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**Identification cards — Contactless  
integrated circuit cards — Vicinity  
cards —**

**Part 3:  
Anticollision and transmission protocol**

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*Cartes d'identification — Cartes à circuit(s) intégré(s) sans contact —  
Cartes de voisinage —  
Partie 3: Anticollision et protocole de transmission*

ISO/IEC 15693-3:2009

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# Contents

Page

Foreword.....	v
Introduction .....	vi
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Terms, definitions, symbols and abbreviated terms.....</b>	<b>2</b>
3.1 Terms and definitions.....	2
3.2 Abbreviated terms .....	2
3.3 Symbols .....	2
<b>4 Definition of data elements .....</b>	<b>3</b>
4.1 Unique identifier (UID) .....	3
4.2 Application family identifier (AFI) .....	3
4.3 Data storage format identifier (DSFID) .....	6
4.4 CRC .....	6
<b>5 VICC memory organization.....</b>	<b>6</b>
<b>6 Block security status.....</b>	<b>7</b>
<b>7 Overall protocol description.....</b>	<b>7</b>
7.1 Protocol concept.....	7
7.2 Modes.....	8
7.2.1 Addressed mode.....	8
7.2.2 Non-addressed mode.....	8
7.2.3 Select mode.....	8
7.3 Request format.....	9
7.3.1 Request flags .....	9
7.4 Response format.....	10
7.4.1 Response flags .....	11
7.4.2 Response error code .....	11
7.5 VICC states .....	12
7.5.1 Power-off state .....	12
7.5.2 Ready state .....	12
7.5.3 Quiet state .....	12
7.5.4 Selected state .....	12
<b>8 Anticollision .....</b>	<b>14</b>
8.1 Request parameters .....	14
8.2 Request processing by the VICC .....	15
8.3 Explanation of an anticollision sequence .....	17
<b>9 Timing specifications .....</b>	<b>19</b>
9.1 VICC waiting time before transmitting its response after reception of an EOF from the VCD.....	19
9.2 VICC modulation ignore time after reception of an EOF from the VCD .....	19
9.3 VCD waiting time before sending a subsequent request .....	19
9.4 VCD waiting time before switching to the next slot during an inventory process .....	20
9.4.1 When the VCD has started to receive one or more VICC responses .....	20
9.4.2 When the VCD has received no VICC response .....	20
<b>10 Commands .....</b>	<b>21</b>
10.1 Command types .....	21
10.1.1 Mandatory.....	21
10.1.2 Optional .....	21

10.1.3	Custom .....	21
10.1.4	Proprietary .....	21
10.2	Command codes .....	22
10.3	Mandatory commands .....	22
10.3.1	Inventory .....	22
10.3.2	Stay quiet .....	23
10.4	Optional commands.....	24
10.4.1	Read single block.....	24
10.4.2	Write single block .....	25
10.4.3	Lock block.....	26
10.4.4	Read multiple blocks .....	26
10.4.5	Write multiple blocks .....	28
10.4.6	Select.....	29
10.4.7	Reset to ready.....	29
10.4.8	Write AFI.....	30
10.4.9	Lock AFI.....	31
10.4.10	Write DSFID command .....	32
10.4.11	Lock DSFID .....	32
10.4.12	Get system information .....	33
10.4.13	Get multiple block security status .....	35
10.5	Custom commands.....	36
10.6	Proprietary commands .....	37
Annex A (informative) Compatibility with other card standards .....		38
Annex B (informative) VCD pseudo-code for anticollision .....		39
Annex C (informative) Cyclic Redundancy Check (CRC).....		40
C.1	The CRC error detection method.....	40
C.2	CRC calculation example .....	41
Bibliography .....		43

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## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15693-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

This second edition cancels and replaces the first edition (ISO/IEC 15693-3:2001), Table 1 and 9.4.2 of which have been technically revised and Figure 10 redrawn for clarity.

ISO/IEC 15693 consists of the following parts, under the general title *Identification cards — Contactless integrated circuit cards — Vicinity cards*:

- *Part 1: Physical characteristics*
- *Part 2: Air interface and initialization*
- *Part 3: Anticollision and transmission protocol*

## Introduction

ISO/IEC 15693 is one of a series of International Standards describing the parameters for identification cards as defined in ISO/IEC 7810 and the use of such cards for international interchange.

