MEM](HW) and FMT_MSA.3[SFR](HW) (Static attribute initialization) no conflicts
- FPT_FLS.1(HW) (Failure with preservation of secure state) matches FPT_FLS.1 of the Composite ST

- FPT_ITT.1(HW) (Basic internal TSF data transfer protection) is covered by FPT_EMS.1 of the Composite ST
- FPT_PHP.3(HW) (Resistance to physical attack) is covered by FPT_FLS.1 and FPT_PHP.3 of the Composite ST
- FDP_SDI.2(HW) (Stored data integrity monitoring and action) concerns the hardware operation, does not conflict with SFRs of the TOE

FRU_FLT.2(HW) (Limited fault tolerance) concerns the hardware operation, does not conflict with SFRs of the TOESecurity Assurance Requirements

353 The chosen level of assurance of the hardware is EAL 6 augmented with ALC_FLR.1 and ASE_TSS.2. This includes AVA_VAN.5.

354 This shows that the Assurance Requirements of the TOE matches the Assurance Requirements of the hardware.

7.11.3 Security Objectives

355 The Security Objectives of the TOE and the hardware can be mapped or are not relevant. They show no conflict between each other.

Security Objectives of the TOE related to the Composite ST:

- O.Integrity covers O.HW_AES of the [HWST]
- O.Confidentiality covers O.HW_AES of the [HWST]
- O.Authentication covers O.HW_AES of the [HWST]
- O.AccessControl no conflict
- O.KeyManagement no conflict
- O.TrustedChannel no conflict
- O.Leakage covers O.Leak-Inherent and O.Leak-Forced from [HWST]
- O.PhysicalTampering covers O.Phys-Probing and O.Phys-Manipulation from [HWST]
- O.AbuseFunctionality covers O.Prot_Abuse-Func from [HWST]
- O.Malfunction matches O.Prot_Malfunction from [HWST]
- O.Sign no conflict
- O.KeyAgreementDH, O.KeyAgreementEG no conflict
- O.Random covers O.RND from [HWST]
- O.PACE no conflict

Security Objectives for the hardware ([HWST]):

- O.Leak-Inherent (Protection against Inherent Information Leakage) is covered by O.Leakage
- O.Phys-Probing (Protection against Physical Probing) is mapped to O.Physical-Tampering
- O.Malfunction (Protection against Malfunctions) is covered by the corresponding objective O.Malfunction of the TOE

- O.Phys-Manipulation (Protection against Physical Manipulation) is mapped to O.PhysicalTampering
- O.Leak-Forced (Protection against Forced Information Leakage) is covered by O.Leakage
- O.Abuse-Func (Protection against Abuse of Functionality) is covered by O.AbuseFunctionality
- O.Identification (Hardware Identification) is an objective related to the manufacturing phase. Its support by the TOE is considered in more detail in the Guidance Documentation and is subject to evaluation within the assurance components ALC_DEL.1 and AGD_PRE.1.
- O.RND (Random Numbers) is covered by Security Objective O.Random of the TOE
- O.HW_DES3 (Triple DES Functionality) is not relevant

  The TDES functionality is not used in TOE's OS, therefore related objectives must not be considered.
- O.HW_AES (AES Functionality) is mapped to O.Integrity, O.Authentication and O.Confidentiality.

  The AES Functionality is used to ensure the integrity, the confidentiality and the authenticity of user data during transmission
- O.CUST_RECONFIG: Customer Option Reconfiguration (not relevant)

  This functionality is not used in TOE's OS.
- O.EEPROM_INTEGRITY: Integrity support of data stored in EEPROM

  The hardware shall provide a mechanism to support the integrity of the data stored in the EEPROM. This objective is mapped due to the used in hardware security features to O.AbuseFunctionality, O.PhysicalTampering and O.Malfunction of the TOE.
- O.FM_FW: Firmware Mode Firewall (not relevant)

  This functionality is not used in TOE's OS.
- O.MEM_ACCESS is mapped to O.AbuseFunctionality

  This objective for the hardware supports the correct operation of the TOE providing memory area access control.
- O.SFR_ACCESS is mapped to O.AbuseFunctionality

  The objectives O.MEM_ACCESS and O.SFR_ACCESS support the correct operation of the TOE providing memory area access and Special Function Registers access control. Therefore these objectives are mapped to O.AbuseFunctionality.

