

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
19 October 2006 (19.10.2006)

PCT

(10) International Publication Number
WO 2006/110000 A1

(51) International Patent Classification:
G06K 19/07 (2006.01)

(21) International Application Number:
PCT/KR2006/001360

(22) International Filing Date: 13 April 2006 (13.04.2006)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2005-0031241 15 April 2005 (15.04.2005) KR

(71) Applicant (for all designated States except US): **KTFree-
tel CO., LTD.** [KR/KR]; 7-18 Sinchun-dong Songpa-gu,
Seoul 138-703 (KR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **NA, Jun-Chae**
[KR/KR]; 412-1008 Gayang Apt. Gayang-2-dong
Kangseo-gu, Seoul 157-202 (KR). **KIM, Min-Jeoung**
[KR/KR]; 302-1310 Hyundai-hometown Apt.,
Bongchun-6-dong Gwanak-gu, Seoul 151-056 (KR). **KIM,
Kyung-Tae** [KR/KR]; 101-1202 Chungdam-hyundai Apt.,
Chungdam-dong Kangnam-gu, Seoul 135-100 (KR).

(74) Agent: **C & S PATENT AND LAW OFFICE**; C-2306
Daelim Acrotel 467-6 Dogok-dong Kangnam-gu, Seoul
135-971 (KR).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KM, KN, KP, KZ, LC, LK, LR, LS, LT, LU, LV, LY,
MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO,
NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK,
SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,
VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- with amended claims

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: CONTACTLESS TYPE INTEGRATED CIRCUIT CARD AND METHOD FOR COMMUNICATING DATA BY
MULTIPROTOCOL

(57) Abstract: A contactless type integrated circuit (IC) card for supporting a plurality of protocols to communicate with a card terminal and a method of communicating thereof are provided. The contactless type IC card includes: a transceiving unit for transmitting and receiving a radio frequency signal to/from a card terminal using a plurality of protocols; a plurality of protocol processing units for processing signals received through the transceiving unit according to corresponding protocols; and a protocol selecting unit for transmitting a request signal received through the transceiving unit to the plurality of the protocol processing units, receiving data error check values from the plurality of the protocol processing units and selecting one of the protocol processing units to be used for communicating with the card terminal corresponding to the received signal based on the data error check value.



WO 2006/110000 A1

Description

CONTACTLESS TYPE INTEGRATED CIRCUIT CARD AND METHOD FOR COMMUNICATING DATA BY MUL- TI-PROTOCOL

Technical Field

- [1] The present invention relates to a contactless type integrated circuit (IC) card for supporting a plurality of protocols to communicate with a card terminal and a method of communicating thereof.

[2]

Background Art

- [3] A contactless type integrated circuit card (IC) denotes a card capable of exchanging data with a card terminal without being contacted to the card terminal. That is, the contactless type IC card communicates with the card terminal using self-generated power in response to a radio frequency (RF) signal transmitted from the card terminal.

- [4] FIG. 1 is a block diagram showing a conventional method of recognizing a contactless type IC card. Referring to FIG. 1, a card terminal 100 generates a radio frequency (RF) signal, transmits the RF signal and communicates with a contactless type IC card 200 separated at a predetermined distance D from the card terminal 100 using the RF signal.

- [5] The RF signal transmitted from the card terminal 10 induces the contactless type IC card 200 to self-generate power to communicate with the card terminal.

- [6] In order to communicate, the card terminal 100 and the contactless type IC card 200 must employ a predetermined communication standard. That is, the contactless IC card using a 13.56MHz of shortwave may be classified by a distance from the card terminal into a close range such as 10cm or an adjacent range such as 1m. The close range non-contact type IC card employs a communication protocol standard ISO/IEC 14443 and is further classified into a type A and a type B according to the communication protocol. A non-standard protocol MIFARE is also included in the close range contactless IC card. The adjacent range contactless IC card employs a communication protocol standard ISO/IEC 15693.

- [7] The close range contactless type IC card may be embodied as a bus fare card, a phone card or a prepaid card. The adjacent range IC card may be embodied as an ID card for entering a specific gate, as a certification or as a card for managing products.

- [8] As described above, the standards of the contactless IC cards, ISO/IEC 14443 and ISO/IEC 15693, have different application fields and employ different wireless communication protocols according to the distance from the card terminal.

[9] However, the conventional way of communication between the contactless type IC card and the card terminal has a limitation. That is, a service provider must select one of the standards to provide a target service using a contactless IC card. Therefore, the service provider must manufacture systems providing the target service in various types for supporting different protocols.

[10] In order to receive various services provided with a contactless IC card, a user must use different contactless type IC cards according to a target service.

[11] For example, a bus fare auto-paying service using a contactless IC card employing the ISO 14443 type A was already available in Seoul, Korea. If a service provider wants to provide another bus fare auto-paying service using an adjacent range contactless IC card supporting Mifare in Seoul Korea, the service provider must provide a backbone system such as a new reader and a new contactless IC card supporting ISO 15693 although the backbone systems supporting the ISO 14443 type A were already provided in Seoul, Korea. Therefore, there is a limitation to provide various contactless IC card services.

[12]

Disclosure of Invention

Technical Problem

[13] An object of the present invention is to provide a contactless IC card for supporting various protocols to communicate with a card terminal.

[14] Another object of the present invention is to provide a method of communicating between a card terminal and a contactless IC card using a plurality of protocols.

[15]

Technical Solution

[16] In order to achieve the above objects, the present invention provides a contactless IC (integrated circuit) card capable of using a plurality of protocol for data communication, including: a transceiving unit for transmitting and receiving a radio frequency signal to/from a card terminal using a plurality of protocols; a plurality of protocol processing units for processing signals received through the transceiving unit according to corresponding protocols; and a protocol selecting unit for transmitting a request signal received through the transceiving unit to the plurality of the protocol processing units, receiving data error check values from the plurality of the protocol processing units and selecting one of the protocol processing units to be used for communicating with the card terminal corresponding to the received signal based on the data error check value.

[17]

[18] The contactless IC card may further include a switch for deciding a data transmit

path to selectively transmit the signal from the card terminal to the protocol processing unit selected by the protocol selecting unit. The switch may switch the plurality of the protocol processing units at a predetermined cycle in response to the protocol selecting unit until one of the protocol processing units is selected.

- [19] The transceiving unit may include an antenna coil made of a winded thin wire for generating an inductive power in response to a radio frequency signal of the card terminal.
- [20] Each of the protocol processing units may include: a memory for storing a signal received at the corresponding protocol processing unit from the card terminal and a signal transmitted to the card terminal from the protocol processing unit; a modulating/demodulating unit for modulating or demodulating a signal used in the protocol processing unit and another signal used in the card terminal using protocol information of corresponding protocol processing unit; a data detecting unit for extracting essential information from the information stored in the memory and transmitting the extracted information to the modulating/demodulating unit; and an error checking unit for checking an error on the modulated data and transmitting the result of the checking error to the protocol selecting unit.
- [21] In order to achieve the above objects, the present invention also provides a method of communications using a contactless IC card capable of data communication through a plurality of protocols, the method including the steps of: a) transiting the state of the contactless IC card to a power-on state by generating an inductive power inside the contactless IC card in response to a radio frequency signal outputted from a card terminal; b) deciding one of protocol processing units corresponding to a request signal transmitted from the card terminal; and c) performing operations to communicate with the card terminal using a protocol corresponding to the decided protocol processing unit.
- [22] The step c) for selecting a protocol may include the steps of: c-1) transferring the request signal from the card terminal to a plurality of the protocol processing units; c-2) modulating the request signal based on a corresponding protocol at each of the protocol processing units; c-3) performing an error checking process on the modulated request signal at each of the protocol processing units; and c-4) selecting one of protocols that is used to transmit the request signal based on the result of performing the error check.
- [23] The error checking process may be a cyclic redundancy check (CRC) performed on the modulated data.
- [24]

Advantageous Effects

- [25] The contactless IC card according to the present invention is capable of using a plurality of protocols for data communication. Therefore, the service provider is allowed to conveniently provide services related to the contactless IC card and the user is also allowed to conveniently use various services related to the contactless IC card. That is, various services using the contactless IC card may be provided according to the present invention.

