INTERNATIONAL STANDARD

ISO/IEC 14443-4

Second edition
2008-07-15

Identification cards — Contactless integrated circuit cards — Proximity cards —

Part 4: Transmission protocol

Cartes d'identification — Cartes à circuit(s) intégré(s) sans contact — Cartes de proximité —
Partie 4: Protocole de transmission

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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.

ISO/IEC 14443-4 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 14443-4:2001). It also incorporates the Amendment ISO/IEC 14443-4:2001/Amd.1:2006.

ISO/IEC 14443 consists of the following parts, under the general title *Identification cards — Contactless integrated circuit cards — Proximity cards*:

— *Part 1: Physical characteristics*

— *Part 2: Radio frequency power and signal interface*

— *Part 3: Initialization and anticollision*

— *Part 4: Transmission protocol*

Introduction

ISO/IEC 14443 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.

The protocol as defined in this part of ISO/IEC 14443 is capable of transferring the application protocol data units as defined in ISO/IEC 7816-4. Thus, application protocol data units may be mapped as defined in ISO/IEC 7816-4 and application selection may be used as defined ISO/IEC 7816-5.

ISO/IEC 14443 is intended to allow operation of proximity cards in the presence of other contactless cards conforming to ISO/IEC 10536 and ISO/IEC 15693 and Near Field Communication (NFC) devices conforming to ISO/IEC 18092 and ISO/IEC 21481.

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 the ISO and IEC. Information may be obtained from:

US Patent US5359323	FRANCE TELECOM Centre National d'Études des Télécommunications 38-40 rue de Général Leclerc 92794 Issy-les-Moulineaux Cedex 9 France
	MOTOROLA Motorola ESG 207 route de Ferney P O Box 15 1218 Grand-Saconnex Geneva Switzerland
JP 2129209, JP 2561051, JP 2981517 Contactless Responding Unit	OMRON Intellectual Property Department Law & Intellectual Property H.Q. 20, Igadera Shimokaiinji Nagaokakyo City Kyoto 617-8510 Japan
Patent EP 0 492 569 B1 A system and method for the non-contact transmission of data	ON-TRACK INNOVATIONS Z.H.R. Industrial Zone P O Box 32 Rosh-Pina 12000 Israel

The following companies may hold patents relating to this document but have not provided details of the patents or agreed to provide licences.

US 4 650 981	WAYNE S FOLETTA CA 95129, USA 4760 Castlewood Drive San Jose, California CA 9512 USA
US Patent No. 4, 661,691	JOHN W HALPERN C/O Vincent M DeLuca Rothwell, Figg, Ernst & Kurz, p.c. 555 Thirteenth Street, N.W. Suite 701 East Tower Washington, D.C. 20004
WO 89 05549 A	MAGELLAN CORPORATION 8717 Research Drive Irvine CA 92618 USA

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 14443 may be the subject of patent rights other than those identified above. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Identification cards — Contactless integrated circuit cards — Proximity cards —

Part 4: Transmission protocol

1 Scope

This part of ISO/IEC 14443 specifies a half-duplex block transmission protocol featuring the special needs of a contactless environment and defines the activation and deactivation sequence of the protocol.

This part of ISO/IEC 14443 is intended to be used in conjunction with other parts of ISO/IEC 14443 and is applicable to proximity cards or objects of Type A and Type B.

2 Normative references

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 7816-3, *Identification cards — Integrated circuit cards — Part 3: Cards with contacts — Electrical interface and transmission protocols*

ISO/IEC 7816-4, *Identification cards — Integrated circuit cards — Part 4: Organization, security and commands for interchange*

ISO/IEC 14443-2, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 2: Radio frequency power and signal interface*

ISO/IEC 14443-3, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 3: Initialization and anticollision*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
bit duration
one elementary time unit (etu), calculated by the following formula:

$$1 \text{ etu} = 128 / (D \times fc)$$

the initial value of the divisor D is 1, giving the initial etu as follows:

$$1 \text{ etu} = 128 / fc$$

where *fc* is the carrier frequency as defined in ISO/IEC 14443-2.

3.2
block
special type of frame, which contains a valid protocol data format

NOTE A valid protocol data format includes I-blocks, R-blocks or S-blocks.

3.3
invalid block
type of frame, which contains an invalid protocol format

NOTE A time-out, when no frame has been received, is not interpreted as an invalid block.

3.4
frame
sequence of bits as defined in ISO/IEC 14443-3

NOTE The PICC Type A uses the standard frame defined for Type A and the PICC Type B uses the frame defined for Type B.

4 Symbols and abbreviated terms

ACK	positive ACKnowledgement
ATS	Answer To Select
ATQA	Answer To reQuest, Type A
ATQB	Answer To reQuest, Type B
CID	Card IDentifier
CRC	Cyclic Redundancy Check, as defined for each PICC Type in ISO/IEC 14443-3
CRC1	most significant byte of CRC (b16 to b9)
CRC2	least significant byte of CRC (b8 to b1)
D	Divisor
DR	Divisor Receive (PCD to PICC)
DRI	Divisor Receive Integer (PCD to PICC)
DS	Divisor Send (PICC to PCD)
DSI	Divisor Send Integer (PICC to PCD)
EDC	Error Detection Code
etu	elementary time unit
fc	carrier frequency
FSC	Frame Size for proximity Card
FSCI	Frame Size for proximity Card Integer
FSD	Frame Size for proximity coupling Device

