

Security Accreditation Scheme for UICC Production Standard Version 8.0 31 March 2017

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1 Introduction

1.1 Overview

The GSMA Security Accreditation Scheme for UICC Production (SAS-UP) is a voluntary scheme through which UICC suppliers (including eUICC suppliers) subject their operational sites to a comprehensive security audit to ensure that adequate security measures to protect the interests of mobile network operators (MNO) have been implemented.

MNOs are dependent on suppliers to control risks; to ensure that adequate security is in place. Confidence is improved by the introduction of an auditable SAS standard, which can be applied consistently to UICC suppliers. The purpose of the SAS-UP standard is to:

- Minimise risks to MNOs introduced by UICC production (including eUICC production).
- Provide a set of auditable requirements, together with the SAS Consolidated Security Requirements [2] and Guidelines [3] and the SAS-UP Methodology [1], to allow UICC suppliers to provide assurance to their customers that risks are controlled.
- Support SAS for Subscription Management (SAS-SM) by facilitating the accreditation
 of UICC suppliers producing eUICCs and maintaining associated interfaces to entities
 performing subscription management roles.

Security objectives applicable to UICC suppliers are herein outlined.

NOTE: All references to UICCs and UICC suppliers in this document apply equally to eUICCs and eUICC suppliers unless specifically stated otherwise.

1.2 Background

This SAS-UP Standard and related documents have been created and developed within GSMA through collaboration between representatives from MNOs, UICC suppliers and the GSMA-appointed auditing companies. The GSMA is responsible for updating the SAS Standard. A review of the scheme and its documentation takes place with MNOs, UICC suppliers and the appointed auditors annually.

1.3 Scope

Sites eligible for auditing include only those carrying out activities within the scope of this document, as follows:

- Generation of personalisation data for UICCs
- UICC personalisation
- Value-added fulfilment of UICCs
- Processing of data for subscription management

The security objectives have been achieved by defining:

- UICC production life cycle and processes
- Assets to be protected
- Risk and threats
- · Security requirements.

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Official Document FS.04 - Security Accreditation Scheme for UICC Production - Standard

This document is not intended to be a UICC production protection profile.

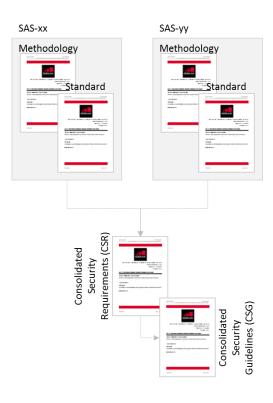
To further reduce the risks for MNOs, it is acknowledged that the security objectives must continue to be met after the personalisation phases where the supplier is responsible for delivery.

1.4 Intended Audience

- Security professionals and others within UICC supplier organisations seeking to obtain accreditation under SAS-UP.
- Security professionals and others within organisations seeking to procure UICCs
- SAS Certification Body members
- SAS-UP auditors

1.5 Related Documents

This document is part of the Security Accreditation Scheme documentation published by the GSMA. Documentation is structured as follows:



Each SAS scheme comprises a **Methodology** and **Standard** relevant to Sensitive Processes (SPs) that should be protected.

The **Methodology** describes the purpose of the scheme and how it is administered.

The **Standard** describes the security objectives related to the relevant SPs.

The Consolidated Security
Requirements (CSR) describe all of
the security requirements that may
apply to SPs in the different SAS
schemes.

The Consolidated Security
Guidelines (CSG) provide examples
of how the security requirements may
be achieved.

Figure 1 - SAS Documentation Structure

The accreditation schemes and documents are designed such that multiple schemes may utilise the same Consolidated Requirements and Guidelines.

The security objectives described in this document are supported by the GSMA SAS Methodology for UICC Production [1], the GSMA SAS Consolidated Security Requirements [2], and the GSMA SAS Consolidated Security Guidelines[3].