[26]

Brief Description of the Drawings

- [27] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

- [28] FIG. 1 is a block diagram showing a conventional method of recognizing a contactless type IC card;

- [29] FIG. 2 is a block diagram illustrating a contactless IC card according to an embodiment of the present invention;

- [30] FIG. 3 is a block diagram illustrating a protocol processing unit according to an embodiment of the present invention;

- [31] FIG. 4 is a schematic flowchart of a method of deciding a protocol to communicate with a card terminal supporting a multiprotocol in a contactless type IC card according to an embodiment of the present invention;

- [32] FIG. 5 is a flowchart illustrating a method of communicating in a contactless IC card according to an embodiment of the present invention;

- [33] FIG. 6 is a graph showing intensities of electromagnetic fields according to a distance in RF protocols using 13.56 MHz;

- [34] FIG. 7 is a flowchart illustrating a method of deciding a protocol to communicate with a card terminal supporting multiprotocol in a contactless IC card according to another embodiment of the present invention;

- [35] FIG. 8 is a flowchart illustrating a method of deciding a protocol to communicate with a card terminal supporting multiprotocol in a contactless IC card according to still another embodiment of the present invention.; and

- [36] FIG. 9 shows a format of a response signal message according to ISO 7618-3 of a protocol processing unit for a request signal of a card terminal.

[37]

Best Mode for Carrying Out the Invention

- [38] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

- [39] FIG. 2 is a block diagram illustrating a contactless IC card according to an embodiment of the present invention.
- [40] Referring to FIG. 2, the contactless IC card 200 according to the present embodiment includes a transceiving unit 210, a protocol selecting unit 220, a switch 230, and a plurality of protocol processing units 240 to 260.
- [41] The transceiving unit 210 receives a radio frequency (RF) signal transmitted from a card terminal (not shown) and generates an inductive power to drive the contactless IC card 200. In order to generate the inductive power, the transceiving unit 210 includes an antenna coil (not shown) made of a winded thin wire. Especially, it is preferable that the antenna coil may be included inside the contactless IC card. The antenna coil generates the inductive power using the RF signal transmitted from the card terminal. The generated inductive power transmits the state of the contactless IC card 200 into a power-on state.
- [42] The protocol selecting unit 220 receives a request signal from the transceiving unit 210 and transmits the received request signal to a plurality of the protocol processing units 240, 250 and 260. The protocol selecting unit 220 receives a data error check value, for example, cyclic redundancy check (CRC), from each of the protocol processing units 240, 250 and 260 as a response of the request signal, and selects one of the protocol processing units 240, 250 and 260 based on the data error check value.
- [43] As shown in FIG. 2, the contactless IC card 200 includes the switch 230 between the protocol selecting unit 220 and a plurality of protocol processing units 240, 250 and 260. The switch 230 selectively transmits the output of the protocol selecting unit 220 to one of the protocol processing units 240, 250 and 260. The switch 230 is controlled in response to the protocol selecting unit 220, and the switch 230 connects the protocol selecting unit 220 to a selected one of the protocol processing units 240, 250 and 260. There is no limitation to selectively connect the protocol selecting unit 220 and one of the protocol processing units 240, 250 and 260. As shown in FIG. 2, the present embodiment uses a method of using the switch 230 to alternatively connect the protocol selecting unit 220 to one of the protocol processing units 240, 250 and 260 at a predetermined cycle is shown. However, the present invention is not limited by the switching operation of the switch 230 shown in FIG. 2.
- [44] When the transceiving unit 210 receives the request signal, the protocol selecting unit 220 transmits the received request signal to all of the protocol processing units 240, 250 and 260. The protocol processing units 240, 250 and 260 receive the request signal and feed the error check values back to the protocol selecting unit 220 as the response of the request signal. The protocol selecting unit 220 decides one of the protocol processing units 240, 250 and 260 to perform the data communication between the contactless IC card to the card terminal based on the feed-back error check

values from the protocol processing units 240, 250 and 260.

- [45] FIG. 3 is a block diagram block diagram illustrating a protocol processing unit according to an embodiment of the present invention. Herein, a plurality of the protocol processing units 240, 250 and 260 is driven by different protocols. The present invention is not limited by the number and the arrangement of the protocol processing units. Therefore, the number and the arrangement of the protocol processing units may be decided by those skilled in the art without departing from the scope and spirit of the invention.
- [46] Referring to FIG. 3, the protocol processing unit includes a modulating/de-modulating unit 241, a data detecting unit 242, a memory 243 and a CRC unit 244.
- [47] When the protocol processing unit 240 receives the request signal from the transceiving unit 210 through the protocol selecting unit 220, the modulating/de-modulating unit 241 modulates the request signal and transmits the modulated request signal to the data detecting unit 242. Also, the modulating/demodulating unit 241 demodulates data transmitted to the card terminal 100. Herein, the modulating/de-modulating unit 241 uses protocol information supported by the corresponding protocol processing unit for modulating/ demodulating signals.
- [48] The data detecting unit 242 detects essential information from information stored in the memory using the modulated signal from the modulating/demodulating unit 241 and transmits the detected information to the modulating/demodulating unit 241. For example, if a card terminal requests the traffic fare charging information stored in the memory 243, the data detecting unit 242 extracts the traffic fare charging information from the memory 243 and transmits the extracted information to the modulating/de-modulating unit 241.
- [49] The memory 243 stores data received/transmitted from/to a card terminal through a protocol supported by the corresponding protocol processing unit. For example, if the protocol processing unit supports ISO/IEC 14443 type A, the memory 243 stores information related a traffic fare card such as charging or bus fare in order to use a traffic fare automatic paying service driven by the protocol ISO/IEC 14443 type A supported by the protocol processing unit.
- [50] The CRC unit 244 performs a cyclic redundancy check (CRC) on an input signal to determine whether there is error included in the input signal which is modulated through the modulating/ demodulating unit 241. That is, it determines whether the input signal is transmitted using a protocol supported by a corresponding protocol processing unit or not. The CRC unit 244 feeds the result, for example, a CRC value, back to the protocol selecting unit 220. For example, if the first protocol processing unit 240 supports the protocol ISO/IEC 14443 type A and the request signal created based on the ISO/IEC 14443 type A is received from the card terminal, the CRC unit

244 determines that there is no error. However, if the first protocol processing unit 240 supports ISO/IEC 14443 type A and a request signal created based on the ISO/IEC 15693 is received from the card terminal, the CRC unit 244 determines that there is the error in the request signal.

- [51] FIG. 4 is a schematic flowchart showing a method of deciding a protocol to communicate with a card terminal supporting a multiprotocol at a contactless type IC card according to an embodiment of the present invention.
- [52] At first, if the contactless IC card 200 according to the present embodiment receives a RF signal from the card terminal 100 at step S105, the antenna coil (not shown) included in the transceiving unit 210 of the contactless IC card 200 generates the inductive power and the state of the contactless IC card 200 is transited to the power-on state at step S110.
- [53] The protocol selecting unit 220 waits to receive a request signal from the card terminal 100 at step S115. When the protocol selecting unit 220 receives the request signal from the card terminal 100 at step S120, the protocol selecting unit 220 transmits the received request signal to all of the first protocol processing unit 240, the second protocol processing unit 250 and the third protocol processing unit 260 at steps S125, S135 and S145. The first protocol processing unit 240, the second protocol processing unit 250 and the third protocol processing unit 260 modulate the request signal using the corresponding protocols and feed the result of checking the error back to the protocol selecting unit 220 at step S130, S140 and S150.
- [54] The protocol selecting unit 220 receives the CRC values from each of the protocol processing units 240, 250 and 260 and decides the protocol to be used for communicating with the card terminal 100 using the CRC values at step S155. That is, the protocol selecting unit 220 detects a CRC value having no error among the received CRC values from the protocol processing units 240, 250 and 260. Then, the protocol selecting unit 220 decides the protocol used in the protocol processing unit that transmits the CRC value with no error as a protocol to be used for communicating with the card terminal 100. Then, the protocol selecting unit 220 and the corresponding protocol processing unit transmitting the detected CRC value are connected (not shown).
- [55] FIG. 5 is a flowchart illustrating a method of communicating between a contactless IC card and a card terminal according to an embodiment of the present invention. Especially, FIG. 5 is a flowchart showing a data communication process between the contactless IC card capable of communicating through a plurality of protocols and the card terminal using a predetermined protocol.
- [56] When the contactless IC card 200 comes near to the card terminal 100, the contactless IC card 200 generates the inductive power using the RF signal transmitted

from the card terminal, and the state of the contactless IC card 200 is transited to the power-on state by the generated inductive power at step S205. The contactless IC card 200 waits to receive a request signal from the card terminal 100 at step S210.

