INTERNATIONAL STANDARD

ISO/IEC 14443-2

Second edition
2010-09-01

AMENDMENT 3
2012-03-15

Identification cards — Contactless integrated circuit cards

Part 2:
Radio frequency power and signal interface

AMENDMENT 3: Bits rates of *fc*/8, *fc*/4 and *fc*/2

Cartes d'identification — Cartes à circuit(s) intégré(s) sans contact
Partie 2: Interface radiofréquence et des signaux de communication
AMENDEMENT 3: Débits binaires de fc/8, fc/4 et fc/2

Reference number
ISO/IEC 14443-2:2010/Amd.3:2012(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

Amendment 3 to ISO/IEC 14443-2:2010 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*

Identification cards — Contactless integrated circuit cards

Part 2:
Radio frequency power and signal interface

AMENDMENT 3: Bits rates of *fc*/8, *fc*/4 and *fc*/2

Page 5, Figure 1

Replace Figure 1 with:

“

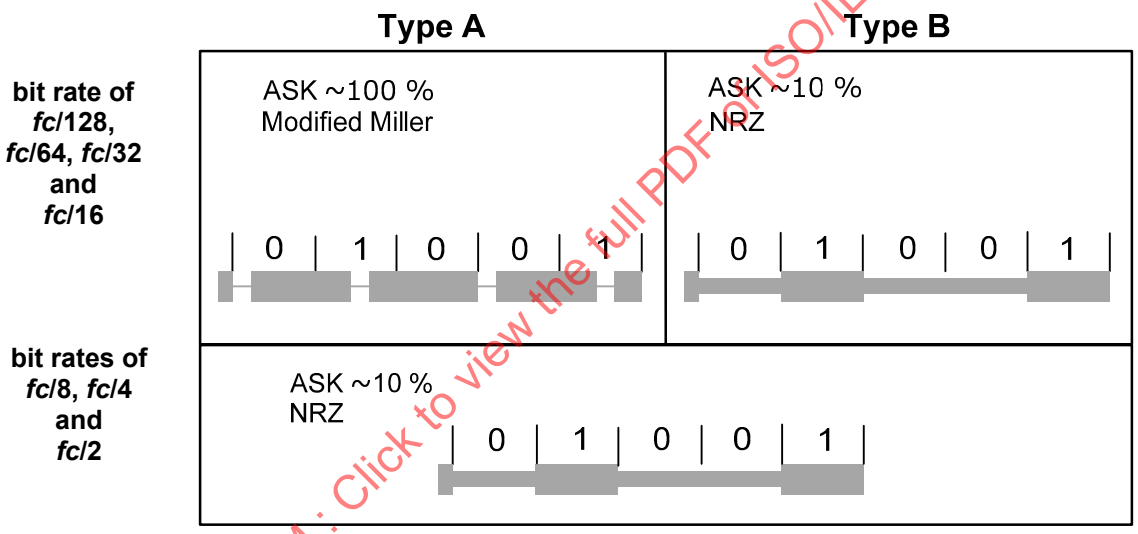

Figure 1 — Example PCD to PICC communication signals for Type A and Type B interfaces

”

Page 6, Figure 2

Replace Figure 2 with:

