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(54) CONTROL SIGNAL-ADAPTIVE CONTACTLESS CHIP CARD

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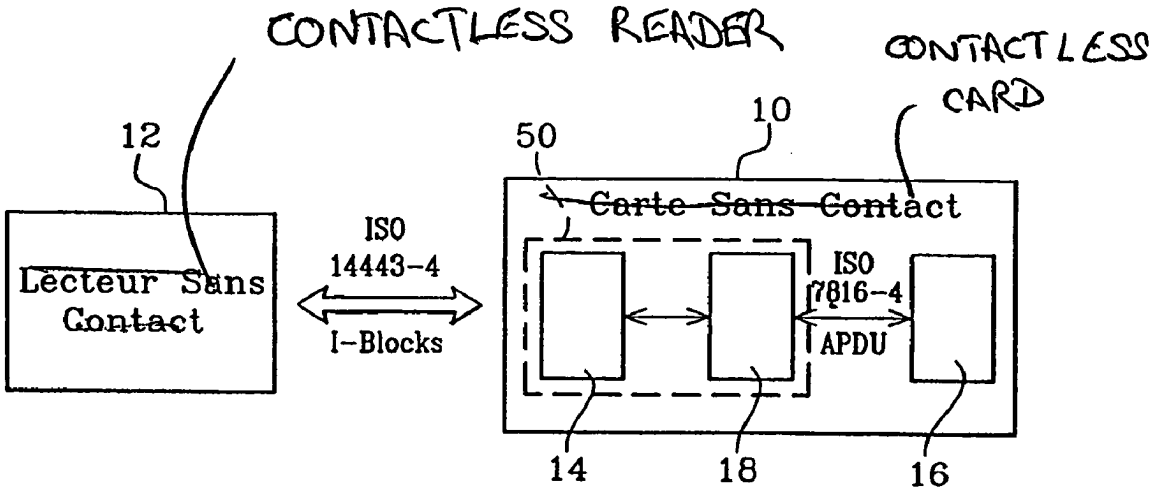
(57) **ABSTRACT**

The invention relates to a contactless electronic IC card (**10**), characterized in that it comprises

a communication device (**14**) for communicating with a contactless electronic IC card reader (**12**) in accordance with the ISO 14443-4 standard,

a contact type electronic IC card operating system (**16**) communicating by APDU command and APDU response in accordance with the ISO 7816-4 standard, and

a protocol conversion interface (**18**) between the communication device (**14**) and the operating system (**16**).



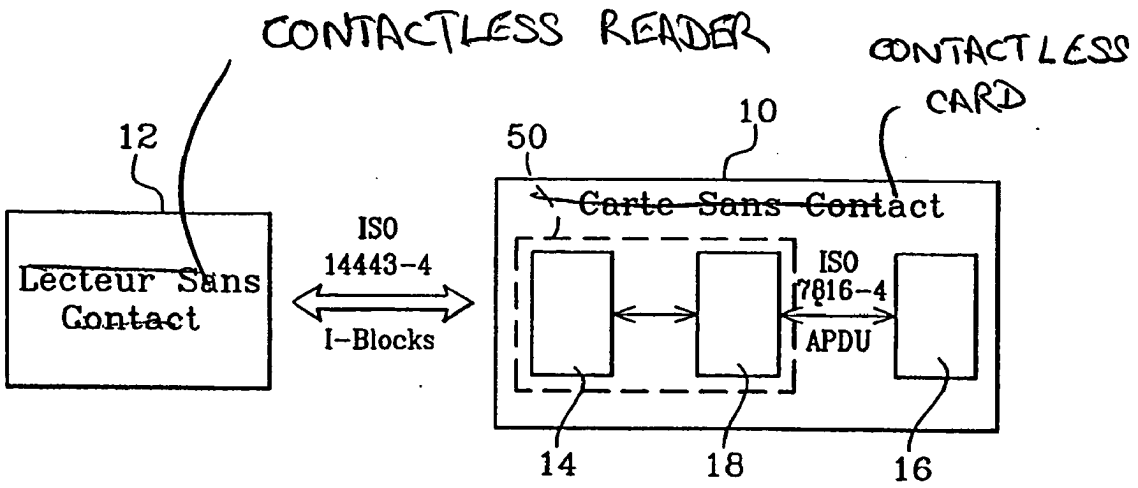

CONTACTLESS READER
CONTACTLESS CARD
12
50
10
Lecteur Sans Contact
Carte Sans Contact
ISO 14443-4
I-Blocks
ISO 7816-4
APDU
14
18
16