[57] When the contactless IC card 200 receives the request signal from the card terminal 100 at step S215, the protocol selecting unit 230 transmits the request signal to the all of the protocol processing units 240, 250 and 260 in the contactless IC card 200 at step S220. And, the protocol selecting unit 230 receives the error check values, for example, a CRC value, from the protocol processing units 240, 250 and 260 as a response of the request signal at step S225.

[58] The contactless IC card 200 selects one of the protocol processing units to be used to communicate to the card terminal 100 based on the error check values at step S230. That is, the contactless IC card 200 selects the protocol processing unit that transmits the error check value with no error as a protocol processing unit to be used for communicating to the card terminal.

[59] After selecting the protocol processing unit for communicating to the card terminal 100, the data communication to the card terminal 100 is performed using the selected protocol processing unit at step S235.

[60] FIG. 6 is a graph showing intensities of electro-magnetic fields according to a distance in RF protocols using 13.56 MHz, and FIG. 7 is a flowchart illustrating a method of deciding a protocol to communicate with a card terminal supporting multiprotocol in a contactless IC card according to another embodiment of the present invention.

[61] In the graph shown in FIG. 6, a protocol A may be ISO 14443 type A and type B, a protocol B may be AFC and a protocol C may be ISO 15693. As shown in FIG. 6, the intensities of the electromagnetic fields of each protocol are different not only according to a distance but also according to each protocol.

[62] In FIG. 7, if the contactless IC card 200 according to the present embodiment receives the RF signal from the card terminal 100 at step S205, the antenna coil (not shown) included in the transceiving unit 210 of the contactless IC card 200 generates the inductive power and the contactless IC card 200 is transited to the power-on state at step S310.

[63] Then, the protocol selecting unit 200 decides a protocol priority based on the intensity of the electromagnetic field received from the transceiving unit 210 and stores the decided protocol priority at step S311. The protocol priority is decided according to a relation between a type of protocol and intensity thereof. For example, if the intensity of the electromagnetic field received from the transceiving unit 210 is about 7H, the protocol priority is decided in an order of the protocol A, the protocol B and the protocol C as shown in the graph of FIG. 6.

- [64] After storing the protocol priority, the protocol selecting unit 220 waits to receive a request signal from the card terminal 100 at step S315. If the contactless IC card 200 receives the request signal from the card terminal 100 at step S320, the protocol selecting unit 220 reads the stored protocol priority information at step S321 and transmits the request signal to the protocol processing units in the order of the protocol priority at steps S325, S335 and S345. That is, a test is preferentially performed on a protocol processing unit corresponding to the selected protocol by previously estimating a protocol to be used for the data communication between the contactless IC card 200 and the card terminal supporting the contactless communication protocol according to the intensity of the electro-magnetic field outputted from the card terminal. Therefore, the data communication between the card terminal and the contactless IC card is further quickly established according to the present embodiment.
- [65] The first protocol processing unit 240, the second protocol processing unit 250 and the third protocol processing unit 260 modulate the request signals using corresponding protocols and feed the result of checking the error in the modulated signals, for example, a CRC, back to the protocol selecting unit 220 at steps S130, S140 and S150.
- [66] The protocol selecting unit 220 receives the CRC values from the protocol processing units 240, 250 and 260 and decides a protocol to be used for data communication to the card terminal 100 using the CRC values at step S155. That is, the protocol selecting unit 220 selects a CRC value having no error among the received CRC values and selects a protocol supported by the protocol processing unit that transmits the selected CRC value as a protocol to be used for data communication with the card terminal. Then, the protocol processing unit transmitting the selected CRC value is connected to the protocol selecting unit 220 (not shown).
- [67] For example, if the CRC value from the first protocol processing unit 240 does not include the error, the protocol supported by the first protocol processing unit 240 is decided for data communication between the card terminal 100 and the contactless IC card 200. Herein, if the first protocol processing unit 240 responds a message noticing there is no error, it is preferable to connect the protocol selecting unit 200 and the first protocol processing unit 240 without waiting to receive the CRC values from the second protocol processing unit 250 and the n^{th} protocol processing unit 260.
- [68] FIG. 8 is a flowchart illustrating a method of deciding a protocol to communicate with a card terminal supporting multiprotocol in a contactless IC card according to still another embodiment of the present invention, and FIG. 9 shows a format of a response signal message according to ISO 7618-3 of a protocol processing unit for a request signal of a card terminal.
- [69] Steps for deciding a protocol to communicate with a card terminal supporting mul-

tiprotocol in FIG. 8 are identical or similar to the steps S305 to S355 shown in FIG. 6.

[70] After the protocol selecting unit 220 decides the protocol processing unit 300 corresponding to the protocol to be used to communicate with the card terminal supporting the multiprotocol at step S355, it determines whether the decided protocol is matched with the protocol priority at step S360. The protocol priority is obtained at the step S311 and the protocol having higher priority denotes a protocol having a superior recognizing rate in the communication between the contactless IC card 200 and the card terminal supporting the multiprotocol. The protocol selecting unit 220 transmits the protocol priority information obtained in step S311 to the decided protocol processing unit 300 at step S365. Herein, it is preferable that the protocol selecting unit 220 only transmits the protocol priority information to the decided protocol processing unit 300 if the protocol decided at the step S355 is different from the protocol having high priority in the step S311.

[71] Then, the protocol processing unit 300 selected by the protocol selecting unit 220 creates a response message for the request message from the card terminal 100 and transmits the created response message to the protocol selecting unit 220 at step S370 and the protocol selecting unit 220 transmits the response message to the card terminal 100 at step S375.

[72] FIG. 9 shows a format of a response signal message according to ISO 7618-3 of a protocol processing unit for a request signal of a card terminal.

[73] A response signal message 400 includes state information of the contactless IC card, basically. Such an information is included in trailer data T0 410, T1, T2, ... Tk 450. Herein, the response signal message 400 includes the protocol priority information TD1 420, TD2 430, ~ TDn 440 between T0 410 and T1, ... and T(k-1) and Tk. First four bits 421, 431 and 441 of the TD1 420, TD2 430, ~ TDn 440 are information related to the protocol and following bits 422 to 425, 432 to 435 and 442 to 445 are state information related to the first four bits 421, 431 and 441.

[74] If the response message from the protocol processing unit 300 includes the protocol priority information generated at the step S311, it is preferable that the card terminal 100 may communicate with the contactless IC card a protocol selected based on the protocol priority generated from the step S311. Accordingly, it is preferable that the card terminal may transmit the request signal according to the protocol having a superior recognizing rate based on the protocol priority of the step S311 to the contactless IC card again.

