US 20070084925A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0084925 A1**

Palmade (43) **Pub. Date: Apr. 19, 2007**

(54) **CONTACTLESS IC CARD WITH OPERATING SYSTEM USED IN CONTACT TYPE CARDS AND READER FOR SUCH CONTACTLESS CARDS**

(75) Inventor: **Romain Palmade**, Auriol (FR)

Correspondence Address:
FLEIT, KAIN, GIBBONS, GUTMAN, BONGINI
& BIANCO P.L.
ONE BOCA COMMERCE CENTER
551 NORTHWEST 77TH STREET, SUITE 111
BOCA RATON, FL 33487 (US)

(73) Assignee: **STMICROELECTRONICS SA**, MONTROUGE (FR)

(21) Appl. No.: **11/564,864**

(22) Filed: **Nov. 30, 2006**

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/471,883, filed on Mar. 13, 2004, now Pat. No. 7,163,154, filed as 371 of international application No. PCT/FR02/00573, filed on Feb. 14, 2002.

(30) **Foreign Application Priority Data**

Mar. 13, 2001 (FR) 01 03401

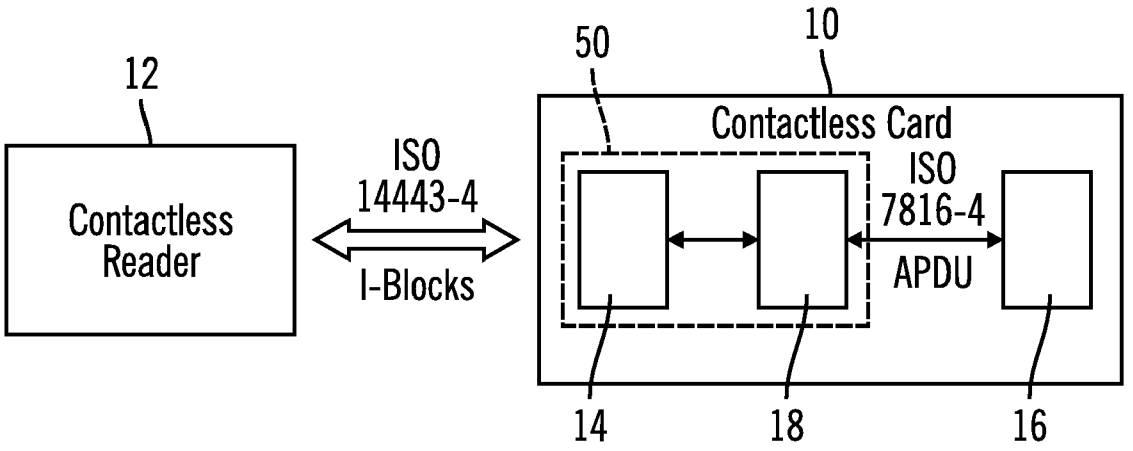
Publication Classification

(51) **Int. Cl.**
G06K 7/08 (2006.01)
G06K 19/06 (2006.01)

(52) **U.S. Cl.** **235/451**; 235/492

(57) **ABSTRACT**

A contactless electronic IC card (**10**), includes 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**).