This part of ISO/IEC 15693 describes the anticollision and transmission protocols.

This part of ISO/IEC 15693 does not preclude the incorporation of other standard technologies on the card.

Contactless card standards cover a variety of types as embodied in ISO/IEC 10536 (close-coupled cards), ISO/IEC 14443 (proximity cards) and ISO/IEC 15693 (vicinity cards). These are intended for operation when very near, nearby and at a longer distance from associated coupling devices, respectively.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and IEC. Information may be obtained from:

JP 2561051 - Circuit Structure of Inductive Contactless Responding Unit

OMRON Corporation  
Intellectual Property Group  
20 Igadera, Shimokaiinji  
Nagaokakyo-City  
Kyoto 617-8510  
Japan

JP 2981517, JP 2129209 – Read to Verify Written Data

Texas Instruments Deutschland GMBH  
TIRIS  
Haggarty Strasse 1  
8050 Freising  
Germany

US5793324

EP831618

EP837412

EP845751

The subject matter of these patents is anticollision, affecting Clause 8 of this part of ISO/IEC 15693.

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# Identification cards — Contactless integrated circuit cards — Vicinity cards

## Part 3: Anticollision and transmission protocol

### 1 Scope

This part of ISO/IEC 15693 specifies:

- protocol and commands,
- other parameters required to initialize communications between a vicinity integrated circuit card and a vicinity coupling device,
- methods to detect and communicate with one card among several cards ("anticollision"),
- optional means to ease and speed up the selection of one among several cards based on application criteria.

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### 2 Normative references [79299a676924/iso-iec-15693-3-2009](https://standards.iteh.ai/catalog/standards/sist/01aa89fb-8951-40fc-afc4-79299a676924/iso-iec-15693-3-2009)

The following referenced documents are indispensable for the application 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/IEC 7816-6:2004, *Identification cards — Integrated circuit cards — Part 6: Interindustry data elements for interchange*

ISO/IEC 13239, *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures*

ISO/IEC 15693-1, *Identification cards — Contactless integrated circuit(s) cards — Vicinity cards — Part 1: Physical characteristics*

ISO/IEC 15693-2, *Identification cards — Contactless integrated circuit cards — Vicinity cards — Part 2: Air interface and initialization*

### 3 Terms, definitions, symbols and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15693-1, ISO/IEC 15693-2 and the following apply.

##### 3.1.1 anticollision loop

algorithm used to prepare for and handle a dialogue between a VCD and one or more VICCs from several in its energizing field

##### 3.1.2 byte

string that consists of 8 bits of data designated b1 to b8, from the most significant bit (MSB, b8) to the least significant bit (LSB, b1)

#### 3.2 Abbreviated terms

AFI application family identifier

CRC cyclic redundancy check

DSFID data storage format identifier

EOF end of frame

LSB least significant bit

LSByte least significant byte

MSB most significant bit

MSByte most significant byte

RFU reserved for future use

SOF start of frame

UID unique identifier

VCD vicinity coupling device

VICC vicinity integrated circuit card

#### 3.3 Symbols

$f_c$  frequency of operating field (carrier frequency)

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## 4 Definition of data elements

### 4.1 Unique identifier (UID)

The VICCs are uniquely identified by a 64 bits unique identifier (UID). This is used for addressing each VICC uniquely and individually, during the anticollision loop and for one-to-one exchange between a VCD and a VICC.

The UID shall be set permanently by the IC manufacturer in accordance with figure 1.

MSB				LSB	
64	57	56	49	48	1
'E0'		IC Mfg code		IC manufacturer serial number	

Figure 1 — UID format

The UID comprises

- The MSByte (bits 64 – 57) shall be 'E0',
- The IC manufacturer code (bits 56 – 49) according to ISO/IEC 7816-6:2004,
- A unique serial number (bits 48 – 1) assigned by the IC manufacturer.

### 4.2 Application family identifier (AFI)

AFI (Application family identifier) represents the type of application targeted by the VCD and is used to extract from all the VICCs present only the VICCs meeting the required application criteria.

It may be programmed and locked by the respective commands.

AFI is coded on one byte, which constitutes 2 nibbles of 4 bits each.

The most significant nibble of AFI is used to code one specific or all application families, as defined in table 1.