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1.6 Definitions

Term	Description			
Actor	Person who is involved in, or can affect, the Sensitive Process			
Business Continuity	Capability of a UICC supplier to continue production at acceptable predefined levels (as determined by customer requirements) following a failure incident.			
Common Criteria	Criteria used as the basis for evaluation of security properties. The evaluation results help in determining whether or not the product is secure			
Duplicate	Two or more assets of the same nature showing a set of information that should be individual according to the correct process			
Employee	An individual who works part-time or full-time under a contract of employment, whether oral or written, express or implied, and has recognized rights and duties. Also called worker.			
Environment	Environment of use of the sensitive process limited to the security aspects			
eUICC	A UICC which is not easily accessible or replaceable, is not intended to be removed or replaced in a device, and enables the secure changing of profiles. Note: The term originates from "embedded UICC".			
Key	Refers to any logical key (e.g. cryptographic key)			
Physical key	Any key and/or combination used for opening a physical lock (e.g. a door, vault, safe or secure cabinet)			
Reject	Finished or partially finished product containing sensitive information which has been ejected from the process.			
Sensitive Process	The security evaluation field, covering the processes and the assets within those processes			
Universal Integrated Circuit Card	A smart card that conform to the specification written and maintained by the ETSI Smart Card Platform.			

1.7 Abbreviations

Term	Description	
ASI	Additional Sensitive Information	
CSR	Consolidated Security Requirements	
CSG	Consolidated Security Guidelines	
eUICC	Embedded UICC (as defined above)	
EIS	eUICC Information Set	
FIN	FIN Finished Products	
FS.nn	Prefix identifier for official documents belonging to GSMA Fraud and Security Group	
GSMA	GSM Association	
ISC	Incoming Sensitive Components characterise the process sensitive inputs such as information, products, files, keys, etc.	
ISI	Incoming Sensitive Information characterise the process sensitive inputs such as requests, files and keys.	
IT	Information Technology	

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Term	Description	
MNO	Mobile Network Operator	
OSI	Outgoing Sensitive Information characterise the process sensitive outputs such as responses, files and keys.	
PFP	Party Finished Products	
PRJ	Personalisation Rejects	
SEN	Sensitive Information	
SAS	Security Accreditation Scheme	
SAS-SM	Security Accreditation Scheme for Subscription Management Roles	
SAS-UP	Security Accreditation Scheme for UICC Production	
SGP.nn	Prefix identifier for official documents belonging to GSMA SIM Group	
SM-DP	Subscription Manager – Data Preparation	
SM-DP+	Subscription Manager – Data Preparation (Enhanced compared to the SM-DP in SGP.02 [6])	
SM-SR	Subscription Manager – Secure Routing	
SP	Sensitive Process	
UICC	Universal Integrated Circuit Card	

1.8 References

Ref	Doc Number	Title
[1]	PRD FS.05	GSMA SAS Methodology for UICC Production, latest version available at <u>www.gsma.com/sas</u>
[2]	PRD FS.17 GSMA SAS Consolidated Security Requirements, latest version available at www.gsma.com/sas	
[3]	PRD FS.18	GSMA SAS Consolidated Security Guidelines, available to participating sites from sas@gsma.com
[4]	RFC 2119	"Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997. Available at http://www.ietf.org/rfc/rfc2119.txt

The following additional references apply only in the context of the eUICC.

Ref	Doc Number	Title	
[5]	PRD SGP.01 Embedded SIM Remote Provisioning Architecture		
[6]	PRD SGP.02	Remote Provisioning Architecture for Embedded UICC Technical Specification	
[7]	PRD SGP.21	RSP Architecture	
[8]	PRD SGP.22	Remote SIM Provisioning (RSP) Architecture for consumer Devices	

1.9 Conventions

The key words "must", "must not", "required", "shall", "shall not", "should", "should not", recommended", "may", and "optional" in this document are to be interpreted as described in RFC2119 [4]."

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2 Definition of Processes

The UICC product life-cycle can be broken down into a number of phases:

#	Title	Description	
1.	Software development	Basic software and operating system development; application software development, integration and validation	
2.	IC design	IC development; hardware development, initialisation and test program development, integration and validation, initialisation of identification information and delivery keys	
3.	Production	Manufacture, assembly and testing of the card or other device to be personalised.	
4.	Personalisation	Receipt and processing of input data; production data generation and preparation; output data generation, preparation and transfer. Receipt and management of physical assets for personalisation, personalisation of assets, packaging and delivery. Re-work of defective or reject personalised assets	
5.	User	Commences when the network operator takes responsibility for the personalised device. Includes the operator's storage, distribution and activation of the device and subsequent use by the customer.	
6.	End-of-life	When the card reaches a stage where it can no longer perform the functions for which it was produced	

Table 1 - UICC product life-cycle

This SAS-UP Standard is defined only for activities within phase 4 – Personalisation. Remote provisioning and management of the eUICC is out of the scope of this standard.