[75] The above-described method according to the present invention can be embodied as a program and stored on a computer readable recording medium. The computer readable recording medium is any data storage device that can store data which can be thereafter read by the computer system. The computer readable recording medium

includes a read-only memory (ROM), a random-access memory (RAM), a CD-ROM, a floppy disk, a hard disk, an optical magnetic disk, , and carrier waves such as data transmission through the Internet. The computer-readable recording medium can also be distributed over network-coupled computer systems so that the computer-readable code is stored and executed in a distributed fashion. Also, functional programs, codes, and code segments for accomplishing the present invention can be easily construed by programmers skilled in the art to which the present invention pertains.

[76] Also, the present invention may be applied not only to a contactless communication protocol using a 13.56MHz of the RF signal but also to a communication protocol using a 900MHz or other frequency bands of the RF signal.

[77] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

- [1] A contactless IC (integrated circuit) card capable of data communication using a protocol selected from a plurality of protocols, comprising:
a transceiving unit for transmitting and receiving a radio frequency signal to/from a card terminal using a protocol selected from a plurality of protocols;
a plurality of protocol processing units for processing signal received through the transceiving unit, according to distinguished protocol respectively; and
a protocol selecting unit for transmitting a request signal received through the transceiving unit to the plurality of the protocol processing units, receiving data error check values from the plurality of the protocol processing units and selecting one of the protocol processing units corresponding to the protocol of the received signal, based on the data error check value.
- [2] The contactless IC card of claim 1, further comprising a switching unit for deciding a data transmit path to selectively transmit the signal from the card terminal to the protocol processing unit selected by the protocol selecting unit.
- [3] The contactless IC card of claim 2, wherein the switching unit switches the plurality of the protocol processing units until one of the protocol processing units is selected at a predetermined cycle in response to the protocol selecting unit.
- [4] The contactless IC card of any one of claims 1 to 3, wherein the transceiving unit includes an antenna coil winded by thin wire for generating an inductive power in response to a radio frequency signal from the card terminal.
- [5] The contactless IC card of any one of claims 1 to 3, wherein the protocol processing unit includes:
a memory for storing a signal received at the corresponding protocol processing unit from the card terminal and a signal transmitted to the card terminal from the protocol processing unit;
a modulating/demodulating unit for modulating or demodulating a signal used in the protocol processing unit and another signal used in the card terminal using protocol information of corresponding protocol processing unit;
a data detecting unit for extracting essential information from the information stored in the memory and transmitting the extracted information to the modulating/demodulating unit; and
an error checking unit for checking an error on the modulated data and transmitting the result of the error checking to the protocol selecting unit.
- [6] The contactless IC card of claim 5, wherein the error checking unit performs CRC (cycle redundancy check) on the modulated data and feeds the result of the

CRC back to the protocol selecting unit.

- [7] A method of communicating between a card terminal and a contactless IC card comprising a plurality of protocol processing units processing signals with a protocol dislike each other selected from a plurality of protocols, the method comprising the steps of:
- a) transiting the state of the contactless IC card to a power-on state by generating an inductive power inside the contactless IC card in response to a radio frequency signal from the card terminal;
 - b) determining one of protocol processing units corresponding to the protocol of a request signal transmitted from the card terminal; and
 - c) performing operations to communicate with the card terminal using a protocol corresponding to the decided protocol processing unit.
- [8] A method of communicating between a card terminal and a contactless IC card comprising a plurality of protocol processing units processing signals with a protocol dislike each other selected from a plurality of protocols, the method comprising the steps of:
- a) transiting the state of the contactless IC card to a power-on state by generating an inductive power inside the contactless IC card in response to a radio frequency signal outputted from a card terminal;
 - b) obtaining a protocol priority from intensity of electromagnetic field of a radio frequency signal outputted from the card terminal;
 - c) selecting one of protocol processing units corresponding to the protocol of a request signal received from the card terminal based on the obtained protocol priority; and
 - d) performing operations to communicate with the card terminal using a protocol corresponding to the decided protocol processing unit.
- [9] The method of claim 8, wherein the selected protocol processing unit transmits, corresponding to the request signal, a response comprising information related to the protocol priority obtained from intensity of electromagnetic field of a radio frequency signal from the card terminal.
- [10] The method of any one of claims 7 to 9, the step c) includes the steps of:
- c-1) transferring the request signal from the card terminal to a plurality of the protocol processing units;
 - c-2) modulating the request signal based on a corresponding protocol at each of the protocol processing units;
 - c-3) performing an error checking process on the modulated request signal at each of the protocol processing units; and
 - c-4) selecting one of protocols that is used to transmit the request signal based on

the result of performing the error check.

- [11] The method of claim 10, wherein the error checking process is a cyclic redundancy check (CRC) performed on the modulated data.
- [12] A computer readable recording medium storing a program for communicating between a card terminal and a contactless IC card capable of using a plurality of protocols to communicate, comprising:
determining which one of the protocols is used to transmit a signal from a card terminal by responding the signal from the card terminal when the recording medium is driven in response to a radio frequency signal from a card terminal;
and
performing operations to communicate between the card terminal and the contactless IC card using the protocol corresponding to the request signal based on the result of the determination.
- [13] A computer readable recording medium storing a program for communicating between a card terminal and a contactless IC card capable of using a plurality of protocols to communicate, comprising:
determining which one of the protocols is used to transmit a signal from a card terminal by responding the signal from the card terminal according to a protocol priority obtained from intensity of electromagnetic field of a radio frequency signal outputted from the card terminal when the recording medium is driven in response to a radio frequency signal from a card terminal; and
performing operations to communicate between the card terminal and the contactless IC card using the protocol corresponding to the request signal based on the result of the determination.
- [14] The computer readable recording medium of claim 13, further comprising transmitting information about the protocol priority obtained from intensity of electromagnetic field of the radio frequency signal outputted from the card terminal with the response of the request signal to the card terminal after the determining of the protocol and before the performing of operations to communicate.
- [15] The computer readable recording medium of any one of claims 12 to 14, wherein the determining of the protocol includes:
modulating the data signal using the plurality of protocols;
performing an error check on the modulated signals according to each of the protocols; and
transmitting the data signal using a protocol that does not generate an error based on the result of performing the error check.

AMENDED CLAIMS

received by the International Bureau on 20 September 2006 (20.09.06)

terminal.

【Claim 5】

- <86> The contactless IC card of any one of claims 1 to 3, wherein the protocol processing unit includes:
- <87> a memory for storing a signal received at the corresponding protocol processing unit from the card terminal and a signal transmitted to the card terminal from the protocol processing unit;
- <88> a modulating/demodulating unit for modulating or demodulating a signal used in the protocol processing unit and another signal used in the card terminal using protocol information of corresponding protocol processing unit;
- <89> a data detecting unit for extracting essential information from the information stored in the memory and transmitting the extracted information to the modulating/demodulating unit; and
- <90> an error checking unit for checking an error on the modulated data and transmitting the result of the error checking to the protocol selecting unit.

【Claim 6】

- <91> The contactless IC card of claim 5, wherein the error checking unit performs CRC (cycle redundancy check) on the modulated data and feeds the result of the CRC back to the protocol selecting unit.

【Claim 7】

- <92> A method of communicating between a card terminal and a contactless IC card comprising a plurality of protocol processing units processing signals with a protocol dislike each other selected from a plurality of protocols, the method comprising the steps of:
- <93> a) transiting the state of the contactless IC card to a power-on state by generating an inductive power inside the contactless IC card in response to a radio frequency signal from the card terminal;
- <94> b) transmitting a request signal received from the card terminal to the plurality of the protocol processing units, receiving data error check values from the plurality of the protocol processing units and selecting one of the

protocol processing units corresponding to the protocol of the received signal, based on the data error check value; and

- <95> c) performing operations to communicate with the card terminal using a protocol corresponding to the decided protocol processing unit.

【Claim 8】

- <96> A method of communicating between a card terminal and a contactless IC card comprising a plurality of protocol processing units processing signals with a protocol dislike each other selected from a plurality of protocols, the method comprising the steps of:

- <97> a) transiting the state of the contactless IC card to a power-on state by generating an inductive power inside the contactless IC card in response to a radio frequency signal outputted from a card terminal;

- <98> b) obtaining a protocol priority from intensity of electromagnetic field of a radio frequency signal outputted from the card terminal;

- <99> c) selecting one of protocol processing units corresponding to the protocol of a request signal received from the card terminal based on the obtained protocol priority; and

- <100> d) performing operations to communicate with the card terminal using a protocol corresponding to the decided protocol processing unit.