FSDI	Frame Size for proximity coupling Device Integer
FWI	Frame Waiting time Integer
FWT	Frame Waiting Time
FWT_{TEMP}	temporary Frame Waiting Time
HLTA	HALT command, Type A
I-block	Information block
INF	INformation Field
MAX	index to define a maximum value
MIN	index to define a minimum value
NAD	Node ADdress
NAK	Negative AcKnowledgement
OSI	Open Systems Interconnection
PCB	Protocol Control Byte
PCD	Proximity Coupling Device
PICC	proximity card or object
PPS	Protocol and Parameter Selection
PPSS	Protocol and Parameter Selection Start
PPS0	Protocol and Parameter Selection parameter 0
PPS1	Protocol and Parameter Selection parameter 1
R-block	Receive ready block
R(ACK)	R-block containing a positive acknowledge
R(NAK)	R-block containing a negative acknowledge
RATS	Request for Answer To Select
REQA	REQuest Command, Type A
RFU	Reserved for Future Use by ISO/IEC
S-block	Supervisory block
SAK	Select AcKnowledge
SFGI	Start-up Frame Guard time Integer
SFGT	Start-up Frame Guard Time
WUPA	Wake-UP command, Type A

WTX Waiting Time eXtension

WTXM Waiting Time eXtension Multiplier

For the purposes of this document, the following notation applies:

— (xxxxx)b Data bit representation;

— 'XY' Hexadecimal notation, equal to XY to the base 16.

5 Protocol activation of PICC Type A

The following activation sequence shall be applied:

— PICC activation sequence as defined in ISO/IEC 14443-3 (request, anticollision loop and select).

— The SAK byte shall be checked for availability of an ATS. The SAK is defined in ISO/IEC 14443-3.

— The PICC may be set to HALT state, using the HLTA Command as defined in ISO/IEC 14443-3, if no ATS is available.

— The RATS may be sent by the PCD as next command after receiving the SAK if an ATS is available.

— The PICC shall send its ATS as answer to the RATS. The PICC shall only answer to the RATS if the RATS is received directly after the selection.

— If the PICC supports any changeable parameters in the ATS, a PPS request may be used by the PCD as the next command after receiving the ATS to change parameters.

— The PICC shall send a PPS Response as answer to the PPS request.

A PICC does not need to implement the PPS, if it does not support any changeable parameters in the ATS.

The PCD activation sequence for a PICC Type A is shown in Figure 1.

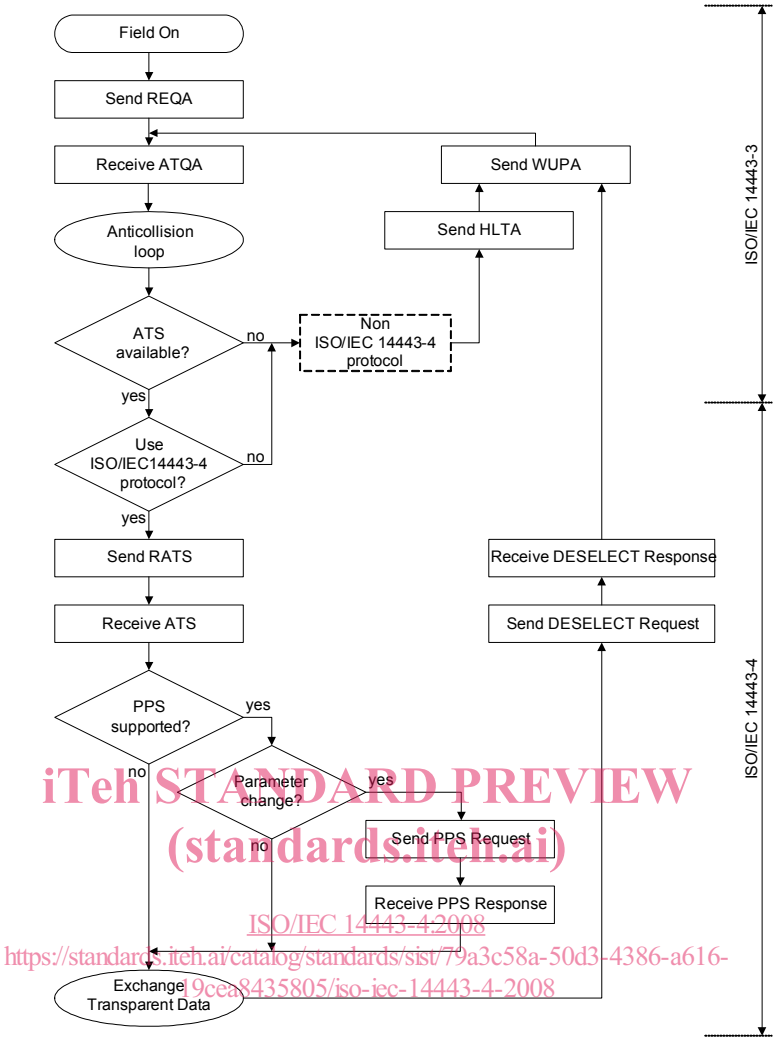

Figure 1 — Activation of a PICC Type A by a PCD

5.1 Request for answer to select

This clause defines the RATS with all its fields (see Figure 2).

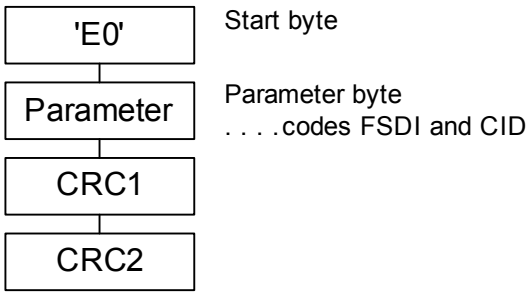

Figure 2 — Request for answer to select

The parameter byte consists of two parts (see Figure 3):

— The most significant half-byte b8 to b5 is called FSDI and codes FSD. The FSD defines the maximum size of a frame the PCD is able to receive. The coding of FSD is given in Table 1.