INTERNATIONAL STANDARD

ISO/IEC 15693-2

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Identification cards — Contactless integrated circuit(s) cards — Vicinity cards —

Part 2: Air interface and initialization

Cartes d'identification — Cartes à circuit(s) intégré(s) sans contact — Cartes de voisinage —

Partie 2: Interface et initialisation dans l'air

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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 part of ISO/IEC 15693 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 15693-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Identification cards and related devices* .

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

— *Part 1: Physical characteristics*

— *Part 2: Air interface and initialization*

— *Part 3: Anticollision and transmission protocol*

— *Part 4: Extended command set and security features*

Annex A of this part of ISO/IEC 15693 is for information only.

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 electrical characteristics of the contactless interface between a vicinity card and a vicinity coupling device. The interface includes power and bi-directional communications.

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), 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 part of ISO/IEC 15693 may involve the use of patents.

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Subclause 7.2 Data rate and data coding

Infineon Technologies AG
P O Box 800949
D-81609 Munich
Germany

Koninklijke Philips Electronics N.V.
Prof. Holstlaan 6
6566 AA Eindhoven
The Netherlands

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

Subclause 8.2 Subcarrier
Subclause 8.3 Data rates

Texas Instruments
Deutschland GmbH
D-85350 Freising
Germany

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Identification cards — Contactless integrated circuit(s) cards — Vicinity cards —

Part 2:
Air interface and initialization

1 Scope

This part of ISO/IEC 15693 specifies the nature and characteristics of the fields to be provided for power and bi-directional communications between vicinity coupling devices (VCDs) and vicinity cards (VICCs).

This part of ISO/IEC 15693 shall be used in conjunction with other parts of ISO/IEC 15693.

This part of ISO/IEC 15693 does not specify the means of generating coupling fields, nor the means of compliance with electromagnetic radiation and human exposure regulations which can vary according to country regulations and/or standards.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 15693. For dated references, subsequent amendments to, or revision of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 15693 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 10373-7:—[1], *Identification cards — Test methods — Vicinity cards.*

3 Terms and definitions

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

3.1
modulation index
index equal to [a-b]/[a+b] where a and b are the peak and minimum signal amplitude respectively.

NOTE The value of the index may be expressed as a percentage.

3.2
subcarrier
a signal of frequency f_s used to modulate the carrier of frequency f_c

[1] To be published.

3.3
byte
a byte consists of 8 bits of data designated b1 to b8, from the most significant bit (MSB,b8) to the least significant bit (LSB,b1)

4 Symbols and abbreviated terms

For the purposes of this part of ISO/IEC 15693, the following abbreviations and symbols apply.

4.1 Abbreviations

ASK	Amplitude shift keying
EOF	End of frame
LSB	Least significant bit
MSB	Most significant bit
PPM	Pulse position modulation
RF	Radio frequency
SOF	Start of frame
VCD	Vicinity coupling device
VICC	Vicinity integrated circuit card

4.2 Symbols

a	Carrier amplitude without modulation
b	Carrier amplitude when modulated
f_c	Frequency of operating field (carrier frequency)
f_s	Frequency of subcarrier
H_{max}	Maximum operating field
H_{min}	Minimum operating field

5 Initial dialogue for vicinity cards

The dialogue between the VCD and the VICC (one or more VICCs may be present at the same time) is conducted through the following consecutive operations:

— activation of the VICC by the RF operating field of the VCD,

— VICC waits silently for a command from the VCD,

— transmission of a command by the VCD,

— transmission of a response by the VICC.

These operations use the RF power transfer and communication signal interface specified in the following paragraphs and shall be performed according to the protocol defined in ISO/IEC 15693-3.

6 Power transfer

Power transfer to the VICC is accomplished by radio frequency via coupling antennas in the VCD and in the VICC. The RF operating field that supplies power to the VICC from the VCD is modulated for communication from the VCD to the VICC, as described in clause 7.

6.1 Frequency

The frequency f_c of the RF operating field is 13,56 MHz ±7 kHz.Operating field

6.2 Operating field

A VICC shall operate as intended continuously between H_{min} and H_{max}.

The minimum operating field is H_{min} and has a value of 150 mA/m rms.

The maximum operating field is H_{max} and has a value of 5 A/m rms.

A VCD shall generate a field of at least H_{min} and not exceeding H_{max} at manufacturer's specified positions (operating volume).