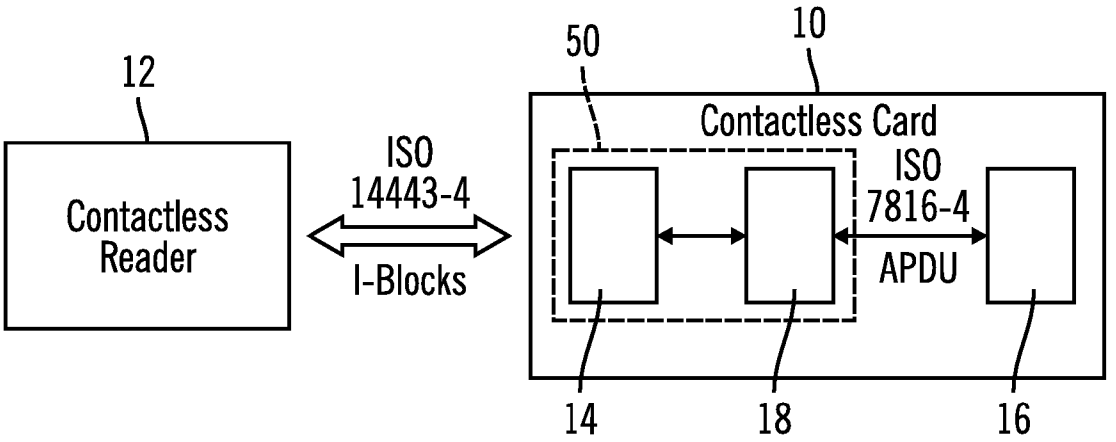

12
Contactless Reader
ISO 14443-4
I-Blocks
50
10
Contactless Card
ISO 7816-4
APDU
14
18
16

FIG. 1

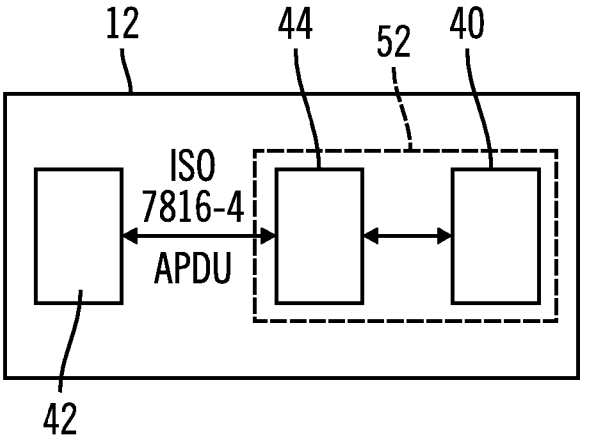

12
44
52
40
ISO 7816-4
APDU
42

FIG. 2

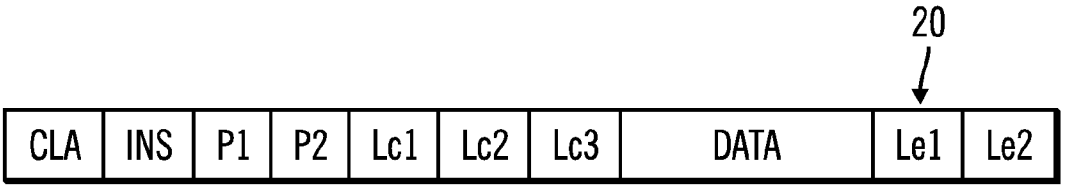


FIG. 3

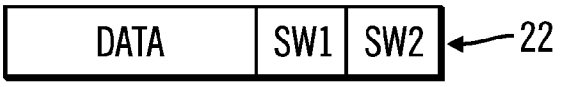


FIG. 4

FIG. 5

FIG. 6A

FIG. 6B

FIG. 6C

FIG. 6D

CONTACTLESS IC CARD WITH OPERATING SYSTEM USED IN CONTACT TYPE CARDS AND READER FOR SUCH CONTACTLESS CARDS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of Ser. No. 10/471,883 filed on Sep. 12, 2003, now U.S. Pat. No. _____, issued on _____, entitled "CONTACTLESS IC CARD WITH OPERATING SYSTEM USED IN CONTACT TYPE CARDS AND READER FOR SUCH CONTACTLESS CARDS", which is the National Stage of International Application No. PCT/FR2002/000573 filed on Feb. 14, 2002, now Publication No. WO 2002/073522, published on Sep. 19, 2002, which is based upon and claims priority from prior French Patent Application No. 01 03401 filed on Mar. 13, 2001.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] 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 a reader for such contactless IC cards.

[0004] 2. Description of Related Art

[0005] 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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.

[0010] Therefore a need exists to overcome the problems with the prior art as discussed above.