The least significant nibble of AFI is used to code one specific or all application sub-families. Sub-family codes different from 0 are proprietary.

Table 1 — AFI coding

AFI most significant nibble	AFI least significant nibble	Meaning VICC's respond from	Examples / note
'0'	'0'	All families and subfamilies	No applicative preselection
X	'0'	All sub-families of family X	Wide applicative preselection
X	Y	Only the Yth sub-family of family X	
'0'	Y	Proprietary sub-family Y only	
'1'	'0', Y	Transport	Mass transit, Bus, Airline
'2'	'0', Y	Financial	IEP, Banking, Retail
'3'	'0', Y	Identification	Access control
'4'	'0', Y	Telecommunication	Public telephony, GSM
'5'	'0', Y	Medical	
'6'	'0', Y	Multimedia	Internet services
'7'	'0', Y	Gaming	
'8'	'0', Y	Data storage	Portable files
'9'	'0', Y	EAN-UCC system for Application Identifiers	Managed by ISO/IEC JTC 1/SC 31
'A'	'0', Y	Data Identifiers as defined in ISO/IEC 15418	Managed by ISO/IEC JTC 1/SC 31
'B'	'0', Y	UPU	Managed by ISO/IEC JTC 1/SC 31
'C'	'0', Y	IATA	Managed by ISO/IEC JTC 1
'D'	'0', Y	RFU	Managed by ISO/IEC JTC 1/SC 17
'E'	'0', Y	RFU	Managed by ISO/IEC JTC 1/SC 17
'F'	'0', Y	RFU	Managed by ISO/IEC JTC 1/SC 17

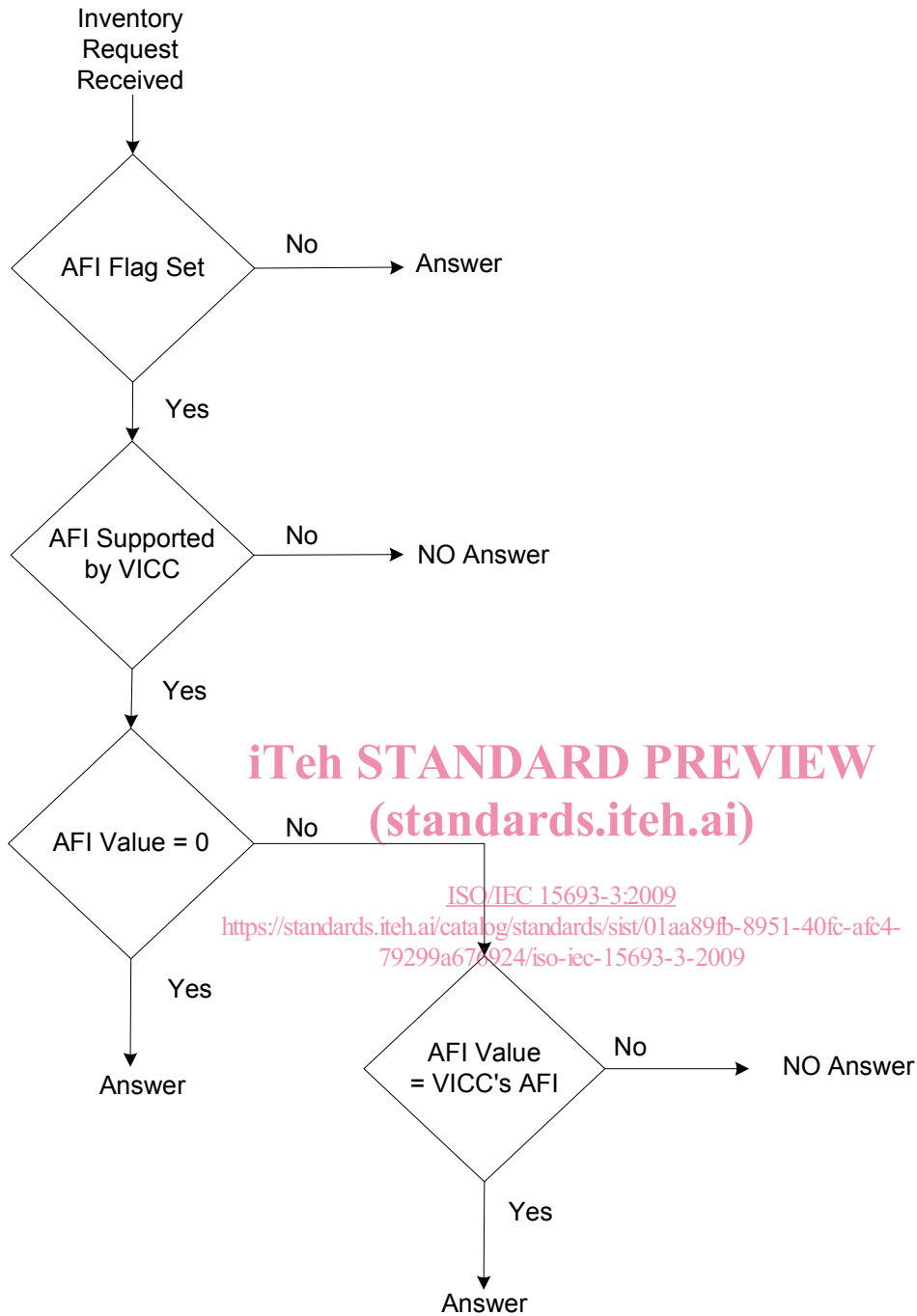
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NOTE X = '1' to 'F', Y = '1' to 'F'.