【Claim 9】

- <101> The method of claim 8, wherein the selected protocol processing unit transmits, corresponding to the request signal, a response comprising information related to the protocol priority obtained from intensity of electromagnetic field of a radio frequency signal from the card terminal.

【Claim 10】

- <102> The method of any one of claims 7 to 9, the step c) includes the steps of:

- <103> c-1) transferring the request signal from the card terminal to a plurality of the protocol processing units;

- <104> c-2) modulating the request signal based on a corresponding protocol at each of the protocol processing units;

<105> c-3) performing an error checking process on the modulated request signal at each of the protocol processing units; and

<106> c-4) selecting one of protocols that is used to transmit the request signal based on the result of performing the error check.

【Claim 11】

<107> The method of claim 10, wherein the error checking process is a cyclic redundancy check (CRC) performed on the modulated data.

【Claim 12】

A computer readable recording medium storing a program for communicating between a card terminal and a contactless IC card capable of using a plurality of protocols to communicate, comprising:

transmitting a request signal received from the card terminal to the plurality of the protocol processing units, receiving data error check values from the plurality of the protocol processing units and selecting one of the protocol processing units corresponding to the protocol of the received signal, based on the data error check value; and

<108> performing operations to communicate between the card terminal and the contactless IC card using the protocol corresponding to the request signal based on the result of the determination.

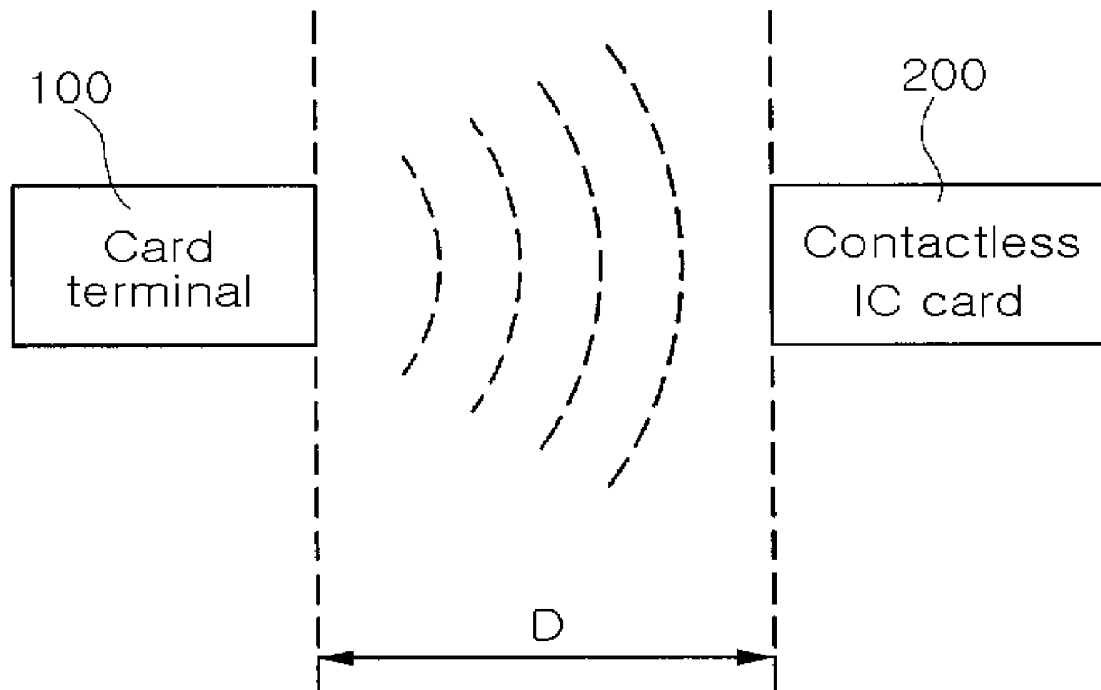
【Claim 13】

<111> A computer readable recording medium storing a program for communicating between a card terminal and a contactless IC card capable of using a plurality of protocols to communicate, comprising:

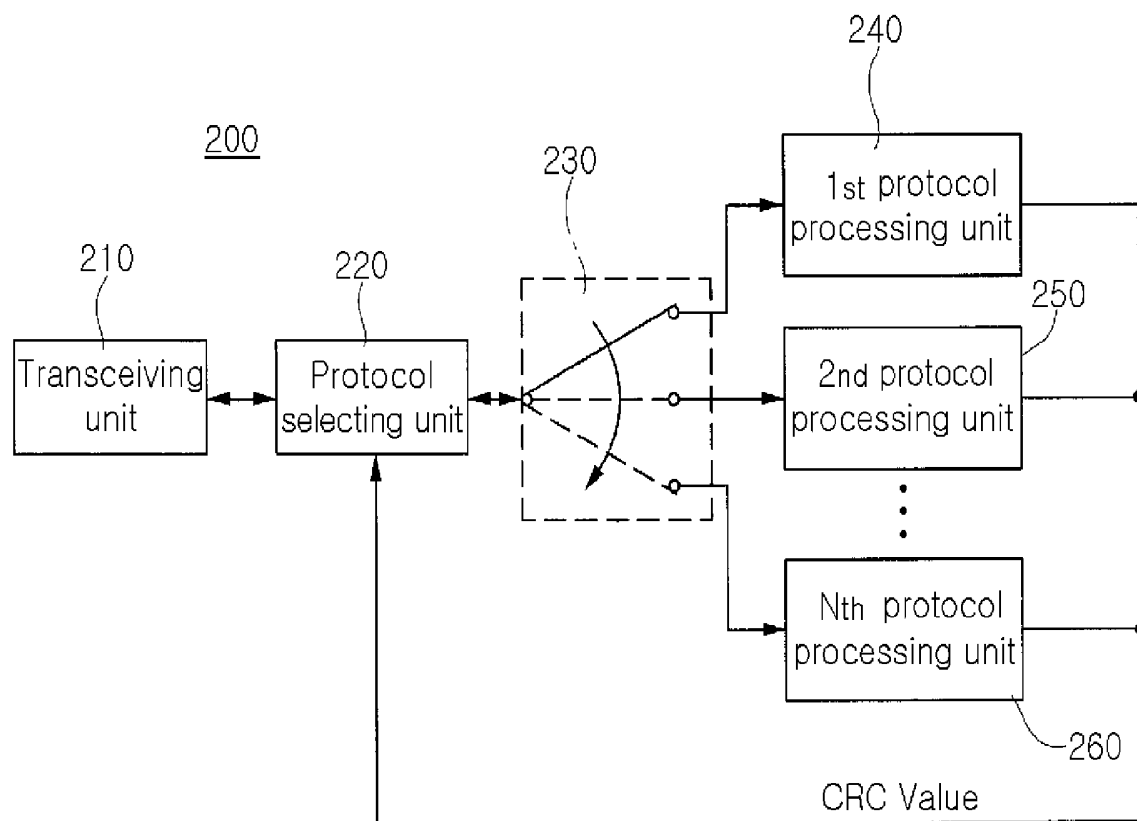
<112> determining which one of the protocols is used to transmit a signal from a card terminal by responding the signal from the card terminal according to a protocol priority obtained from intensity of electromagnetic field of a radio frequency signal outputted from the card terminal when the recording medium is driven in response to a radio frequency signal from a card terminal; and

<113> performing operations to communicate between the card terminal and the contactless IC card using the protocol corresponding to the request signal