7.11.4 Compatibility: TOE Security Environment

Assumptions

356 The following list shows that assumptions neither of the TOE nor of the hardware have any conflicts between each other. They are either not relevant for this Security Target or are covered by appropriate Security Objectives.

Assumptions for the TOE related to the Composite ST:

357 There are no additional assumptions besides the following ones.

Assumptions of the specific hardware platform ([HWST]):

- A.Check-Init (Check of Initialization Data by the Security IC Embedded Software)

  The Check of Initialization Data of the hardware is related to the Life Cycle Phase 2 “Manufacturing of the TOE” and should not be confused with the check of Initialization Data during Personalization. The Assumption A.Check-Init is no more relevant after TOE Initialization, because Hardware Initialization Data is overridden by TOE’s Initialization and Pre-Personalization Data.
- A.Key-Function (Usage of Key-dependent Functions)

  This assumption requires that key-dependent functions are implemented in the OS such that they are not susceptible to leakage attacks. It is covered by the Hardware‘s objective OE.Resp-Appl for the environment and applies to Life Cycle Phase 1 “Development”.

Threats

358 The Threats of the TOE and the hardware can be mapped or are not relevant. They show no conflict between each other.

Threats for the TOE related to the Composite ST:

- T.Skimming no conflict
- T.Eavesdropping no conflict
- T.ID_Card_Tracing no conflict
- T.ForgeryInternalData covers T.RND of the Hardware ST [HWST]
- T.Counterfeit no conflict
- T.Abuse-Func matches the corresponding threat of the of the Hardware ST [HWST]
- T.Leakage matches T.Leak-Inherent and T.Leak-Forced of the Hardware ST [HWST]
- T.PhysicalTampering matches T.Phys-Probing and T.Phys-Manipulation of the Hardware ST [HWST]
- T.Malfunction matches corresponding threat of the Hardware ST [HWST]

Threats of the hardware ST ([HWST]):

- T.Unauthorised_Access Unauthorized Memory or Hardware Access

  This threat is related to the partitioning of memory areas in Boot Mode, Firmware Mode, System Mode and segmentation of memory areas in User Mode. This threat is covered by the objectives O.FW_HW, O.MEM_ACCESS, and O.SFR_ACCESS of the Hardware ([HWST]] and may be considered as part of the threat T.AbuseFunctionality of the Protection Profile [PP0077-SecMod].

7.11.5 Organizational Security Policies

359 The Organizational Security Policies of the TOE and the hardware have no conflicts between each other. They are shown in the following list.

Organizational Security Policies of the Composite ST of the TOE:

- P.Pre-Operational covers P.Process-TOE of the hardware ST
- P.Terminal no conflict
- P.ID_Card_PKI no conflict
- P.Terminal_PKI no conflict
- P.Trustworthy_PKI no conflict

Organizational Security Policies of the Hardware ST:

- P.Add-Components (Additional Specific Security Components) no conflict
  The TOE's hardware provides AES encryption/decryption and Area based Memory Access Control, Memory separation for different software parts and Special Function Register Access Control as security functionalities to the Security IC Embedded Software.
  They are used in security functionalities of the TOE and are considered in the implementation of the OS. The TOE's hardware provides also Triple-DES encryption and decryption, which is not used in the OS.
- P.Process-TOE ([HWST]) is covered by P.Pre-Operational of the Composite ST

7.11.6 Conclusion

360 No contradictions between the Security Targets of the TOE and the underlying hardware can be found.

7.12 Assurance Measures

361 The documentation is produced compliant to the Common Criteria Version 3.1. The following documents provide the necessary information to fulfill the assurance requirements listed in section 6.1.7.