The support of AFI by the VICC is optional.

If AFI is not supported by the VICC and if the AFI flag is set, the VICC shall not answer whatever the AFI value is in the request.

If AFI is supported by the VICC, it shall answer according to the matching rules described in table 1.



NOTE "Answer" means that the VICC shall answer to the Inventory request.

Figure 2 — VICC decision tree for AFI

### 4.3 Data storage format identifier (DSFID)

The Data storage format identifier indicates how the data is structured in the VICC memory.

It may be programmed and locked by the respective commands. It is coded on one byte. It allows for instant knowledge on the logical organisation of the data.

If its programming is not supported by the VICC, the VICC shall respond with the value zero ('00').

### 4.4 CRC

The CRC shall be calculated in accordance with ISO/IEC 13239.

The initial register content shall be all ones: 'FFFF'.

The two bytes CRC are appended to each request and each response, within each frame, before the EOF. The CRC is calculated on all the bytes after the SOF up to but not including the CRC field.

Upon reception of a request from the VCD, the VICC shall verify that the CRC value is valid. If it is invalid, it shall discard the frame and shall not answer (modulate).

Upon reception of a response from the VICC, it is recommended that the VCD verifies that the CRC value is valid. If it is invalid, actions to be performed are left to the responsibility of the VCD designer.

The CRC is transmitted least significant byte first.

Each byte is transmitted least significant bit first.

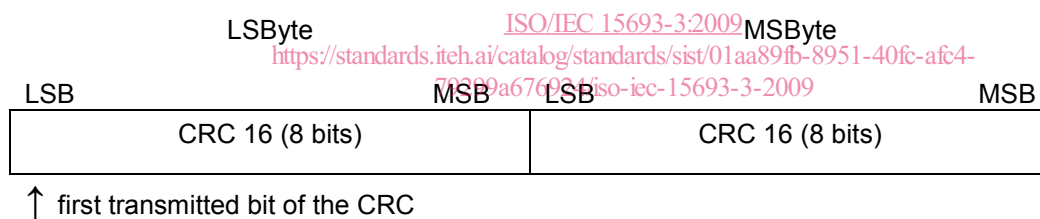


Figure 3 — CRC bits and bytes transmission rules

## 5 VICC memory organization

The commands specified in this part of ISO/IEC 15693 assume that the physical memory is organized in blocks (or pages) of fixed size.

- Up to 256 blocks can be addressed.
- Block size can be of up to 256 bits.
- This leads to a maximum memory capacity of up to 8 kBytes (64 kBits).

NOTE The structure allows for future extension of the maximum memory capacity.

The commands described in this part of ISO/IEC 15693 allow the access (read and write) by block(s). There is no implicit or explicit restriction regarding other access method (e.g. by byte or by logical object in future revision(s) of this part of ISO/IEC 15693 or in custom commands).

## 6 Block security status

The block security status is sent back by the VICC as a parameter in the response to a VCD request as specified in clause 10 (e.g. Read single block). It is coded on one byte.