Fig. 1

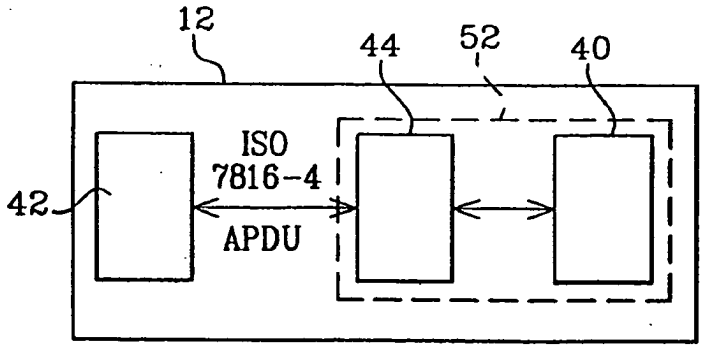

12
44
52
40
42
ISO 7816-4
APDU

Fig. 2

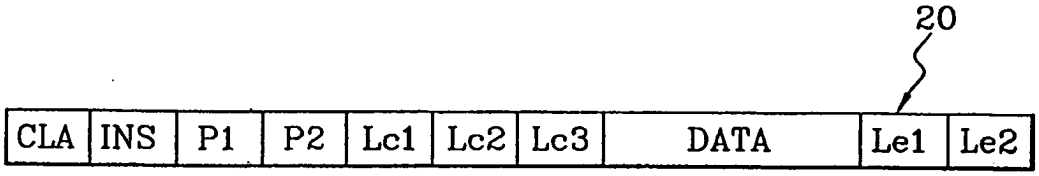


Fig. 3

Fig. 4

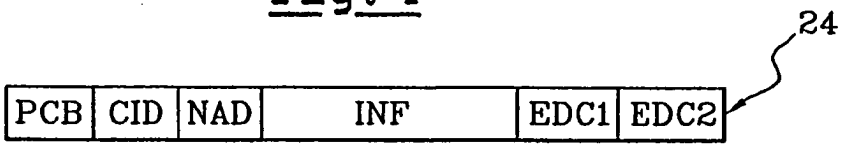


Fig. 5

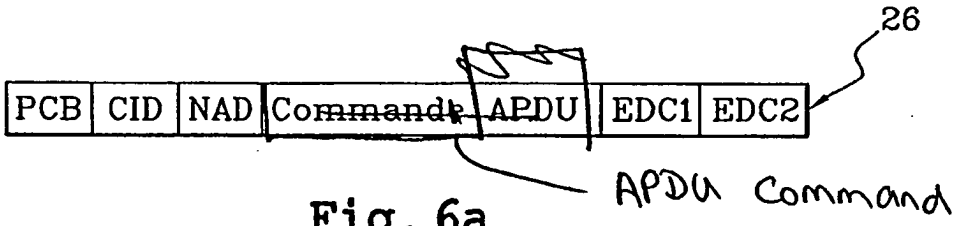


Fig. 6a

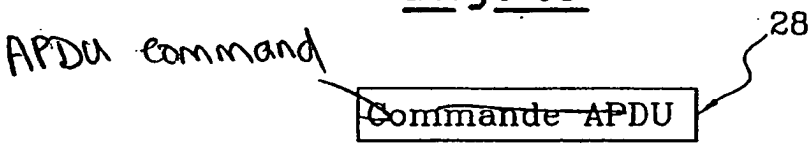


Fig. 6b

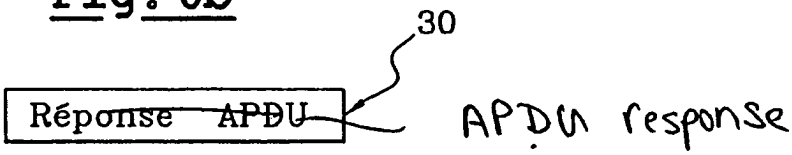


Fig. 6c

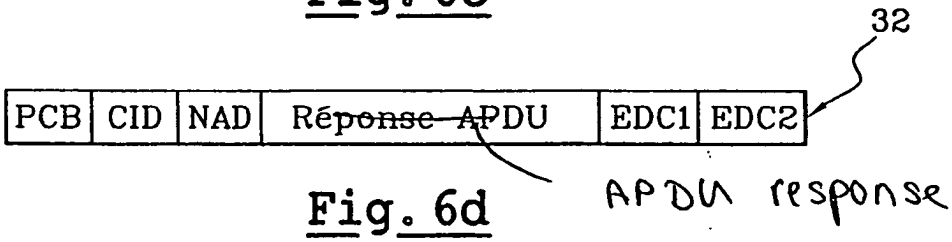


Fig. 6d

CONTROL SIGNAL-ADAPTIVE CONTACTLESS CHIP CARD

[0001] The invention relates to a new type of electronic IC (integrated circuit) card (also known as a smart card or chip card) of the contactless type, but-which operates in accordance with an operating system for a contact type card. It also relates to reader for such contactless IC cards.

[0002] There exist two categories of electronic IC cards, distinguished according to whether or not they have electrical contacts for their link with a card reader.

[0003] Contact type electronic IC cards, presently the most widely used, operate in accordance with card operating systems and communicate with the reader in accordance with communication protocols, these systems and protocols being standardized. In particular, they communicate with the card reader in accordance with the ISO 7816-4 standard.

[0004] Contactless electronic IC cards, which are less widely used than the former, communicate with the card reader in accordance with the ISO 14443-4 standard, which is different from the ISO 7816-4 standard in many respects.

[0005] As a result, the user of contactless electronic IC cards must develop a specific operating system adapted to the ISO 14443-4 standard- to produce the same functional features as those of the contact type IC card.

[0006] Conversely, the user of contact type electronic IC cards cannot implement the operating system of a contactless card without modifying the latter to take into account the specific aspects of the ISO 14443-4 standard.

[0007] An aim of the present invention is thus to produce a contactless electronic IC card which implements the operating system of a contact type card, but which communicates with a contactless card reader in accordance with a classic communication protocol.

[0008] This aim is achieved by producing a contactless electronic IC card, characterized in that it comprises

[0009] a communication device for communicating with a contactless electronic IC card reader in accordance with the ISO 14443-4 standard,