Development

ADV_ARC.1	Security Architecture Description TCOS Smart Meter Security Module
ADV_FSP.4	Functional Specification TCOS Smart Meter Security Module
ADV_IMP.1	Implementation of the TSF TCOS Smart Meter Security Module
ADV_TDS.3	Modular Design of TCOS Smart Meter Security Module

Guidance documents

AGD_OPE.1	User Guidance TCOS Smart Meter Security Module
AGD_PRE.1	Administrator Guidance TCOS Smart Meter Security Module

Life-cycle support

ALC_CMC.4, ALC_CMS.4	Documentation for Configuration Management
ALC_DEL.1	Documentation for Delivery and Operation
ALC_LCD.1	Life Cycle Model Documentation TCOS Smart Meter Security Module

ALC_TAT.1, ALC_DVS.1 Development Tools and Development Security for TCOS Smart Meter Security Module

Tests

ATE_COV.2, ATE_DPT.1 Test Documentation for TCOS Smart Meter Security Module

ATE_FUN.1 Test Documentation of the Functional Testing

Vulnerability assessment

AVA_VAN.5 Independent Vulnerability Analysis TCOS Smart Meter Security Module

362 The developer team uses a configuration management system that supports the generation of the TOE. The configuration management system is well documented and identifies all different configuration items. The configuration management tracks the implementation representation, design documentation, test documentation, user documentation, administrator documentation, and security flaws. The security of the configuration management is described in detail in a separate document.

363 The delivery process of the TOE is well defined and follows strict procedures. Several measures prevent the modification of the TOE based on the developer's master copy and the user's version. The Administrator and the User are provided with necessary documentation for initialization and start-up of the TOE.

364 The implementation is based on an informal high-level and low-level design of the components of the TOE. The description is sufficient to generate the TOE without other design requirements.

365 The tools used in the development environment are appropriate to protect the confidentiality and integrity of the TOE design and implementation. The development is controlled by a life-cycle model of the TOE. The development tools are well-defined and use semi-formal methods, i.e. a security model.

366 The development department is equipped with organizational and personnel means that are necessary to develop the TOE. The testing and the vulnerability analysis require technical and theoretical know-how available at T-Systems International GmbH.

367 As the evaluation is identified as a composite evaluation based on the CC evaluation of the hardware, the assurance measures related to the hardware (IC) will be provided by documents of the IC manufacturer.

Appendix Glossary and Acronyms

368 These are the unchanged tables from [PP0077-SecMod], more detailed information can be found there, too.

Acronyms

Term	Definition
ATR	Answer To Reset
ATS	Answer To Select
AUTH	External Authentication
BSI	Bundesamt für Sicherheit in der Informationstechnik
CC	Common Criteria for IT Security Evaluation
CEM	Common Methodology for Information Technology Security Evaluation
DEMA	Differential Electromagnetic Analysis
DF	Dedicated File
DPA	Differential Power Analysis
EAL	Evaluation Assurance Level
ECC	Elliptic Curve Cryptography
EF	Elementary File
Enc	Encryption
ECDSA	Elliptic Curve Digital Signature Algorithm
ECDH	Elliptic Curve Diffie-Hellman
ECKA	Elliptic Curve Key Agreement
ECKA-DH	Elliptic Curve Key Agreement - Diffie-Hellman
ECKA-EG	Elliptic Curve Key Agreement - ElGamal
ENC	Content Data Encryption
GW	Gateway
GWA	Smart Meter Administrator, Gateway Administrator
HAN	Home Area Network
HW	Hardware
ID	Identifier
IT	Information Technology
KDF	Key Derivation Function
LMN	Local Metrological Network
NIST	National Institute of Standards and Technology
PIN	Personal Identification Number
PKI	Zertifizierungsinfrastruktur / Public Key Infrastructure
PP	Protection Profile
SAR	Security Assurance Requirement
SecMod	Security Module / Sicherheitsmodul
SEMA	Simple Electromagnetic Analysis