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3 The Process Models

The life cycle is used to depict the security target implementation. The representation of the steps within the process is based on product and data flows. All possible combinations are not described and chronological order is not necessarily represented.

3.1 Personalisation Process

The personalisation process includes customer data in various forms throughout the process and could include the rework process.

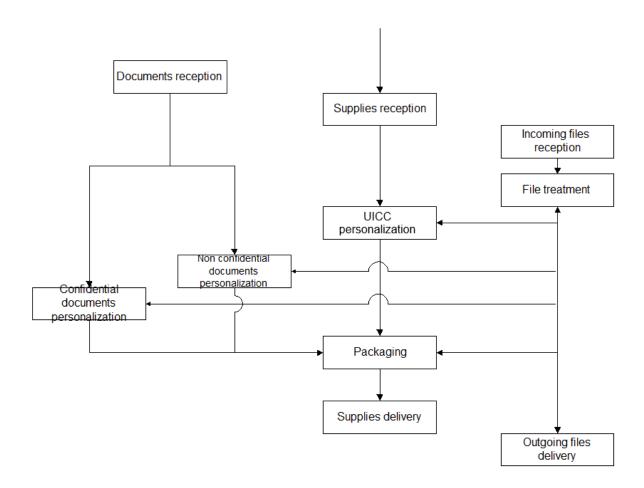


Figure 2 - Personalisation Process

3.2 The Actors

There are four classes of actor:

- Internal Authorised [INT_AUTH] Employees authorised to access the SP and supporting environment
- 2. Internal Unauthorised [INT_UNAU] Employees not authorised to access the SP, but who can access the supporting environment
- External Authorised [EXT_AUTH] Third party with authority to access the SP and supporting environment
- 4. External Unauthorised [**EXT_UNAU**] Third party not authorised to access the SP or supporting environment.

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4 The Assets

4.1 Introduction

Within the processes described above, assets are highly regarded and their security must be protected. Most assets are located in the personalisation process. However, customer specific requirements may make certain devices more sensitive if the production cycle involves additional steps prior to the personalisation process.

This document is limited to the production of UICCs for a single issuer. Other products are not part of the subject matter. The assets are laid on in tabular form below.

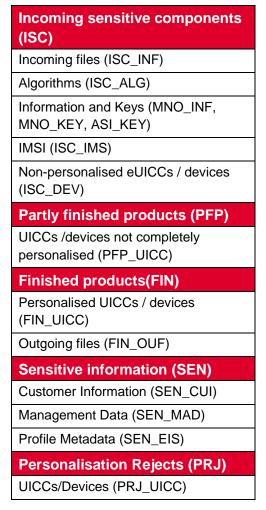


Table 2: Assets

4.2 Assets Classification

The assets that require protection are in various forms within the personalisation processes. The protection required can be complex, unless classes are arranged logically. A classification table is contained in Annex A.

4.3 Asset Characteristics

Files and data are transmitted, stored and used in many media and transport forms.

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Finished products and partly finished products may be used as examples that only follow the same security rules as the corresponding assets when they contain customer data.

4.4 Incoming Sensitive Components (ISC)

Incoming sensitive components such as algorithms, products, files and keys are supplied to the manufacturing sites and can be sent between production sites.

Incoming sensitive components include:

- Incoming files containing classified information which must be protected in terms of integrity, confidentiality, and availability commensurate with the highest class of information contained in the file [ISC _INF]
- Information and Keys [MNO_INF, MNO_KEY] whose confidentiality, integrity and availability must be protected
- Algorithms [ISC_ALG] which must be protected in terms of availability, confidentiality, and integrity.
- UICCs [ISC_DEV] for personalisation

4.5 Partly Finished Products (PFP)

Partly finished products come from ISC transformations or ISC usage inside the same production site.