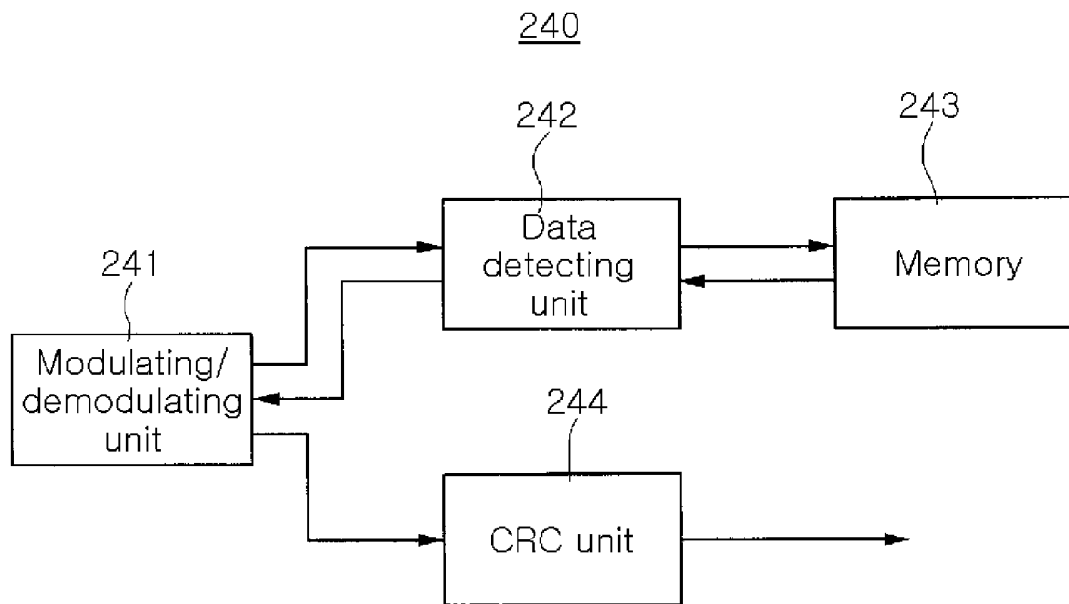
[Fig. 1]



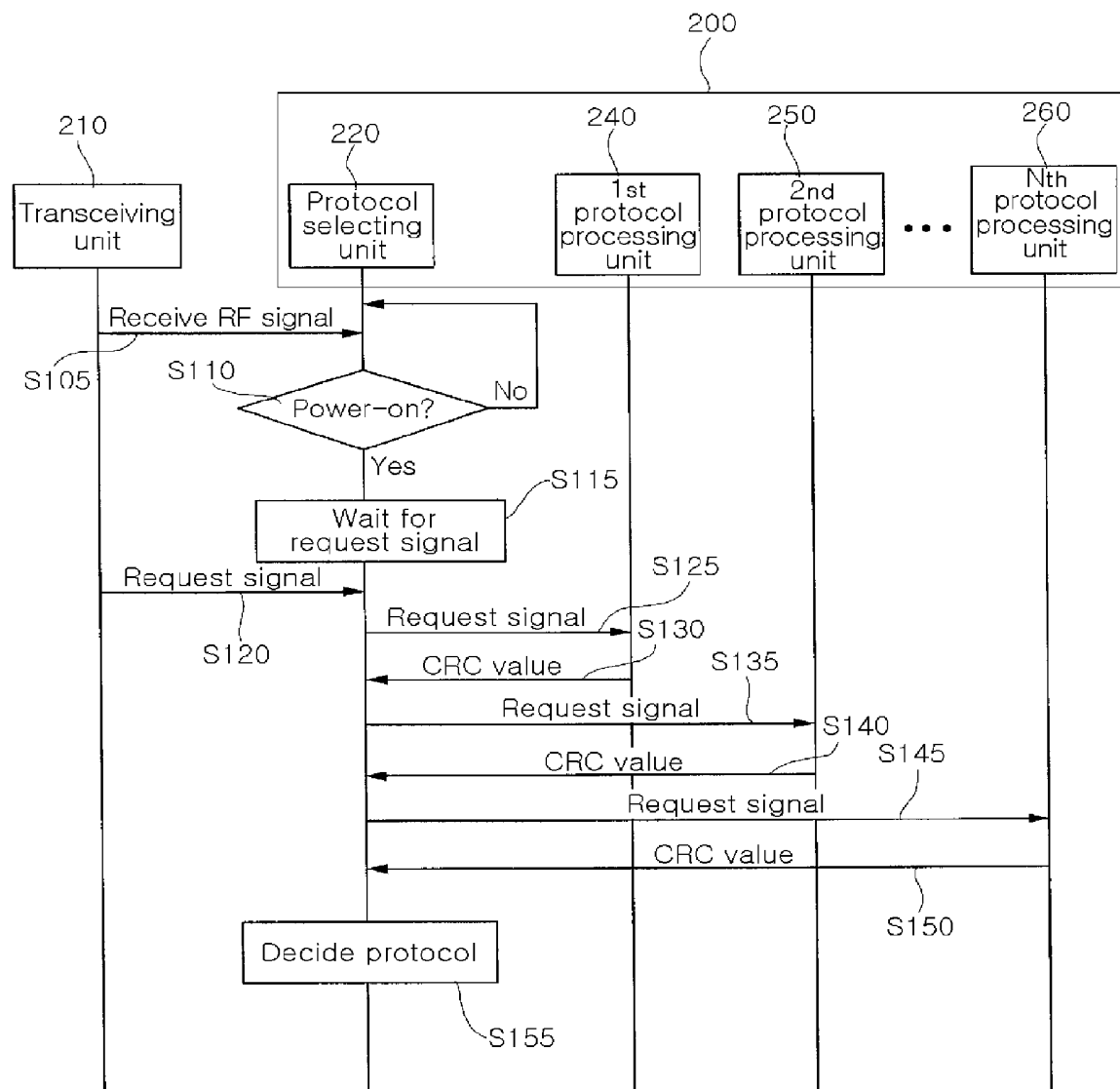
[Fig. 2]



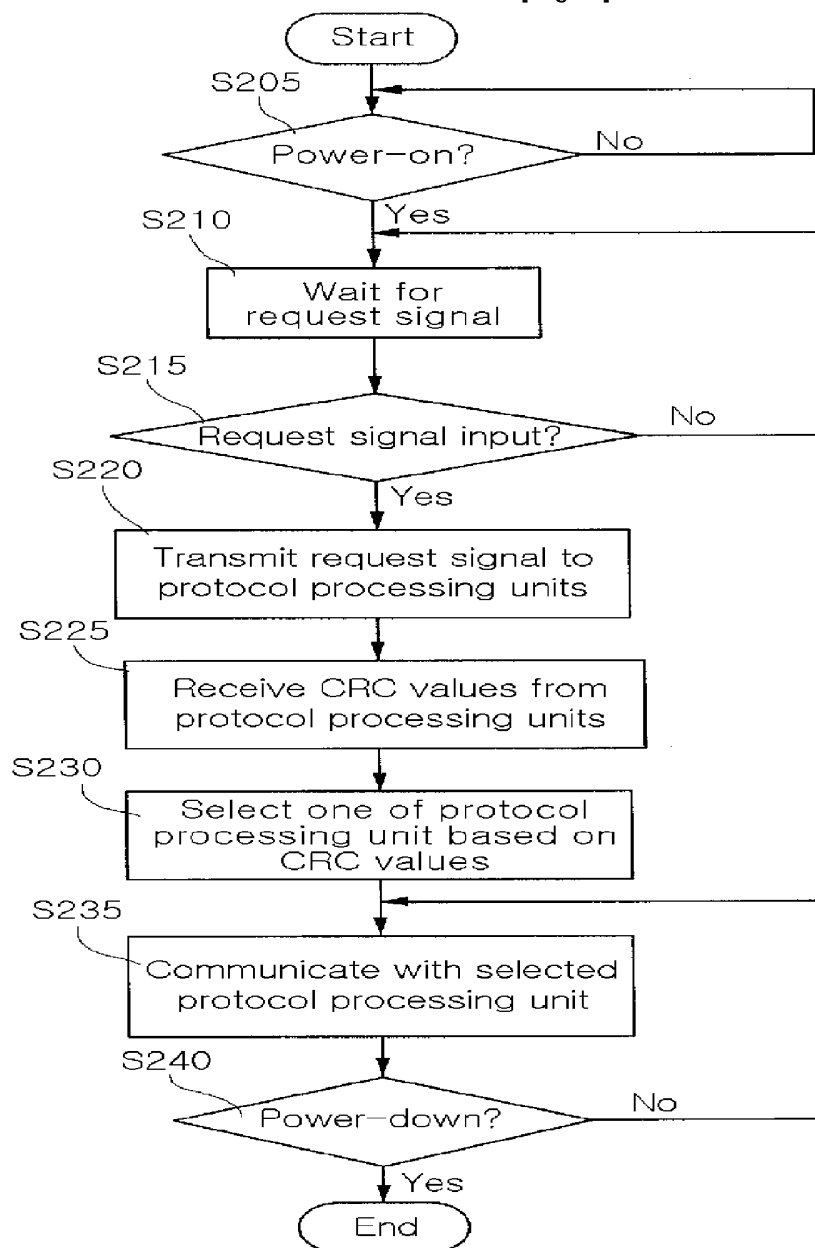
[Fig. 3]