Term	Definition
SF	Security Function
SFP	Security Function Policy
SFR	Security Functional Requirement
SHA	Secure Hash Algorithm
SIG	Content Data Signature
Sign	Signature
SM	Smart Meter
SMGW	Smart Meter Gateway
SM-PKI	Smart Metering - Public Key Infrastructure (SM-PKI)
SPA	Simple Power Analysis
ST	Security Target
TLS	Transport Layer Security
TOE	Target Of Evaluation
TR	Technische Richtlinie
TSF	TOE Security Functionality
WAN	Wide Area Network

Glossary

Term	Description
Authenticity	Property that an entity is what it claims to be.
Confidentiality	Property that information is not made available or disclosed to unauthorized individuals, entities, or processes.
Consumer	End user of electricity, gas, water or heat (according to [CEN]).
External Entity	See chapter 3.1
Gateway Administrator	Smart Meter Gateway Administrator, see chapter 1.4.4 and 3.1.
Home Area Network (HAN)	In-house LAN which interconnects domestic equipment and can be used for energy management purposes (according to [CEN]).
Initialization	Completion of the OS by patch code and object system, see chapter 1.4.4 and 3.1.
Integrator	See chapter 1.4.4 and 3.1.
Integration	Installation of the TOE in the assigned Gateway, see chapter 1.4.4 and 3.1. This finishes the IC Personalization.
Integrity	Property that sensitive data has not been modified or deleted in an unauthorized and undetected manner.
LAN, Local Area Network	Data communication network, connecting a limited number of communication devices (Meters and other devices) and covering a moderately sized geographical area within the premises of the consumer. In the context of this PP the term LAN is used as a hyponym for HAN and LMN.
Local Metrological Network (LMN)	In-house LAN which interconnects metrological equipment (i.e. Meters) (according to [CEN]).
Metering Service Provider	Service provider responsible for installing and operating measuring devices in the area of Smart Metering.

References

[AIS20/31]
Bundesamt für Sicherheit in der Informationstechnik, Anwendungshinweise und Interpretationen zum Schema (AIS), AIS20/AIS 31, A proposal for Functionality classes for random number generators Version 2.0 vom 18.09.2011, Bundesamt für Sicherheit in der Informationstechnik (BSI)

[AIS36]
Bundesamt für Sicherheit in der Informationstechnik, Anwendungshinweise und Interpretationen zum Schema (AIS), AIS 36, Version 4 vom 15.05.2013, Bundesamt für Sicherheit in der Informationstechnik (BSI)

[CC]
Common Criteria for Information Technology Security Evaluation, Version 3.1,
Part 1: Introduction and General Model; Version 3.1 Revision 4, September 2012, CCMB-2012-09-001,
Part 2: Security functional components; Version 3.1 Revision 4, September 2012, CCMB-2012-09-002,
Part 3: Security Assurance Requirements; Version 3.1 Revision 4, September 2012, CCMB-2012-09-003

Common Methodology for Information Technology Security Evaluation, Evaluation Methodology, Version 3.1, September 2012, CCMB-2012-09-004

[FIPS186]
Federal Information Processing Standards Publication FIPS PUB 186-4, Digital Signature Standard (DSS), July 2013

[FIPS197]
Federal Information Processing Standards Publication 197, Advanced Encryption Standard (AES), U.S. Department of Commerce/National Institute of Standards and Technology, 2001-11-26

[HWCR] Certification Report of the underlying hardware platform
BSI-DSZ-CC-0978-2016 for NXP Secure Smart Card ControllerP60x144/080yVA/yVA(Y/B/X)/yVE with IC DedicatedSoftware

from NXP Semiconductors Germany GmbH,
Bundesamt für Sicherheit in der Informationstechnik (BSI), 2016-02