Partly finished products include:

• UICCs not completely personalised [PFP_UICC]

These assets must be protected in terms of availability and integrity. Traceability must also be ensured.

4.6 Finished Products (FIN)

Finished products are made up of:

- UICCs or other devices successfully personalised [FIN UICC]
- Outgoing files [FIN_OUF]
 - [A_OUT_FIL1] must be protected in availability, integrity and confidentiality as they contain sensitive information e.g. Ki
 - [A_OUT_FIL2] must be protected in availability and integrity. They do not contain sensitive information e.g. PIN and PUK
 - [A_OUT_FIL3] only need to have the integrity preserved as they do not contain sensitive information e.g. MSISDN
 - [A_OUT_FIL4] must be protected in confidentiality, integrity and availability preserved in the context of [5] and [6] for remote provisioning for M2M devices or [7] and [8] for remote provisioning for consumer devices, e.g. eUICC information or OTA Keysets.

In all cases, if the files contain different classes of data the higher class shall prevail.

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4.7 Personalisation Rejects (PRJ)

Personalisation rejects are:

• UICCs [PRJ_UICC], confidentiality must be protected

The integrity and traceability of these assets must be assured until they are destroyed.

4.8 Sensitive information (SEN)

Sensitive information is:

- Customer information [SEN_CUI], information from the personalisation site that is created or can be obtained inside or by a third party attack. Customer information can be recorded in the following devices:
 - Security elements [DE_SEC] such as mother UICCs, batch UICCs, security modules etc.
 - Random number generators [DE_RNG]
 - Transmission and ciphering systems [DE_TRA]
 - Testing systems [DE_TST]
 - Production file systems [DE_PRD]
- Management Data [SEN_MAD], information on the management of batches and UICCs. This can consist of:
 - **[SEN_PRD]** production data which, if it contains classified information, must be protected in terms of integrity, confidentiality, and availability.
 - **[SEN_MAT]** traceability information which should allow the supplier identify the person, or group of persons, who worked on a batch
 - [SEN_MAU] audit information which should be available in relation to the recorded production history of a UICC/batch of UICCs for up to 12 months, subject to local laws.
- eUICC information [SEN_EIS], information received and exchanged with MNO and SM-SR in the context of [5] and [6] for remote provisioning of M2M devices, or received and exchanged with MNO in the context of [7] and [8] for remote provisioning of consumer devices.

The integrity of sensitive information must be assured and the confidentiality protected. Sensitive information includes all files, particularly working, temporary or safeguarded files that contain the information outlined above.

4.9 Cryptographic Keys (KEY)

- Secret [ASI_KEY] whose confidentiality, integrity and availability must be protected.
- Private keys [KEY_PRI] whose authenticity, confidentiality, integrity and availability must be protected.
- Public keys [KEY_PUB] whose authenticity, integrity and availability must be protected.

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5 The Threats

5.1 Introduction

The threat analysis has been completed to identify the main threats to the UICC supplier. The list is not intended to be exhaustive.

The main threats to data are loss of availability, confidentiality and integrity.

The threats are listed in sections 5.2 and 5.3 independently of the process step concerned. In 5.4 each threat is associated to a step in the production process.

In the threat description, data means all type of data assets described in section 4.

5.2 Direct Threats Description

Threats	Actors	Assets	Description
T_DOUB_TEC		PFP_UICC, FIN_UICC, SEN_MAD	Physical duplicate or mismatch creation resulting from a technical mistake/bug
T_DOUB_REW	INT_AUTH INT_UNAU EXT_AUTH	PFP_UICC, FIN_UICC, SEN_MAD, PRJ_UICC,	Physical duplicate creation resulting from non destroyed material after a rework (error or malevolence)
T_DOUB_REU	INT_AUTH INT_UNAU	PFP_UICC, FIN_UICC, SEN_MAD, PRJ_UICC	Physical duplicate creation resulting from reused sensitive information (error or malevolence)
T_LOSS	INT_AUTH INT_UNAU EXT_AUTH EXT_UNAU	ALL SENSITIVE ASSETS	Loss or theft of classified assets (1, 2)
T_CONT	INT_AUTH INT_UNAU EXT_AUTH EXT_UNAU	FIN_UICC, PFP_UICC, PRJ_UICC, ISC_DEV	Accidental or deliberate cross- contamination of assets in the production environment
T_DISC	INT_AUTH INT_UNAU EXT_AUTH EXT_UNAU	ALL ASSETS CONTAINING CLASSIFIED INFORMATION	Disclosure of classified information
T_MODIF	INT_AUTH INT_UNAU EXT_AUTH	ALL ASSETS CONTAINING CLASSIFIED INFORMATION	Unauthorised modification of classified information causing loss of integrity through error or malevolence