In addition, the VCD shall be capable of powering any single reference VICC (defined in the test methods) at manufacturer's specified positions (within the operating volume).

The VCD shall not generate a field higher than the value specified in ISO/IEC 15693-1 (alternating magnetic field) in any possible VICC position.

Test methods for determining the VCD operating field are defined in ISO/IEC 10373-7.

7 Communications signal interface VCD to VICC

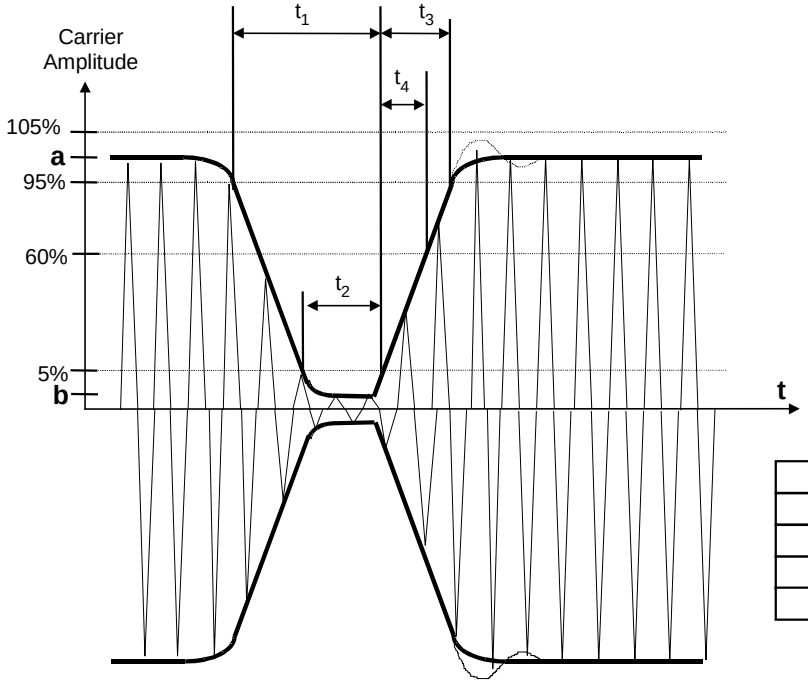
For some parameters several modes have been defined in order to meet different international radio regulations and different application requirements.

From the modes specified any data coding can be combined with any modulation.

7.1 Modulation

Communications between the VCD and the VICC takes place using the modulation principle of ASK. Two modulation indexes are used, 10% and 100%. The VICC shall decode both. The VCD determines which index is used.

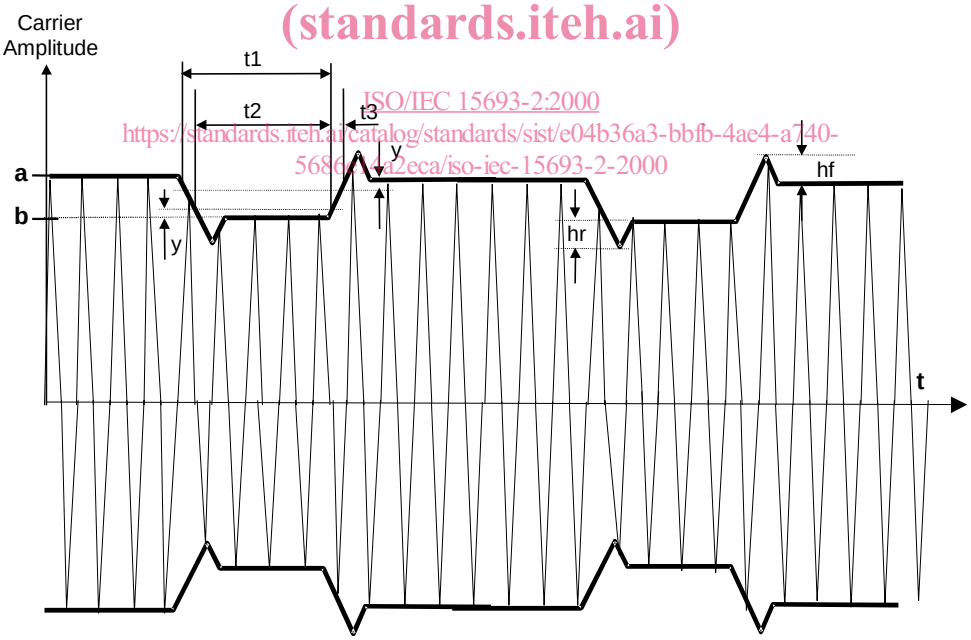
Depending on the choice made by the VCD, a "pause" will be created as described in Figure 1 and Figure 2.