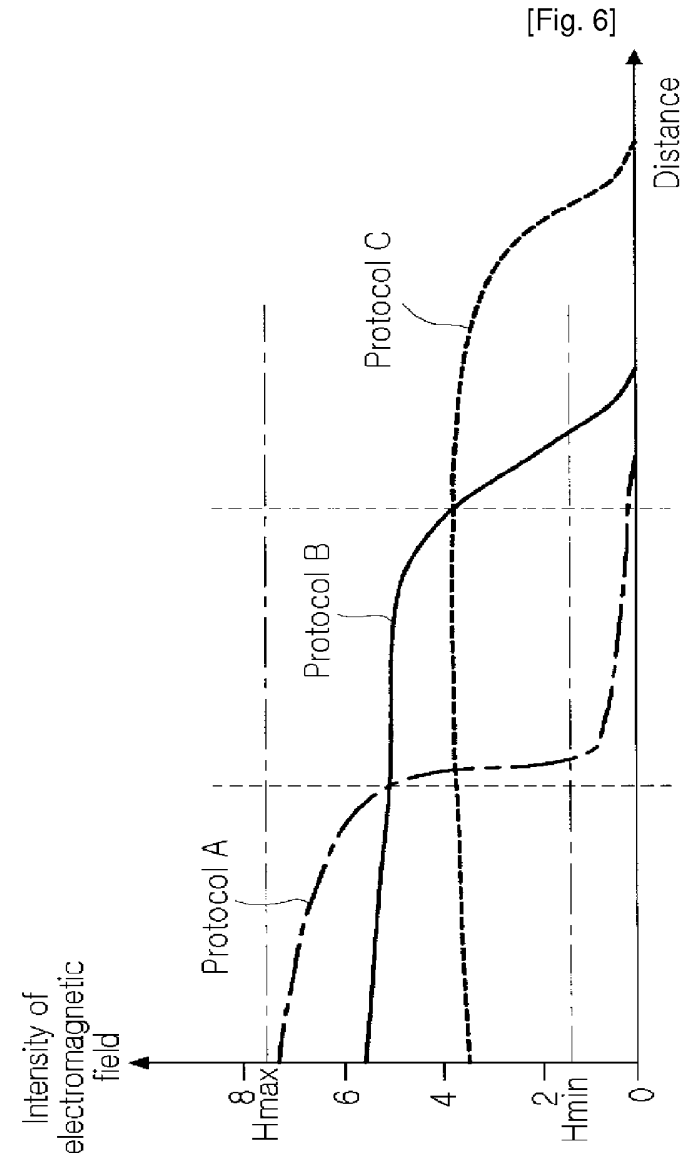


[Fig. 4]

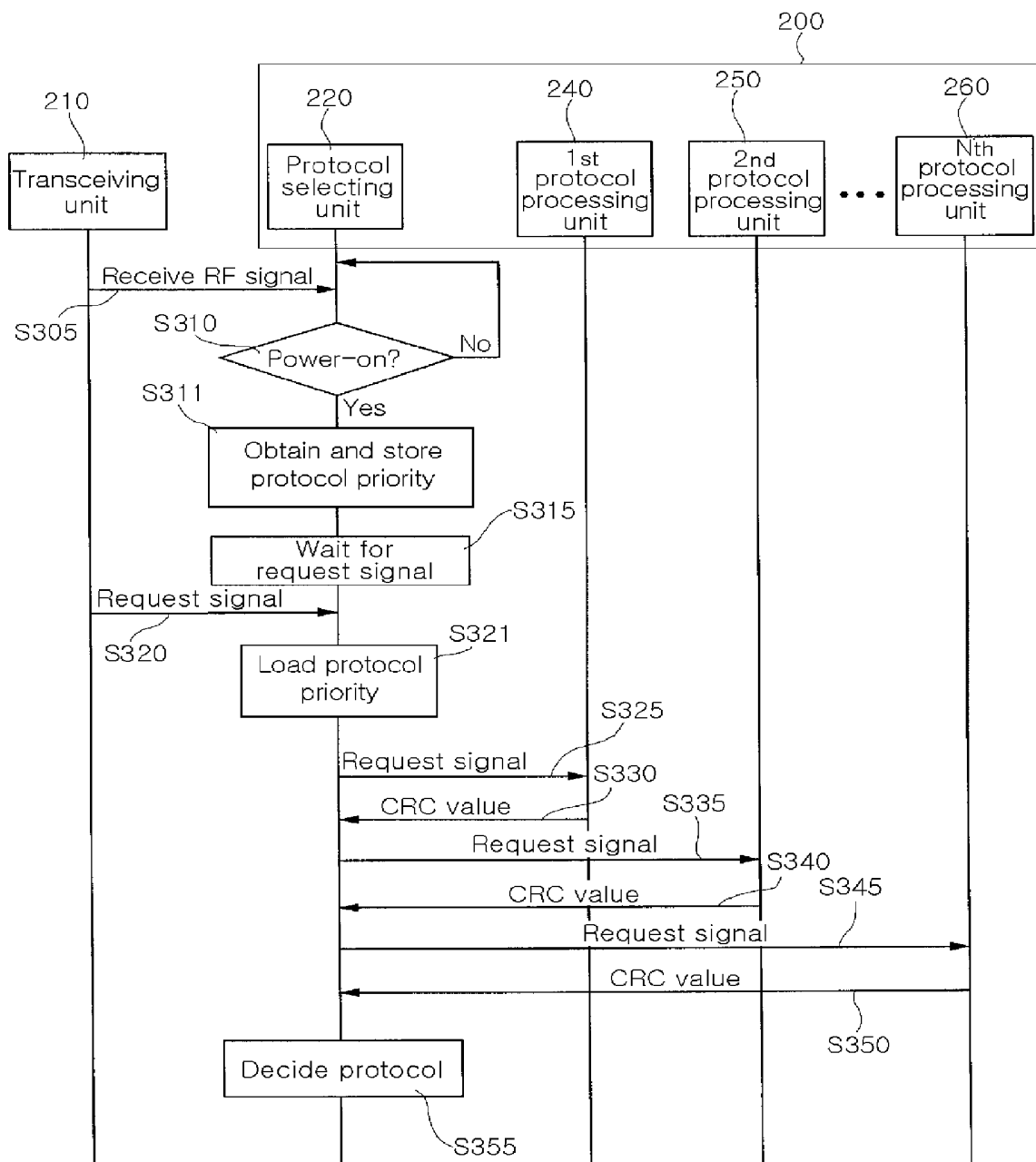


[Fig. 5]