“

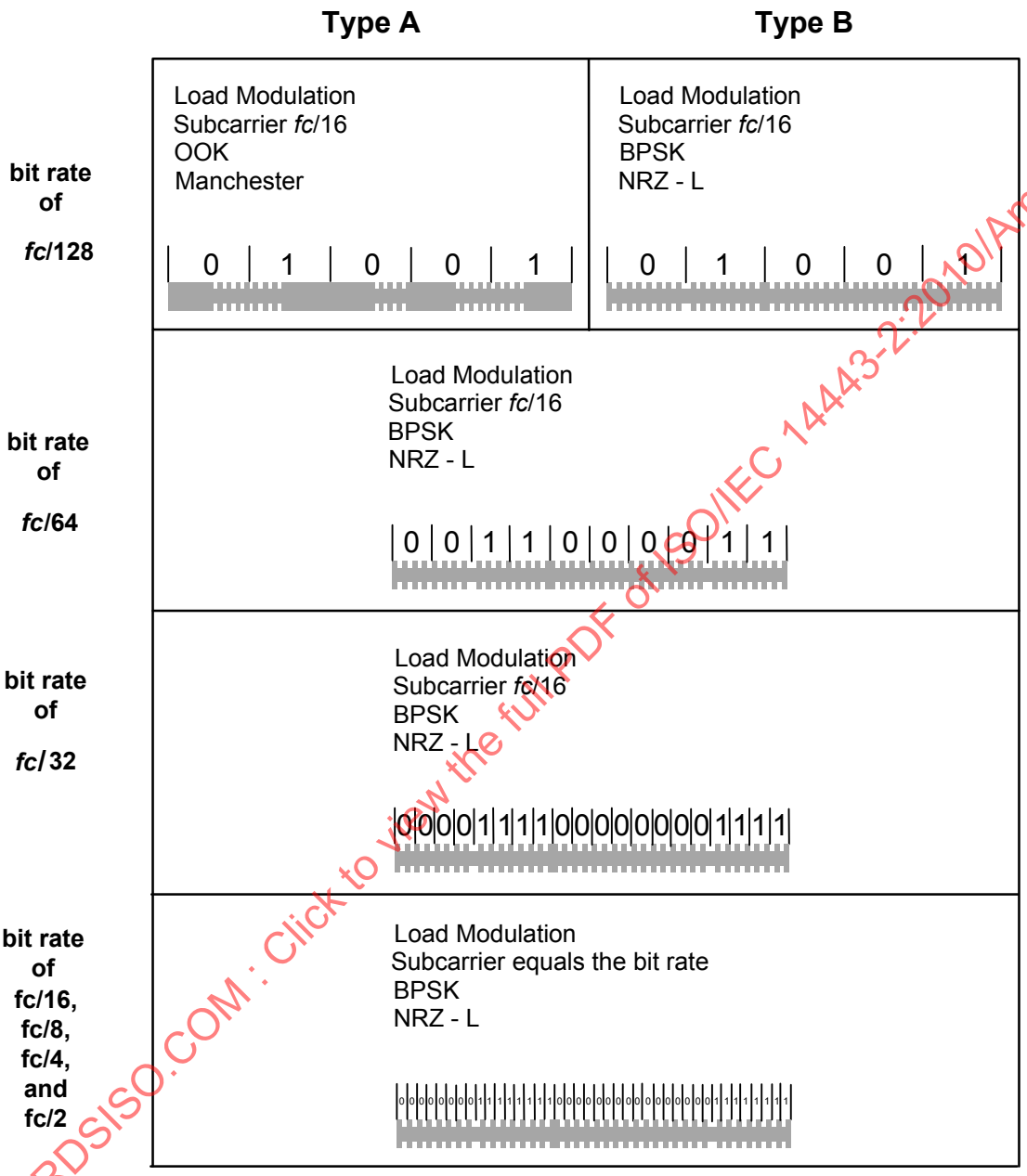

Figure 2 — Example PICC to PCD communication signals for Type A and Type B interfaces

”

Page 6, 8.1.1

Replace 8.1.1 with:

“**8.1.1 Bit rate**

The bit rate for the transmission during initialization and anticollision shall be *fc*/128 (~106 kbit/s).

The bit rate for the transmission after initialization and anticollision shall be one of the following:

— *fc*/128 (~106 kbit/s),

— *fc*/64 (~212 kbit/s),

— *fc*/32 (~424 kbit/s),

— *fc*/16 (~848 kbit/s),

— *fc*/8 (~1,70 Mbit/s),

— *fc*/4 (~3,39 Mbit/s),

— *fc*/2 (~6,78 Mbit/s).”

Page 14

Add new subclause after Figure 9:

“**8.1.2.3 Modulation for bit rates of *fc*/8, *fc*/4 and *fc*/2**

See 9.1.2.”

Page 14, 8.1.3

Add the following new subclause title below the 8.1.3 title:

“**8.1.3.1 Bit representation and coding for bit rates of *fc*/128, *fc*/64, *fc*/32 and *fc*/16**”

Page 15

Add following new subclause before 8.2:

“**8.1.3.2 Bit representation and coding for bit rates of *fc*/8, *fc*/4 and *fc*/2**

Bit representation and coding is defined in 9.1.3.

Start of communication is defined in ISO/IEC 14443-3:2011, 7.1.4.

End of communication is defined in ISO/IEC 14443-3:2011, 7.1.5.”

Page 16, 8.2.3

Replace 8.2.3 with:

“**8.2.3 Subcarrier**

The PICC shall generate a subcarrier only when data is to be transmitted.

8.2.3.1 Bit rates of *fc*/128, *fc*/64, *fc*/32 and *fc*/16

The frequency *fs* of the subcarrier shall be *fc*/16 (~848 kHz). Consequently, during initialization and anticollision, one bit duration is equivalent to 8 periods of the subcarrier. After initialization and anticollision, the number of subcarrier periods is determined by the bit rate.