	Min (µs)	Max (µs)
t_1	6,0	9,44
t_2	2,1	t_1
t_3	0	4,5
t_4	0	0,8

The clock recovery must be operational after t_4 max

Figure 1 — Modulation of the carrier for 100% ASK



	Min	Max
t1	6,0 µs	9,44 µs
t2	3,0 µs	t1
t3	0	4,5 µs
Modulation index	10%	30%

y	0,05 (a-b)
hf, hr	0,1 (a-b) max

The VICC shall be operational for any value of modulation index between10% and 30%.

Figure 2 — Modulation of the carrier for 10% ASK

7.2 Data rate and data coding

Data coding shall be implemented using pulse position modulation.

Two data coding modes shall be supported by the VICC. The selection shall be made by the VCD and indicated to the VICC within the start of frame (SOF), as defined in 7.3.

7.2.1 Data coding mode: 1 out of 256

The value of one single byte shall be represented by the position of one pause. The position of the pause on 1 of 256 successive time periods of $256/f_c$ (~18,88 µs), determines the value of the byte. In this case the transmission of one byte takes ~4,833 ms and the resulting data rate is 1,65 kbits/s ($f_c/8192$). The last byte of the frame shall be completely transmitted before the EOF is sent by the VCD.

Figure 3 illustrates this pulse position modulation technique.

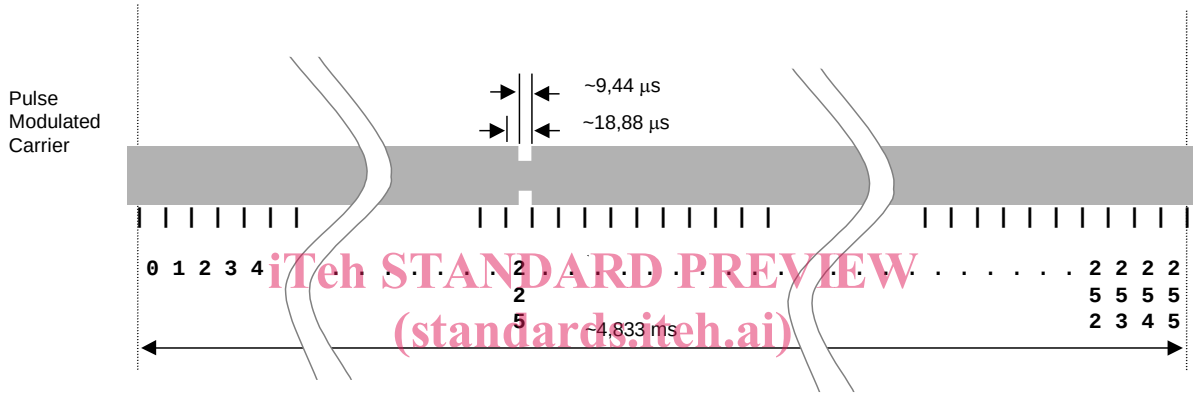


Figure 3 — 1 out of 256 coding mode

In Figure 3 data 'E1' = (11100001)b = (225) is sent by the VCD to the VICC.

The pause shall occur during the second half of the position of the time period that determines the value, as shown in Figure 4.

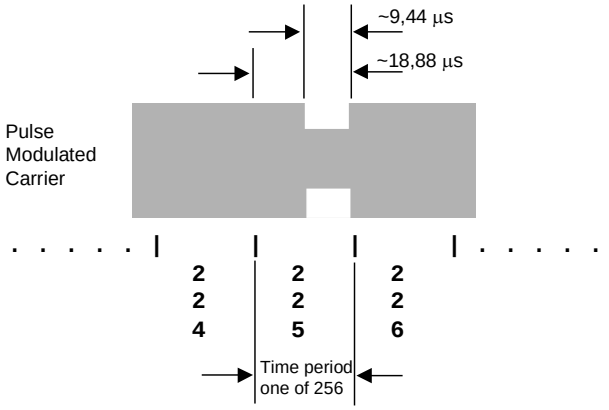


Figure 4 — Detail of one time period