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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 68, *Financial services*, Subcommittee SC 7, *Core banking*.

A list of all the parts in the ISO 12812 series can be found on the ISO website.

Introduction

ISO 12812 is made up of ISO 12812-1, an International Standard, and ISO/TS 12812-2 to ISO/TS 12812-4, published as Technical Specifications addressing interoperable and secure systems for the provision, operation and management of Mobile Financial Services (MFS).

This document is intended to assist MFS developers and MFS providers (MFSPs) to evaluate and select security mechanisms for an MFS to be managed according to a pre-established security policy. It is also important for users of MFS to understand how security requirements and considerations come into play in the mobile environment.

Security is a central requirement for any MFS. Institutions increasingly seek to mitigate the risk of fraud in order to protect their customers and hence their own business. Security objectives focus on risk mitigation of identified threats against the integrity and confidentiality of data. Any sustainable MFS business model relies on security and fraud prevention. Consequently, the MFSP needs to define the confidentiality and availability of data prior to implementing any MFS.

Mobile technology has security-specific concerns due to the proliferation and ease of availability of mobile devices and the observed hacking of mobile applications. The experience with traditional card payments is different than that with the mobile device and the wireless channel and requires that risks and controls be reassessed and re-implemented where necessary. Hence, MFSPs require a common understanding of the risks faced by the ecosystem and the suitability of existing security standards (architecture, devices and mechanisms) to address them. This document assumes that when the MFSP is deciding on the security policy to be implemented, the principle of proportionality applies. In other words, security countermeasures should be proportional to the potential risk of financial and reputational damage of a particular MFS.

MFS are initiated from a mobile device which is able to support different wireless communication protocols for different modes of operation. The mobile device can leverage various technologies to deliver MFS, including but not limited to near-field communications in conjunction with the presence of an appropriate secure environment (e.g. SE, TEE, software with supplementary security controls) resident in the mobile device or accessible from a remote/cloud-based back-office. Both types of technology offer different methods for securing financial data, financial applications, and personal data. In order to define security requirements for MFS, this document differentiates between:

— **a proximate mode of operation**, appropriate for various forms of payments where the mobile device directly communicates with another mobile device (i.e. a payee's mobile device) or a payment terminal located at a merchant. Proximate payments are defined as those occurring where the payer and the payee are physically present in the same location (see ISO 12812-1).

— **a mobile remote mode of operation**, where the mobile device uses a mobile communication network which enable MFS to operate where the payer and the payee are not physically located in the same place (see ISO 12812-1). In remote mode, the wireless communication channel is established according to a specific set of standard protocols (e.g. GSM, CDMA, WiFi) which includes authentication procedures to grant access to the network services. A second authentication process of the mobile financial application enables the connection with the corresponding peer application in a remote platform.

This document analyses the various security issues that may arise from the choice of platform and technologies for the operation of MFS. This document also identifies various mobile malware vulnerabilities (e.g. worms, viruses, trojans) specific to mobile devices.

ISO/TS 12812-2 objectives include

a) defining the minimum security requirements, recommendations and guidelines as appropriate,

b) facilitating a generic security framework for the provision and execution of MFS with sufficient flexibility to accommodate different security policies,

c) establishing a generic model for managing security of MFS,

d) providing references for implementers to use in evaluating risks of MFS, and

e) identifying security management practices for the operation of MFS, including reference to specific national legal requirements to combat criminal activities (e.g. anti-money laundering) and to enhance data security through the use of proven cryptographic methods.

This document is structured as follows.

Clause 5 categorizes the technical content of the clauses of the document as types of materials: descriptive, recommendations or requirements.

Clause 6 introduces the concept of security management, addressing all different aspects of MFS security including risk management. Insight into risk analysis is found in Annex A.

Clause 7 describes the minimum set of security requirements for MFS, starting with challenges and technologies for a secure mobile application system design.

Clause 8 sets out requirements for those components specifically designed to create a secure environment in the mobile device, as well as cryptographic modules used for MFS transaction processing.

Clause 9 provides insight and sets out requirements for secure evaluation and certification methods.

Clause 10 through Clause 12 discuss more in depth the concepts outlined in Clause 7, by providing further requirements for security services needed to balance the vulnerabilities and threats of different wireless networks both in proximate and remote modes.

Clause 13 is specific to electronic money security requirements.

Clause 14 provides information relevant for selecting countermeasures to mitigate the legal risks of infringement of data protection laws.

Annex A focus on risk analysis including principles to establish a security management program for MFS.

Annex B provides insight into regulatory constraints that are taken into account when designing and/or operating an MFS.