[0010] a contact type electronic IC card operating system communicating by APDU command and APDU response in accordance with the ISO 7816-4 standard, and

[0011] a protocol conversion interface between the communication device and the operating system.

[0012] APDU is an acronym for "Application Protocol Data Unit".

[0013] The protocol conversion interface is preferably in software form, the control being exercised by the communication device or the operating system.

[0014] The invention also relates to a reader for contactless electronic IC cards such as defined above, characterized in that it comprises:

[0015] a reader communication device for communicating, as reader, with a plurality of contactless IC cards and working in accordance with the ISO 14443-4 standard,

[0016] a reader operating system for contact type electronic IC card operation as reader, and

[0017] a protocol conversion interface between the reader communication device and the reader operating system to establish a communication in accordance with the ISO 7816-4 standard.

[0018] The protocol conversion interface of the reader is preferably in software form under the control of either the reader communication device or the reader operating system.

[0019] This reader operating system comprises means for processing several above-defined electronic IC cards.

[0020] Other characteristics and advantages of the present invention shall become apparent from reading the following description of a preferred embodiment, the description being made in conjunction with the appended drawings in which:

[0021] **FIG. 1** is a block diagram of a contactless card according to the invention and its communication link with a contactless card reader,

[0022] **FIG. 2** is a block diagram of a contactless electronic IC card reader implemented with cards according to the invention,

[0023] **FIG. 3** shows the format of an APDU command message in accordance with the ISO 7816-4 standard,

[0024] **FIG. 4** shows the format of an APDU response message in accordance with the ISO 7816-4 standard,

[0025] **FIG. 5** shows the format of an I-Block command message in accordance with the ISO 14443-4 standard, and

[0026] **FIGS. 6***a*, **6***b*, **6***c* and **6***d* show the messages at different stages of communication.