Table 3 - Direct Threats Description

Additional threats can result from combinations of those threats listed above.

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5.3 Indirect Threats Description

Actors	Assets	Description
ANY	ANY	Accidental or deliberate security failure.

Table 4 - Indirect Threats Description

5.4 Application of Threats in the Process

	T_DOUB_TEC	T_DOUB_REW	T_DOUB_REU	T_LOSS	T_CONT	T_DISC	T_MODIF	T_SEF
Customer Order Reception			✓	✓		✓	✓	✓
Incoming files reception	1		✓	1		✓	✓	✓
Production data generation and preparation	✓	✓	✓	✓		✓	✓	✓
Internal and external transfer of production data	1	✓	✓	✓		✓	✓	✓
Output data generation and preparation	✓	✓	✓	✓		✓	✓	✓
Outgoing files delivery	1			✓		✓	✓	✓
Incoming materials receipt, storage and issue				✓	✓	✓	✓	✓
Pre personalisation				✓	✓	✓	✓	✓
Materials transfer to personalisation				✓	✓	✓	✓	✓
UICC/device personalisation	1	✓	✓	✓	✓	✓	✓	✓
UICC / device packaging	✓			✓	✓	✓	✓	✓
Supplies delivery (finished products)	✓			✓	✓	✓	✓	✓
Transport between sites				✓		✓	✓	✓

Table 5 - Application of Threats in the Process

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6 Security Objectives

6.1 Introduction

The supplier is responsible to ensure that assets are protected from the security risks to which they are exposed, as defined by the security objectives. It is this protection that provides assurance to the MNOs. The security objectives relate to both the sensitive process and its environment. All the objectives must be addressed but higher levels of assurance are needed depending on the asset classification.

6.2 Security Objectives for the Sensitive Process

#	Objective	Threat	Description
1	The SP must control the production process	T_DOUB_TEC T_DOUB_REW T_DOUB_REU T_LOSS T_MODIF T_CONT	To prevent clone, mismatch, anomalies
2	The SP must control, manage and protect data against loss of integrity and confidentiality	T_DOUB_REU T_LOSS T_DISC T_MODIF	To prevent:
3	The SP must guarantee a secure product flow	T_DOUB_REU T_LOSS T_DISC T_SEF T_CONT	To prevent theft, loss, misappropriation of assets
4	The SP must manage the elements that are specified as auditable	T_MODIF	To look for possible or real security violation
5	The SP must be designed in such a way that independence of different customer files (asset) is always achieved	T_DISC	To prevent one customer's data being disclosed to another customer

Table 6 - Security Objectives for the Sensitive Process

6.3 Security Objectives for the Environment

#	Objective	Threat	Description
1	The SP environment must manage the elements that are specifically auditable	T_SEF	To look for possible or real security violation
2	The SP environment must guarantee a secure product flow	T_SEF	To prevent theft, loss or misappropriation of assets

Table 7 - Security Objectives for the Environment

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7 Security Requirements

In order to consider the personalisation processes secure, certain requirements must be met. These requirements are specified in the SAS Consolidated Security Requirements (CSR) document [2] as relevant to UICC production, and supported by the Consolidated Security Guidelines (CSG) [3], specifically addressing the requirements for:

- Policy, strategy and documentation (including business continuity planning)
- Organisation and responsibility
- Information
- Personnel security
- · Physical security
- · Certificate and key management
- Production data management
- Logistics and production management
- Computer and network management

These requirements are considered as minimum-security requirements for the environment in which the SP is used.