8.2.3.2 Bit rates of *fc*/8, *fc*/4 and *fc*/2

The frequency *fs* of the subcarrier shall be *fc*/8 (~1,70 MHz), *fc*/4 (~3,39 MHz) or *fc*/2 (~6,78 MHz) depending on the bit rate as specified in Table Amd.3-1.

Table Amd.3-1 — Subcarrier frequency vs bit rate

Bit rate	Subcarrier frequency
fc/8 (~1,70 Mbit/s)	*fc*/8
fc/4 (~3,39 Mbit/s)	*fc*/4
fc/2 (~6,78 Mbit/s)	*fc*/2

”

Page 16, 8.2.4

Replace the second paragraph with the following:

“At the bit rate of *fc*/128 the subcarrier is modulated using OOK with the sequences defined in 8.2.5.1. At bit rates of *fc*/64, *fc*/32, *fc*/16, *fc*/8, *fc*/4 and *fc*/2 the subcarrier is modulated using BPSK with the sequences defined in 8.2.5.2.”

Page 17, 8.2.5.2

Change the 8.2.5.2 title to:

“**8.2.5.2 Bit representation and coding for bit rates of fc/64, fc/32, fc/16, fc/8, fc/4 and fc/2**”

Pages 17–18, 9.1.1

Replace 9.1.1 with:

“**9.1.1 Bit rate**

The bit rate for the transmission during initialization and anticollision shall be nominally *fc*/128 (~106 kbit/s).

The bit rate for the transmission after initialization and anticollision shall be one of the following:

— *fc*/128 (~106 kbit/s),

— *fc*/64 (~212 kbit/s),

— *fc*/32 (~424 kbit/s),

— *fc*/16 (~848 kbit/s),

— *fc*/8 (~1,70 Mbit/s),

— *fc*/4 (~3,39 Mbit/s),

— *fc*/2 (~6,78 Mbit/s).

Bit boundary tolerances and character separation are defined in ISO/IEC 14443-3:2011, 7.1.1 and 7.1.2, respectively."

Page 18, 9.1.2

Replace the paragraphs between Figure 12 and Figure 13 with:

"The PCD shall generate for any bit combination a modulation waveform with a modulation index *m*

— greater than 8 % for all supported bit rates,

— and less than

  — 14 % for bit rates of *fc*/128, *fc*/64, *fc*/32 and *fc*/16,

  — 20 % for bit rates of *fc*/8, *fc*/4 and *fc*/2.

The PICC shall be able to receive for any bit combination a modulation waveform with a modulation index *m*

— greater than

  — both $(9,5 – 1,5H/H_{min})$ % and 7 % for bit rates of *fc*/128, *fc*/64, *fc*/32 and *fc*/16,

  — 8 % for bit rates of *fc*/8, *fc*/4 and *fc*/2.

— and less than

  — 15 % for bit rates of *fc*/128, *fc*/64, *fc*/32 and *fc*/16,

  — 21 % for bit rates of *fc*/8, *fc*/4 and *fc*/2.

NOTE 1 Minimum and maximum values of *H* are defined in Table 1 and Table 2.

The limits for the modulation index *m* for bit rates of *fc*/128, *fc*/64, *fc*/32 and *fc*/16 are illustrated in Figure 13."

Page 19, 9.1.2

Replace Table 8 title with:

"**Table 8 — PCD transmission: Overshoot and undershoot for all supported bit rates**"

Renumber NOTE 1 as NOTE 2.

Replace Table 9 title with:

"**Table 9 — PICC reception: Overshoot and undershoot for all supported bit rates**"

Page 20, 9.1.2

Renumber NOTE 2 as NOTE 3.

Page 23, 9.1.2

After Figure 17 add the following:

"For a bit rate of *fc*/8 the PCD shall generate for any bit combination a modulation waveform with

— a fall time t_f between 0/*fc* and $t_{f,\ max,\ PCD}$ = 6/*fc*,

— and a rise time t_r

  — greater than both 0/*fc* and t_f − 3/*fc*,

  — and less than both t_f + 3/*fc* and $t_{r,\ max,\ PCD}$ = 6/*fc*.

For a bit rate of *fc*/8 the PICC shall be able to receive for any bit combination a modulation waveform with

— a fall time t_f between 0/*fc* and $t_{f,\ max,\ PICC}$ = 6/*fc*,

— and a rise time t_r:

  — greater than both 0/*fc* and t_f − 3/*fc*,

  — and less than both t_f + 3/*fc* and $t_{r,\ max,\ PICC}$ = 6/*fc*.

The timing parameters for PCD and PICC are illustrated in Figure Amd.3-1.