[HWST] Security Target of the underlying hardware platform
NXP Secure Smart Card Controller P60x144/080yVA/yVA(Y/B/X)/yVE, Security Target Lite, Rev. 2.61 — 14 October 2015, BSI-DSZ-CC-0978

[ISO7816]
ISO 7816-4:2013, Identification cards – Integrated circuit cards with contacts, Part 4: Organization, security and commands for interchange, ISO, 2013-04

[ISO7810]
ISO/IEC 7810:2003, Identification cards -- Physical characteristics, ISO, 2010-05-03

[ISO14888-3]
ISO/IEC 14888-3:2006, Information technology – Security techniques – Digital signatures with appendix -- Part 3: Discrete logarithm based mechanisms, ISO, 2006

[PP0035-ICC]
Security IC Platform Protection Profile, Version 1.0, Registered and Certified by Bundesamt für Sicherheit in der Informationstechnik under BSI-CC-PP-0035-2007, 2007-06-15

[PP0073-SMGW]
CC Protection Profile for the Gateway of a Smart Metering System (Smart Meter Gateway PP), Version 1.3, Registered and Certified by Bundesamt für Sicherheit in der Informationstechnik under BSI-CC-PP-0073-2014, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2014-03-31

[PP0077-SecMod]
CC Protection Profile for the Security Module of a Smart Meter Gateway (Security Module PP), Version 1.03, Registered and Certified by Bundesamt für Sicherheit in der Informationstechnik under BSI-CC-PP-0077-V2-2015, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2014-12

[RFC5639]
M. Lochter, J. Merkle, Elliptic Curve Cryptography (ECC) Brainpool Standard Curves and Curve Generation, RFC 5639, IETF, 2010-03

[SP800-38A]
Recommendation for Block Cipher Modes of Operation: Methods and Techniques, NIST Special Publication 800-38A, National Institute of Standards and Technology, December 2001

[SP800-38B]
Recommendation for Block Cipher Modes of Operation: The CMAC Mode for Authentication, NIST Special Publication 800-38B, National Institute of Standards and Technology, May 2005

[TCOSADM]
Administrator's Guidance TCOS Smart Meter Security Module Version 1.0 Release 2, T-Systems International GmbH, 2016-10

[TR03109-SecMod]
Technische Richtlinie BSI TR-03109 Smart Energy, Version 1.0, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2013-03

[TR03109-1]
Technische Richtlinie BSI TR-03109-1: Smart Meter Gateway - Anforderungen an die Interoperabilität der Kommunikationseinheit eines intelligenten Messsystems, Version 1.0, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2013-03

[TR03109-2]
Technische Richtlinie BSI TR-03109-2: Smart Meter Gateway - Anforderungen an die Funktionalität und Interoperabilität des Sicherheitsmoduls, Version 1.1, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2014-12

[TR03109-3]
Technische Richtlinie BSI TR-03109-3: Kryptographische Vorgaben für die Infrastruktur von intelligenten Messsystemen, Version 1.1, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2014-04

[TR03109-4]

Technische Richtlinie BSI TR-03109-4: Smart Metering PKI - Public Key Infrastruktur für Smart Meter Gateway, Version 1.1.1, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2015-05-18

[TR03110-2]

Technical Guideline TR-03110-2: Advanced Security Mechanisms for Machine Readable Travel Documents Part 2, Version 2.20, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2015-02

[TR03111-ECC]

Technical Guideline TR-03111: Elliptic Curve Cryptography, Version 2.0, Bundesamt für Sicherheit in der Informationstechnik (BSI), 2012-08

[TR03116-3]

Technische Richtlinie TR-03116: Kryptographische Vorgaben für Projekte der Bundesregierung, Teil 3: Intelligente Messsysteme, Stand 2016, Datum: 4. April 2016, Bundesamt für Sicherheit in der Informationstechnik (BSI)