The requirements of the SAS-UP standard should be met by established processes / controls for which evidence of correct operation exists.

Annex A Assets

	Code	Asset	Class
Products	FIN_UICC	Finished UICCs	1
	PFP_UICC	UICC / device not completely personalised	
	PRJ_UICC	Personalised rejected UICC	
Information	ISC_ALG	Incoming algorithms	
	SEN_CUI	Customer information	
	MNO_KEY	MNO Cryptographic keys (e.g. Ki, OP, OPC, OTA keys ISD and SSD keys)	1
	KEY	Clear cryptographic keys/key components protecting class 1 assets for confidentiality and integrity. An asset protected by these cryptographic keys is considered a class 2 asset.	1
	ASI_KEY	A cryptographic key that is used with a secret-key (symmetric) cryptographic algorithm that is uniquely associated with one or more entities and is not made public.	1
	KEY_PRI	The private component of the asymmetric key pair	
	KEY_PUB	The public component of the asymmetric key pair	2
	MNO_INF	Information in the context of [5] and [6] for remote provisioning for M2M devices (e.g. POL 1 for profile), and [7] and [8] for remote provisioning for consumer devices.	1
Products	ISC_DEV	Incoming devices before entering personalisation process	2
	SEN_MAD	Management data. Information on the management of batches and UICCs. This may contain:	
Information		 Production data, which may contain classified information Traceability information, which should allow the supplier to identify the person(s) who, worked on a batch Audit information related to the recorded production history of a UICC or batch of UICCs. If a file managed Class 1 information, these 	2
		information have to be Class 1 protected and the file Class 2 protected	
	SEN_EIS	eUICC information in the context of [5] and [6] for remote provisioning for M2M devices or [7] and [8] for remote provisioning for consumer devices. If a file manages Class 1 information, the information has to be Class 1 protected and the file has to be Class 2 protected	2
	ISC_INF	Incoming files. If the file contains class 1 information,	

Code	Asset	Class
	it needs to be protected as a class 1	
FIN_OUF	Outgoing files. If the file contains class 1 information (E.g. Ki, EIS), this information has to be Class 1 protected.	2
ISC_KEY_PIN	UICC PIN	2
ISC_KEY_PUK	Unblocking PIN	2
ISC_IMS	International Mobile Subscriber Information	2

Annex B Document Management

B.1 Document History

Version	Date	Brief Description of Change	Editor / Company
3.1.0	24 Jul 2003	Stable version in use.	James Moran, GSMA
3.2.2	16 Nov 2006	Significant clarifications added to security requirements to aid interpretation by auditees. New coversheet.	James Messham, FML
3.2.4	11 Sep 2008	New logo. Minor updates. Appendix B removed	James Messham, FML
3.3	16 Oct 2012	Applied updated GSMA document template and version numbering.	David Maxwell, GSMA
4.0	5 Mar 2013	Remove embedding process from scope of SAS and update assets, threats and security requirements as appropriate	James Messham, FML
4.1	10 Apr 2013	Replaced term "smart card" with "UICC" to clarify that non-card form factor (e.g. M2M) products are included in SAS scope.	David Maxwell, GSMA
4.2	7 Aug 2013	Correction of minor error: removed duplicated column in Table 7 - Application of Threads in the Process	David Maxwell, GSMA
4.3	30 Oct 2013	Removed design media from scope	James Messham, FML
5.0	23 Apr 2014	Integrate the SM-SR & SM-DP ecosystem. Removed personalisation of PIN mailers from SAS scope. General editorial update, including re-numbering of requirements.	SAS subgroup
6.0	14 Mar 2016	Update certificate handling requirements and separation of remote access requirement	SAS subgroup
7.0	27 Jul 2016	Replace requirements with reference to new Consolidated Security Requirements (CSR) PRD.	SAS subgroup
8.0	31 Mar 2017	Updates to reflect addition of remote SIM provisioning for consumer devices (ref. SGP.21/SGP.22) within SAS scope	RSPSAS subgroup

B.2 Other Information

Туре	Description
Document Owner	GSMA Fraud and Security Group
Editor / Company	David Maxwell, GSMA

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