SUMMARY OF THE INVENTION

[0011] 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

[0012] This aim is achieved by producing a contactless electronic IC card, comprising:

[0013] a communication device for communicating with a contactless electronic IC card reader in accordance with the ISO 14443-4 standard,

[0014] a contact type electronic IC card operating system communicating by APDU command and APDU response in accordance with the ISO 7816-4 standard, and

[0015] a protocol conversion interface between the communication device and the operating system.

[0016] APDU is an acronym for "Application Protocol Data unit".

[0017] The protocol conversion interface is preferably in software form, the control being exercised by the communication device or the operating system.

[0018] The invention also relates to a reader for contactless electronic IC cards such as defined above, comprising:

[0019] 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,

[0020] a reader operating system for contact type electronic IC card operation as reader, and

[0021] 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,

[0022] 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.

[0023] This reader operating system comprises means for processing several above-defined electronic IC cards.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] 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:

[0025] FIG. **1** is a block diagram of a contactless card according to the invention and its communication link with a contactless card reader,

[0026] FIG. **2** is a block diagram of a contactless electronic IC card reader implemented with cards according to the invention,

[0027] FIG. **3** shows the format of an APDU command message in accordance with the ISO 7816-4 standard,

[0028] FIG. **4** shows the format of an APDU response message in accordance with the ISO 7816-4 standard,

[0029] FIG. **5** shows the format of an I-Block command message in accordance with the ISO 14443-4 standard, and

[0030] FIGS. **6***a*, **6***b*, **6***c* and **6***d* show the messages at different stages of communication.

DETAILED DESCRIPTION

[0031] A contactless electronic IC card **10** in accordance with the invention comprises, functionally and schematically:

[0032] a communication device **14** for communicating with a contactless electronic IC card reader **12**,

[0033] a contact type electronic IC card operating system **16**, and

[0034] a protocol conversion interface **18** for protocol conversion between the communication device **14** and the operating system **16**.

[0035] 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.

[0036] 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**.

[0037] 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.

[0038] The details of these bidirectional communications shall be described with reference to FIGS. **3** to **6**.

[0039] In the ISO 7816-4 standard, the APDU commands are defined according to the following message format **20** (FIG. **3**):

[0040] a CLA zone indicating the class of the command,

[0041] an INS zone defining the instruction,

[0042] two zones P**1** and P**2** indicating the instruction parameters,

[0043] three zones Lc**1**, Lc**2** and Lc**3** indicating the length of the data contained in a following DATA zone,

[0044] a DATA zone containing the data, and

[0045] two zones Le**1** and Le**2** containing the number of bytes to read if dealing with a read command.

[0046] The length of the message is practically not limited in an APDU command since its maximum size is of 16 777 225 bytes.

[0047] 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**.

[0048] This APDU response **22** comprises:

[0049] a DATA zone containing the data, and

[0050] two zones SW**1** and SW**2** which contain state bytes.

[0051] In the ISO 14443-4 standard, the so-termed I-Block commands are defined in accordance with the following message format **24** (FIG. **5**):

[0052] 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,

[0053] a CID zone which indicates the number of the card to process,

[0054] a NAD zone which indicates the application number,

[0055] an INF zone for the data, and

[0056] a zone EDC**1** and EDC**2** for a transmission error detection in respect of binary digits of the message.

[0057] 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).

[0058] 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.

[0059] There is then obtained the message **26** of FIG. **6***a*.

[0060] 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.

[0061] 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.

[0062] 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.

[0063] 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.

[0064] The contactless electronic IC card reader **12** sends APDU commands and receives APDU responses in accordance with the ISO 14443-4 standard.

[0065] 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.

[0066] Accordingly, the reader **12** must have a functional structure analogous to that of the electronic IC card **10**, i.e. comprising (FIG. **2**):

[0067] 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,

[0068] a reader operating system **42** of the type for contact type electronic IC cards, and

[0069] 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.

[0070] 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**.

[**0071**] 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.

[**0072**] 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**.

[**0073**] 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**.

[**0074**] 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.

[**0075**] 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.