Annex C is a list of ISO recommended cryptographic standards and implementations to design the security services set out in this document.

Annex D elaborates on vulnerabilities and threats for different communication channels used for MFS.

For additional information on the security of mobile payments, please refer to the Bibliography.

Core banking — Mobile financial services —

Part 2: Security and data protection for mobile financial services

1 Scope

This document describes and specifies a framework for the management of the security of MFS. It includes

— a generic model for the design of the security policy,

— a minimum set of security requirements,

— recommended cryptographic protocols and mechanisms for mobile device authentication, financial message secure exchange and external authentication, including the following:

a) point-to-point aspects to consider for MFS;

b) end-to-end aspects to consider;

c) security certification aspects;

d) generation of mobile digital signatures;

— interoperability issues for the secure certification of MFS,

— recommendations for the protection of sensitive data,

— guidelines for the implementation of national laws and regulations (e.g. anti-money laundering and combating the funding of terrorism (AML/CFT), and

— security management considerations.

In order to avoid the duplication of standardization work already performed by other organizations, this document will reference other International Standards as required. In this respect, users of this document are directed to materials developed and published by ISO/TC 68/SC 2 and ISO/IEC JTC 1/SC 27.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9564 (all parts), *Financial services — Personal Identification Number (PIN) management and security*

ISO 11568, *Financial services — Key management (retail)*

ISO 12812-1, *Core banking — Mobile financial services — Part 1: General framework*

ISO/TS 12812-3, *Core banking — Mobile financial services — Part 3: Financial application lifecycle management*

ISO 13491 (all parts), *Financial services — Secure cryptographic devices (retail)*

ISO 19092, *Financial services — Biometrics — Security framework*

ISO 22307, *Financial services — Privacy impact assessment*

ISO/IEC 15408 (all parts), *Information technology — Security techniques — Evaluation criteria for IT security*

ISO/IEC 19790, *Information technology — Security techniques — Security requirements for cryptographic modules*

ISO/IEC 29192 (all parts), *Information technology — Security techniques — Lightweight cryptography*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12812-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
application isolation
security property of the operating system whereby applications are isolated from one another both during execution and in terms of data they store and/or access

3.2
attack pattern
abstracted approach utilized to attack an MFS asset

3.3
attack potential
measurement of the effort to be expended in attacking an MFS asset, expressed in terms of an attacker's expertise, resources and motivation

3.4
attack surface
set of attack points that an attacker can use in order to enter or capture data in an information system

3.5
certificate revocation list
signed data structure containing a time-stamped list of revoked certificates implemented in public key infrastructures

3.6
common criteria
security evaluation methodology for Information Technology components standardized by ISO/IEC 15408

3.7
cryptographic module
set of hardware, software and/or firmware that implements approved security functions

3.8
data breach
loss of control, compromise, unauthorized disclosure, unauthorized acquisition or access where persons other than the legitimate ones have access to personally identifiable information (PII) or any other sensitive information (e.g. authentication data, keys)

3.9
end-to-end security
data encrypted at the source so that only the final recipient has access to the data

3.10
external authentication
process by which a mobile payment application authenticates an entity

3.11
information security management system
part of the overall management system, based on a business risk approach, used to establish, implement, operate, monitor, review, maintain and improve information security

3.12
mobile device integrity
absence of unauthorized or unintended changes in the hardware, firmware and software of a mobile device

3.13
personalization
process of storing on the mobile device the user application data required to execute an MFS

3.14
point-to-point encryption
data encrypted between two nodes, where at least one of the two nodes is neither the source nor the final recipient of the data

3.15
protection profile
set of security requirements that are specified with the aim of countering identified threats in a particular environment

3.16
pseudo-anonymity
security traits whereby the true identity of the person (e.g. payer, payee) is masked

3.17
rooting
manipulation by which the user of a mobile device gains access to privileged operating system administration rights

3.18
secure element provider security domain
confined physical and/or logical unit within the secure element where a security policy under the control of the secure element provider is applied

3.19
security controls
management, operational and technical controls (i.e. safeguards or countermeasures) prescribed for an information system to protect the confidentiality, integrity, and availability of the system and its information

3.20
security encapsulation
layered security where one protocol (e.g. PIN encryption) is embedded inside another (e.g. SSL,TLS)

3.21
sensitive data
data which is required to be protected by security controls for a given MFS

EXAMPLE Authentication credentials, payment and banking credentials, cryptographic keys.

