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## **Identification cards — Contactless integrated circuit cards - Proximity cards — Part 2: Radio frequency power and signal interface**

### **AMENDMENT 3**

Bit rates of  $fc/8$ ,  $fc/4$  and  $fc/2$

*Cartes d'identification — Cartes à circuit intégré - Cartes de proximité — Partie 2: Interface radio fréquence*

### **AMENDEMENT 3**

*Débits binaires de  $fc/8$ ,  $fc/4$  et  $fc/2$*

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



## Identification cards — Contactless integrated circuit cards - Proximity cards — Part 2: Radio frequency power and signal interface

### Amendment 3: Bit rates of $fc/8$ , $fc/4$ and $fc/2$

Page 6 , 8.1.1

Replace the subclause with:

"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:

#### "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

Change title to "**Bit representation and coding for bit rates of  $fc/8$ ,  $fc/4$  and  $fc/2$** "

Page 15, end of subclause 8.1.3

Add following new subclause:

**"8.1.4 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 15, 8.2.1

Replace paragraph with:

"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 16, 8.2.3

Replace 8.2.3 with the following and renumber subsequent tables:

**"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 8.

**Table 8 —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, end of 8.2.4

Replace 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 8.2.5.2 headline text:

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

**[PROJECT EDITOR NOTE]: The following proposed change requires additional technical information.**

Page 17, 8.2.5.2

Add at the following sentence at the end of the definition for "start of communication":

"For bit rates higher than  $fc/16$  the training sequence 'D59BB49C5E51841E' may follow the inverted subcarrier, if supported by the PICC in accordance with ISO/IEC 14443-4:2008/Amd.2, Clause 9, Table A.5,"

Page 18 , 9.1.1

Replace the subclause with:

"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, 7.1.1 and 7.1.2, respectively. "

*Page 18, 9.1.2*

Replace 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  $fc/128$ ,  $fc/64$ ,  $fc/32$  and  $fc/16$  are illustrated in Figure 13."

*Page 19, 9.1.2*

Replace Table 8 renumbered to Table 9 caption text with:

"PCD transmission: Overshoot and undershoot for all supported bit rates"

*Page 19, 9.1.2*

Replace Table 9 renumbered to Table 10 caption text with:

"PICC reception: Overshoot and undershoot for all supported bit rates"

*Page 23, 9.1.2*

After Figure 17 add:

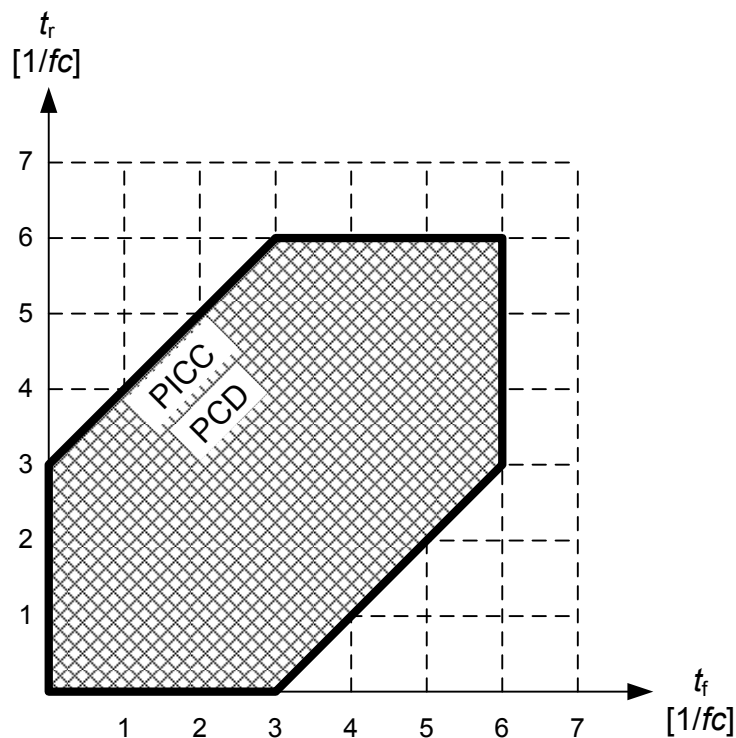
"For a bit rate of  $fc/8$  the PCD shall generate for any bit combination a modulation waveform with

- 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 18.



**Figure 18 — Modulation waveform timing parameters for a bit rate of  $fc/8$**

For bit rates of  $fc/4$  and  $fc/2$  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  $t_{r, \max, PCD} = 4/fc$ .

For bit rates of  $fc/4$  and  $fc/2$  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  $t_r - 2/fc$ ,
  - and less than both  $t_r + 2/fc$  and  $t_{r, \max, PICC} = 4/fc$ .

The timing parameters for PCD and PICC are illustrated in Figure 19.

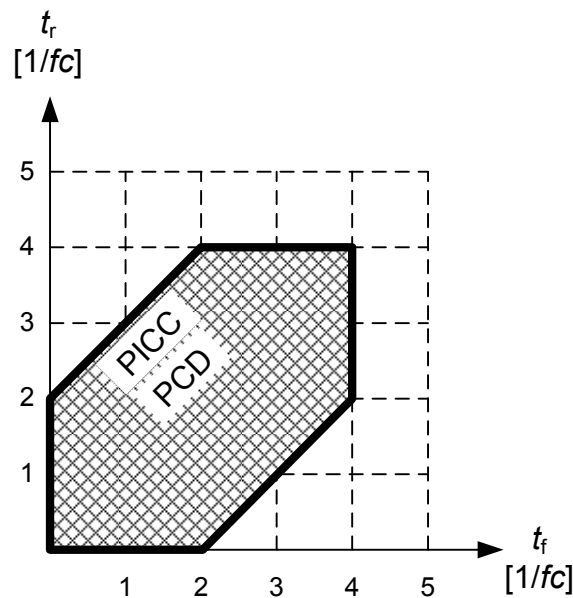


Figure 19 — Modulation waveform timing parameters for bit rates of  $fc/4$  and  $fc/2$

"

Page 24, 9.2.1

Replace paragraph with the following:

"See 8.2.1."

Page 24, 9.2.5

Replace 1<sup>st</sup> bullet of 2<sup>nd</sup> paragraph with the following:

- "After any command from the PCD a guard time TR0 shall apply in which the PICC shall not generate a subcarrier. TR0 shall be greater than  $1024/fc$  (~75,5  $\mu$ s)."