[**0076**] Although specific embodiments of the invention have been disclosed, those having ordinary skill in the art will understand that changes can be made to the specific embodiments without departing from the spirit and scope of the invention. The scope of the invention is not to be restricted, therefore, to the specific embodiments, and it is intended that the appended claims cover any and all such applications, modifications, and embodiments within the scope of the present invention.

What is claimed is:

1. A system comprising:

a communication interface operable to receive commands from an external device, the commands formed in accordance with the ISO 7816-4 standard and transmitted within a data zone (INF) of one or more information blocks (I-Blocks) formed in accordance with the ISO 14443-4 standard; and

a processing device having an operating system responsive to commands formed in accordance with the ISO 7816-4 standard and forming responses in accordance with the ISO 7816-4 standard,

the communication interface operable to extract received commands from the one or more information blocks,

the processing device operable to execute the extracted commands and generates responses formed in accordance with the ISO 7816-4 standard, and

the communication interface operable to transmit the responses to the external device within a data zone (INF) of at least one information block (I-Block) formed in accordance with the ISO 14443-4 standard.

2. The system according to claim 1, wherein the commands comprise Application Protocol Data Units (APDUs).

3. The system according to claim 1, further comprising software controlled by the communication interface that performs extraction of the received commands from the information blocks.

4. The system according to claim 1, wherein the communication interface is operable to communicate the extracted commands to the processing device in accordance with the ISO 7816-4 standard.

5. The system according to claim 1, wherein the responses comprise Application Protocol Data Units (APDUs).

6. The system according to claim 1, further comprising software controlled by the communication interface that performs insertion of the responses into the information blocks.

7. The system according to claim 1, wherein the processing device is operable to communicate the responses to the communication interface in accordance with the ISO 7816-4 standard.

8. A contactless integrated circuit (IC) card including the system according to claim 1, the card further comprising:

a communication device operable to transmit and receive communication signals in accordance with the ISO 14443-4 standard.

9. A system comprising:

a processing device having an operating system responsive to commands formed in accordance with the ISO 7816-4 standard and forming responses in accordance with the ISO 7816-4 standard; and

a communication interface operable to receive, from an external device, commands formed in accordance with the ISO 7816-4 standard and transmitted within a data zone (INF) of at least one information block (I-Block) command formed in accordance with the ISO 14443-4 standard,

the communication interface operable to extract received commands from the information block(s) and to communicate the extracted commands to the processing device in accordance with the ISO 7816-4 standard.

10. The system according to claim 9, wherein the commands comprise Application Protocol Data Units (APDUs).

11. The system according to claim 9, further comprising software controlled by the communication interface that performs extraction of the received commands from the information blocks.

12. The system according to claim 9, wherein the processing device is operable to execute the extracted commands and to generate responses formed in accordance with the ISO 7816-4 standard, and the communication interface is operable to transmit the responses to the external device within a data zone (INF) of at least one information block (I-Block) command formed in accordance with the ISO 14443-4 standard.

13. The system according to claim 12, wherein the responses comprise Application Protocol Data Units (APDUs).

14. The system according to claim 12, wherein the processing device is operable to communicate the responses to the communication interface in accordance with the ISO 7816-4 standard.

15. The system according to claim 12, further comprising software controlled by the communication interface that performs insertion of the responses into the information blocks.

16. A contactless integrated circuit (IC) card including the system according to claim 9, the card further comprising:

a communication device operable to transmit and receive communication signals in accordance with the ISO 14443-4 standard.

17. A system comprising:

a processing device having an operating system responsive to commands formed in accordance with the ISO 7816-4 standard and forming responses in accordance with the ISO 7816-4 standard; and

a communication interface operable to receive, from an external device, commands formed in accordance with the ISO 7816-4 standard and to transmit within a data zone (INF) of at least one information block (I-Block) command formed in accordance with the ISO 14443-4 standard,

the processing device operable to execute the commands to generate responses and to communicate the responses to the communication interface in accordance with the ISO 7816-4 standard.

18. The system according to claim 17, wherein the commands comprise Application Protocol Data Units (APDUs).

19. The system according to claim 17, wherein the communication interface is operable to extract received commands from the information block(s).