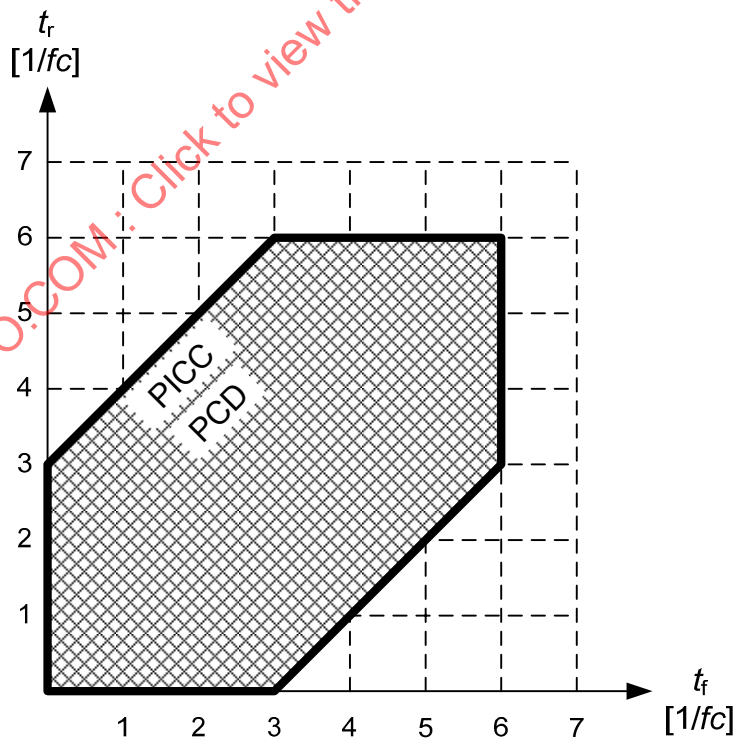

Figure Amd.3-1 — Modulation waveform timing parameters for a bit rate of *fc*/8

For a bit rate of *fc*/4 the PCD shall generate for any bit combination a modulation waveform with

— a fall time t_f between 0/*fc* and $t_{f,\,max,\,PCD}$ = 4/*fc*,

— and a rise time t_r

  — greater than both 0/*fc* and t_f − 2/*fc*,

  — and less than both t_f + 2/*fc* and and $t_{r,\,max,\,PCD}$ = 4/*fc*.

For a bit rate of *fc*/4 the PICC shall be able to receive for any bit combination a modulation waveform with

— a fall time t_f between 0/*fc* and $t_{f,\,max,\,PICC}$ = 4/*fc*,

— and a rise time t_r:

  — greater than both 0/*fc* and t_f − 2/*fc*,

  — and less than both t_f + 2/*fc* and $t_{r,\,max,\,PICC}$ = 4/*fc*.

The timing parameters for PCD and PICC are illustrated in Figure Amd.3-2.

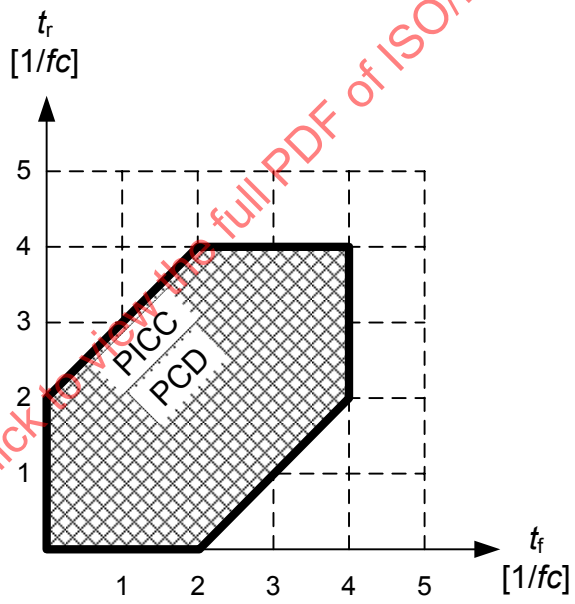

Figure Amd.3-2 — Modulation waveform timing parameters for a bit rate of *fc*/4

For a bit rate of *fc*/2 the PCD shall generate for any bit combination a modulation waveform with

— a fall time t_f less than $t_{f,\,max,\,PCD}$ = 3/*fc* and

— a rise time t_r less than $t_{r,\,max,\,PCD}$ = 3/*fc*.

For a bit rate of *fc*/2 the PICC shall be able to receive for any bit combination a modulation waveform with

— a fall time t_f less than $t_{f,\,max,\,PICC}$ = 3/*fc* and

— a rise time t_r less than $t_{r,\,max,\,PICC}$ = 3/*fc*.

”