[0027] A contactless electronic IC card **10** in accordance with the invention comprises, functionally and schematically:

[0028] a communication device **14** for communicating with a contactless electronic IC card reader **12**,

[0029] a contact type electronic IC card operating system **16**, and

[0030] a protocol conversion interface **18** for protocol conversion between the communication device **14** and the operating system **16**.

[0031] The bidirectional communication between a contactless electronic IC card reader **12** and the communication device **14** is carried out in accordance with the ISO 14443-4 standard.

[0032] The bidirectional communication between the communication device **14** and the protocol conversion interface is preferably carried out in software form under the control of the communication device **14**. This operation is symbolized by the rectangle in broken lines **50**.

[0033] The bidirectional communication between the protocol conversion interface **18** and the operating system **16** is carried out in accordance with the ISO 7816-4 standard.

[0034] The details of these bidirectional communications shall be described with reference to FIGS. **3** to **6**.

[0035] In the ISO 7816-4 standard, the APDU commands are defined according to the following message format **20** (**FIG. 3**):

[0036] a CLA zone indicating the class of the command,

[0037] an INS zone defining the instruction,

[0038] two zones P**1** and P**2** indicating the instruction parameters,

[0039] three zones Lc**1**, Lc**2** and Lc**3** indicating the length of the data contained in a following DATA zone,

[0040] a DATA zone containing the data, and

[0041] two zones Le**1** and Le**2** containing the number of bytes to read if dealing with a read command.

[0042] The length of the message is practically not limited in an APDU command since its maximum size is of 16 777 225 bytes.

[0043] In response to this APDU command, the operating system **16** responds with an APDU message or response **22** in accordance with the format of **FIG. 4**.

[0044] This APDU response **22** comprises:

[0045] a DATA zone containing the data, and

[0046] two zones SW**1** and SW**2** which contain state bytes.

[0047] In the ISO 14443-4 standard, the so-termed I-Block commands are defined in accordance with the following message format **24** (**FIG. 5**):

[0048] a PCB zone which indicates the nature of the "Block", given that there exist, in addition to the I-Blocks for information, R-Blocks for message acknowledgement of receipt and S-Blocks for delay indications,

[0049] a CID zone which indicates the number of the card to process,

[0050] a NAD zone which indicates the application number,

[0051] an INF zone for the data, and

[0052] a zone EDC**1** and EDC**2** for a transmission error detection in respect of binary digits of the message.

[0053] The length of the I-Block message is 256 bytes, but if the length of the INF part leads to a message of more than 256 bytes, the excess is sent by the following message(s).

[0054] In accordance with the invention, the contactless electronic IC card reader sends an APDU command by inserting it in the INF part of the I-Block command message **24** (**FIG. 5**). If the available length in the INF part is not sufficient, the APDU command is sent in several successive messages.

[0055] There is then obtained the message **26** of **FIG. 6***a*.

[0056] The communication device **14** of the electronic IC card receives this message and analyzes it in accordance with the ISO 14443-4 standard to isolate the INF part.

[0057] The protocol conversion interface **18** transfers the APDU command **28** (**FIG. 6***b*) to the operating system **16** in accordance with the ISO 7816-4 standard.

[0058] The operating system **16** processes this APDU command and responds to it by an APDU response **30** (**FIG. 6***c*) which is sent to the protocol conversion interface **18** in accordance with the ISO 7816-4 standard.

[0059] The interface **18** transforms this APDU response into an I-Block command **32** in accordance with the ISO 14443-4 standard and passes it to the communication device **14** for sending to the reader **12** in accordance with the ISO 14443-4 standard.

[0060] The contactless electronic IC card reader **12** sends APDU commands and receives APDU responses in accordance with the ISO 14443-4 standard.

[0061] Also, to prepare these APDU commands and analyze the APDU responses, the reader **12** must have a reader operating system of the type for a contact type electronic IC card which communicates in accordance with the ISO 7816-4 standard.