20. The system according to claim 19, further comprising software controlled by the communication interface that performs extraction of the received commands from the information blocks.

21. The system according to claim 19, wherein the communication interface is operable to communicate the extracted commands to the processing device in accordance with the ISO 7816-4 standard.

22. The system according to claim 19, wherein the responses comprise Application Protocol Data Units (APDUs).

23. The system according to claim 19, further comprising software controlled by the communication interface that performs insertion of the responses into the information blocks.

24. A contactless integrated circuit (IC) card including the system according to claim 17, the card further comprising:

a communication device operable to transmit and receive communication signals in accordance with the ISO 14443-4 standard.

25. A method of operating a contactless integrated circuit (IC) card, the method comprising:

receiving one or more ISO 14443-4 information blocks (I Blocks) in the contactless integrated circuit card from an external device, wherein each of the one or more information blocks contain at least a portion of a command formed in accordance with the ISO 7816-4 standard in a data zone (INF) thereof;

extracting the command from the one or more information blocks; and

communicating the extracted command in accordance with the ISO 7816-4 standard to a processing device within the contactless integrated circuit card, the processing device having an operating system responsive to commands formed in accordance with the ISO 7816-4 standard and forming responses in accordance with the ISO 7816-4 standard.

26. The method according to claim 25, wherein the command comprises an Application Protocol Data Unit (APDU).

27. The method according to claim 25, wherein software controlled by a communication interface in the contactless integrated circuit card and coupled to the processing device extracts the command from the one or more information blocks.

28. The system according to claim 27, wherein a communication device in the contactless integrated circuit card and coupled to the communication interface receives the one or more information blocks.

29. A method of operating a contactless integrated circuit (IC) card, the method comprising:

executing a command formed in accordance with the ISO 7816-4 standard and received from an external device within a processing device in the contactless integrated circuit card, the processing device having an operating system responsive to commands formed in accordance with the ISO 7816-4 standard and forming responses in accordance with the ISO 7816-4 standard;

generating a response to the command, wherein the response is formed in accordance with the ISO 7816-4 standard; and

transmitting the response from the contactless integrated circuit card to the external device in a data zone (INF) of one or more ISO 14443-4 information blocks (I Blocks).

30. The method according to claim 29, wherein the response comprises an Application Protocol Data Unit (APDU).

31. The method according to claim 29, wherein software controlled by a communication interface in the integrated circuit card coupled to the processing device inserts the response into the one or more information blocks.

32. The method according to claim 29, wherein a communication device in the contactless integrated circuit card and coupled to the communication interface transmits the one or more information blocks.

33. A system comprising:

an operating system responsive to commands formed in accordance with the ISO 7816-4 standard and forming responses in accordance with the ISO 7816-4 standard;

means for receiving commands from an external device, the commands formed in accordance with the ISO 7816-4 standard and transmitted within a data zone (INF) of one or more information blocks (I-Blocks) formed in accordance with the ISO 14443-4 standard;

means for extracting received commands from the one or more information blocks;

means for executing the extracted commands and generating responses formed in accordance with the ISO 7816-4 standard; and

means for transmitting the responses to the external device within a data zone (INF) of at least one information block (I-Block) formed in accordance with the ISO 14443-4 standard.

34. The system according to claim 33, wherein the commands comprise Application Protocol Data Units (APDUs).

35. The system according to claim 33, further comprising software means for performing extraction of the received commands from the information blocks.

36. The system according to claim 33, further comprising means for communicating the extracted commands to the operating system in accordance with the ISO 7816-4 standard.

37. The system according to claim 33, wherein the responses comprise Application Protocol Data Units (APDUs).

38. The system according to claim 33, further comprising software means for performing insertion of the responses into the information blocks.

39. The system according to claim 33, wherein the operating system is operable to communicate the responses to the means for communicating in accordance with the ISO 7816-4 standard.

40. A contactless integrated circuit (IC) card including the system according to claim 33, the card further comprising:

means for transmitting and receiving communication signals in accordance with the ISO 14443-4 standard.

* * * * *