It is an element of the protocol. There is no implicit or explicit assumption that the 8 bits are actually implemented in the physical memory structure of the VICC.

**Table 2 — Block security status**

Bit	Flag name	Value	Description
b1	Lock_flag	0	Not locked
		1	Locked
b2 to b8	RFU	0	

## 7 Overall protocol description

### 7.1 Protocol concept

The transmission protocol (or protocol) defines the mechanism to exchange instructions and data between the VCD and the VICC, in both directions.

It is based on the concept of "VCD talks first".

This means that any VICC shall not start transmitting (i.e. modulating according to ISO/IEC 15693-2) unless it has received and properly decoded an instruction sent by the VCD.

- a) the protocol is based on an exchange of
- a request from the VCD to the VICC
  - a response from the VICC(s) to the VCD

The conditions under which the VICC sends a response are defined in clause 10.

- b) each request and each response are contained in a frame. The frame delimiters (SOF, EOF) are specified in ISO/IEC 15693-2.
- c) each request consists of the following fields:
- Flags
  - Command code
  - Mandatory and optional parameters fields, depending on the command
  - Application data fields
  - CRC

- d) each response consists of the following fields:
  - Flags
  - Mandatory and optional parameters fields, depending on the command
  - Application data fields
  - CRC
- e) the protocol is bit-oriented. The number of bits transmitted in a frame is a multiple of eight (8), i.e. an integer number of bytes.
- f) a single-byte field is transmitted least significant bit (LSBit) first.
- g) a multiple-byte field is transmitted least significant byte (LSByte) first, each byte is transmitted least significant bit (LSB) first.
- h) the setting of the flags indicates the presence of the optional fields. When the flag is set (to one), the field is present. When the flag is reset (to zero), the field is absent.
- i) RFU flags shall be set to zero (0).

## 7.2 Modes

The term mode refers to the mechanism to specify in a request the set of VICC's that shall answer to the request.

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### 7.2.1 Addressed mode

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When the Address\_flag is set to 1 (addressed mode), the request shall contain the unique ID (UID) of the addressed VICC.

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Any VICC receiving a request with the Address\_flag set to 1 shall compare the received unique ID (address) to its own ID.

If it matches, it shall execute it (if possible) and return a response to the VCD as specified by the command description.

If it does not match, it shall remain silent.

### 7.2.2 Non-addressed mode

When the Address\_flag is set to 0 (non-addressed mode), the request shall not contain a unique ID.

Any VICC receiving a request with the Address\_flag set to 0 shall execute it (if possible) and shall return a response to the VCD as specified by the command description.

### 7.2.3 Select mode

When the Select\_flag is set to 1 (select mode), the request shall not contain a VICC unique ID.

The VICC in the selected state receiving a request with the Select\_flag set to 1 shall execute it (if possible) and shall return a response to the VCD as specified by the command description.

Only the VICC in the selected state shall answer to a request having the select flag set to 1.

### 7.3 Request format

The request consists of the following fields:

- Flags
- Command code (see clause 10)
- Parameters and data fields
- CRC (see 4.4)

SOF	Flags	Command code	Parameters	Data	CRC	EOF
-----	-------	--------------	------------	------	-----	-----

Figure 4 — General request format

#### 7.3.1 Request flags

In a request, the field "flags" specifies the actions to be performed by the VICC and whether corresponding fields are present or not.

It consists of eight bits.

**Table 3 — Request flags 1 to 4 definition**

Bit	Flag name	Value	Description
b1	Sub-carrier_flag	0	A single sub-carrier frequency shall be used by the VICC
		1	Two sub-carriers shall be used by the VICC
b2	Data_rate_flag	0	Low data rate shall be used
		1	High data rate shall be used
b3	Inventory_flag	0	Flags 5 to 8 meaning is according to table 4
		1	Flags 5 to 8 meaning is according to table 5
b4	Protocol Extension_flag	0	No protocol format extension
		1	Protocol format is extended. Reserved for future use

NOTE 1 Sub-carrier\_flag refers to the VICC-to-VCD communication as specified in ISO/IEC 15693-2.

NOTE 2 Data\_rate\_flag refers to the VICC-to-VCD communication as specified in ISO/IEC 15693-2.