[0062] Accordingly, the reader **12** must have a functional structure analogous to that of the electronic IC card **10**, i.e. comprising (**FIG. 2**):

[0063] a reader communication device **40** for communicating as a reader with a plurality of contactless electronic IC cards operating in accordance with the ISO 14443-4 standard,

[0064] a reader operating system **42** of the type for contact type electronic IC cards, and

[0065] a protocol conversion interface **44** for conversion between the reader communication device **40** and the reader operating system **42** to establish a communication in accordance with the ISO 7816-4 standard.

[0066] The reader communication device **40** is of the classic type, allowing it to communicate with several contactless cards. The protocol conversion interface **44** is analogous to that **18** of the IC card **10** and is preferably in software form under the control of the communication device **40**; its operation is symbolized by the rectangle in broken lines **52**.

[0067] The operating system **42** is of the type for a contact type electronic IC card, but is adapted to process several contactless electronic IC cards simultaneously.

[0068] The electronic IC card in accordance with the invention has been described with a protocol conversion interface **18** under control of the communication device **14**; however, the invention can also be implemented with a protocol conversion interface **18** under control of the operating system **16**.

[0069] Likewise, the contactless electronic IC card reader has been described with a protocol conversion interface **44** under the control of the contactless communication device **40**; however, this control can also be exercised by the reader operating system **42**.

[0070] By virtue of the invention as described above, it is possible to produce a contactless IC card using the operating system of a contact type IC card associated to a contactless card type communication device and by carrying out a

conversion or transposition of protocol between the operating system and the communication device. This avoids having to produce a new operating system adapted to the communication standard for contactless cards.

[**0071**] In a similar way, the remote reader of these new contactless IC cards uses an operating system for cards with contacts combined with a device for communication with contactless cards, a conversion or transposition interface being provided between the operating system and the communication device of the reader. Moreover, the operating system for contact type cards must comprise means for processing all electronic IC cards in accordance with the invention which are in communication with the communication device **40** of the reader.

1. Contactless electronic IC card (**10**), characterized in that it comprises

a communication device (**14**) for communicating with a contactless electronic IC card reader (**12**) in accordance with the ISO 14443-4 standard,

a contact type electronic IC card operating system (**16**) communicating by APDU command and APDU response in accordance with the ISO 7816-4 standard, the term APDU being an acronym for "Application Protocol Data Unit", and

a protocol conversion interface (**18**) between the communication device (**14**) and the operating system (**16**).

2. Card according to claim 1, characterized in that the APDU command and APDU response messages in accordance with the ISO 7816-4 standard are sent between the communication device (**14**) and the electronic IC card reader in accordance with an I-Block command format of the ISO 14443-4 standard, the APDU command or APDU response constituting the data zone (INF) of the I-Block command.

3. Card according to claim 2, characterized in that the protocol conversion interface (**18**) sends on the one hand the APDU command to the operating system (**16**) and, on the other hand, the APDU response from the operating system to the communication device (**14**).

4. Card according to claim 1, **2** or **3**, characterized in that the protocol conversion interface (**18**) is in software form under the control of the communication device (**14**).

5. Card according to claim 1, **2** or **3**, characterized in that the protocol conversion interface (**18**) is in software form under control of the operating system (**16**).

6. Reader for a contactless electronic IC card according to any one of the preceding claims 1 to 5, characterized in that it comprises:

a reader communication device (**40**) for communicating, as reader, with a plurality of contactless IC cards working in accordance with the ISO 14443-4 standard,

a reader operating system (**42**) for contact type electronic IC card operation as reader, and

a protocol conversion interface (**44**) between the reader communication device (**40**) and the reader operating system (**42**) to establish a communication in accordance with the ISO 7816-4 standard.

7. Reader according to claim 6, characterized in that the protocol conversion interface (**44**) is in software form under the control of the reader communication device (**40**).

8. Reader according to claim 6, characterized in that the protocol conversion interface (**44**) is in software form under the control of the reader operating system (**42**).

9. Reader according to claim 6, characterized in that the operating system comprises means for processing several electronic IC cards in communication with the reader communication device (**40**).

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