3.22
session key
temporary cryptographic key used to protect data for the current session only

3.23
time stamp
security mechanism providing the digital proof that an electronic document or message was created or signed before a certain time

3.24
trusted mobile device
mobile device that has been certified to conform to certain industry practices that can support a known risk profile (e.g. generation of electronic signatures)

3.25
unlinkability
security property of a protocol that protect it against an unauthorized party being able to link two executions of the protocol to a specific mobile device

4 Abbreviated terms

AES	Advanced Encryption Standard
AML	Anti-Money Laundering
CBC	Cipher Block Chaining
CC	Common Criteria
CSP	Critical Security Parameters
CVV	Card Verification Value
ECC	Elliptic Curve Cryptography
GCM	Gallois Counter Mode
HCE	Host Card Emulation
HMAC	Keyed-Hash Message Authentication Code
HSM	Hardware Security Module
IMSI	International Mobile Subscriber Identity
ISMS	Information Security Management system
KEK	Key Encryption Key
MAC	Message Authentication Code
MFS	Mobile Financial Service
MFSP	Mobile Financial Service Provider
OEM	Original Equipment Manufacturer
OS	Operating System
OSI	Open System Interconnection
OTA	Over the Air
PCD	Proximity Coupling Device

PCI-DSS	Payment Cared Industry Data Security Standard
PET	Privacy Enhancing Technology
PEF	Privacy Enhancing Feature
PII	Personally Identifiable Information
PIN	Personal Identification Number
RSA	Rivest Shamir Adleman
RNG	Random Number Generator
SE	Secure Element
SMS	Short Message Service
SMSC	Short Message Service Center
SSL	Secure Sockets Layer
TEE	Trusted Execution Environment
TLS	Transport Layer Security
TSM	Trusted Service Manager
USSD	Unstructured Supplementary Service Data
UVM	User Verification Method

5 Summary of the technical nature of the clauses

Table 1 describes the technical nature of the clauses, classified as requirement, recommendation or descriptive material.

Table 1 — Classification of the technical nature of the clauses

Clause	Title	Descriptive	Requirements	Recommendations
Clause 6 Security management considerations				
6.2 Three-layer model to manage security for mobile financial services				
6.2.1	Process layer		X	
6.2.2	Application layer		X	
6.2.3	Infrastructure layer		X	
Clause 7 Security principles and minimum requirements for mobile financial services				
7.1	Security architecture aspects to be considered			X
7.2 Mobile financial services hardening techniques				
7.2.2	Mobile device hardening techniques overview	X		
7.2.3	Wireless networks hardening techniques overview	X		
7.2.4	Secure remote management of mobile device components using OTA		X	
7.2.5	Mobile financial applications hardening techniques	X		

Table 1 *(continued)*

Clause	Title	Descriptive	Requirements	Recommendations
7.2.6	Platform security services	X		
7.2.7	Application-level security services for mobile financial applications			X
7.2.8	Application management security services			X
7.3 Minimum set of security requirements for mobile financial services				
7.3.2	Remote mobile financial services access requirements		X	
7.3.3	Transaction processing requirements		X	
7.3.4	Protection of sensitive data		X	
7.3.5	Mobile device requirements		X	
7.3.6	Customer education			X
7.4 Minimum set of security requirements for mobile application management				
7.4.1	Customer enrolment and provisioning requirements		X	
7.4.2	Key management		X	
7.4.3	Mobile financial service provider and trusted service manager exchanges		X	
7.4.4	Application downloading		X	
7.4.5	Application deactivation		X	
7.5	Summary: Requirements for security services for mobile financial applications and data	X		
Clause 8 Security requirements for cryptographic components used for MFS				
8.1 Mobile device secure environments				
8.1.1	Mobile device requirements for MFS		X	
8.1.2	Software based secure environment		X	
8.1.3	Trusted Execution Environment (TEE)		X	
8.1.4	Secure element requirements		X	
8.1.5	Secure element requirements for digital signature service		X	
8.2 Security requirements for cryptographic modules used for MFS				
8.2.1	List of requirements for cryptographic hardware modules		X	
8.2.2	Requirements for cryptographic software modules		X	
Clause 9 Security evaluation and certification aspects				
9.1	General recommendation			X
9.2 Common security evaluation requirements				
9.3	Security evaluation of the TEE		X	
9.4 Security evaluation and certification of secure elements				
9.5 Security evaluation of cryptographic hardware and software modules				
Clause 10 Security requirements for mobile proximate payments				
10.2 Common security requirements				
10.2.1	Integrity of sensitive data and applications at rest		X	
10.2.2	Authentication		X	
10.2.3	Data protection at rest		X	