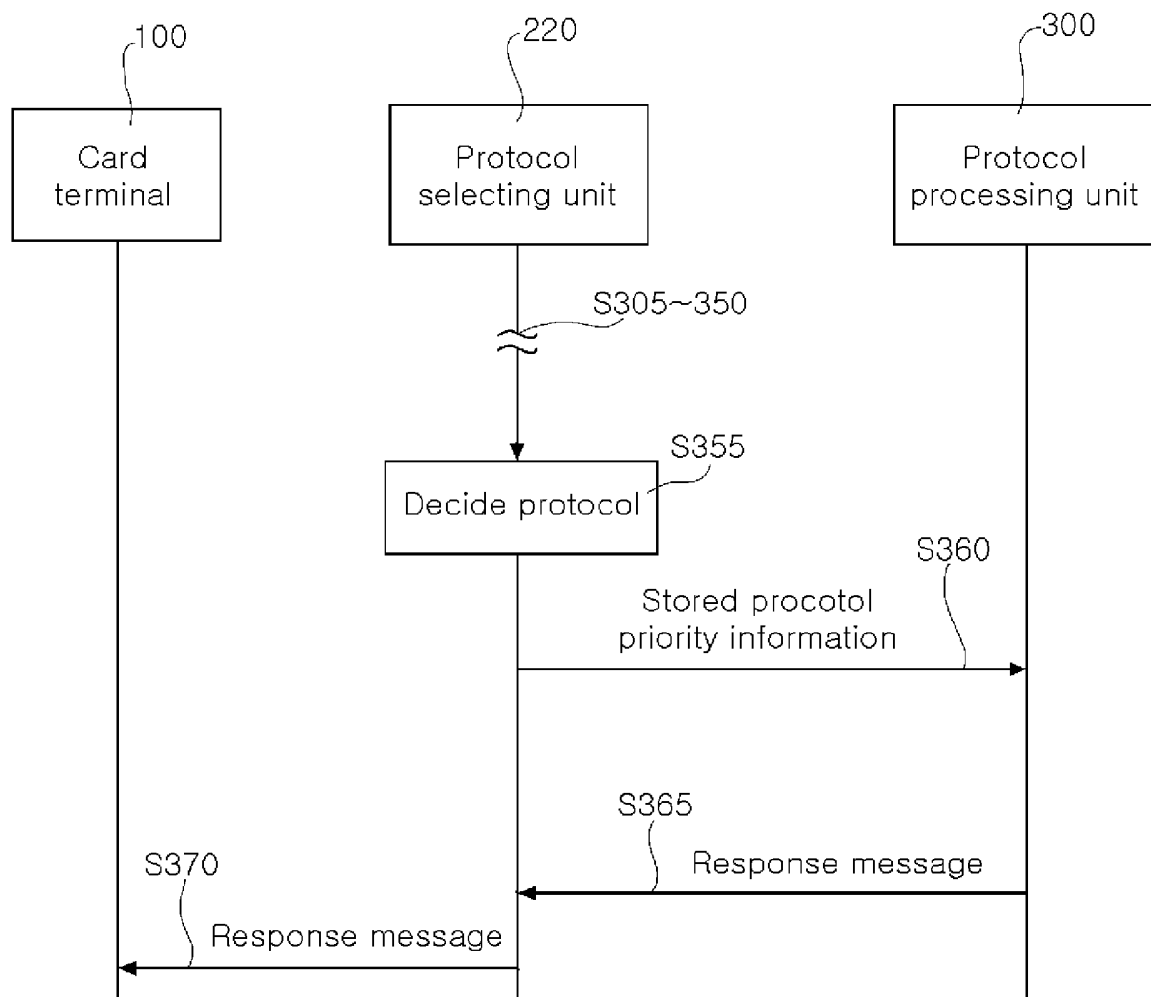




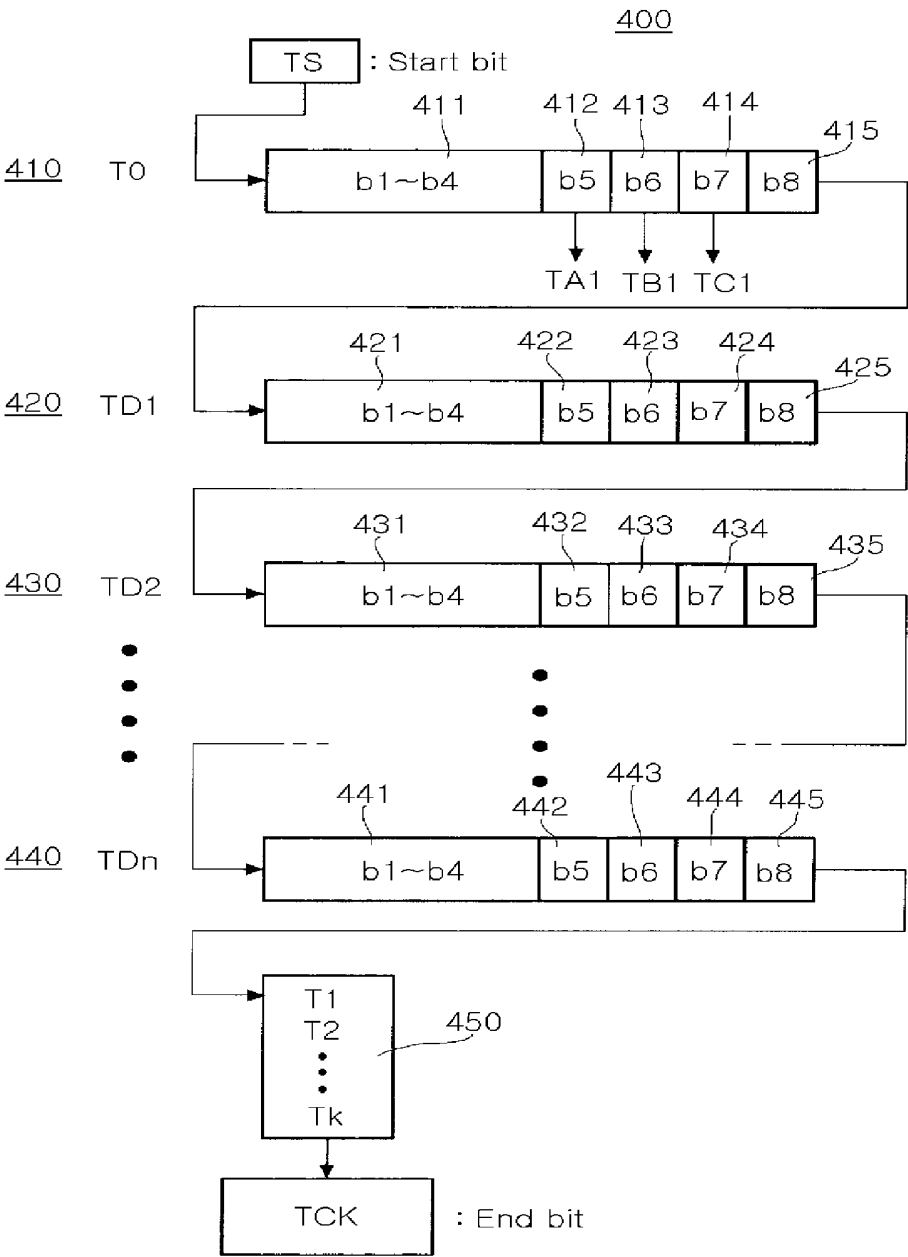
[Fig. 7]



[Fig. 8]



[Fig. 9]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/001360**A. CLASSIFICATION OF SUBJECT MATTER****G06K 19/07(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC8 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

"Korean Patents and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for utility models since 1975"

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ "card*", "tag*", "protocol", "select*", "multi*", "communicat*", "switch*"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004-164170 A1 (KRYGIER M. et. al.) 26.08.2004 * See abstract, page 2-4, figs. 4,6-7.	1-3,7,12
A		4-6,8-11,13-15
X	WO 02-31762 A1 (STM MICROELECTRONICS INC.) 18.04.2002 * See abstract, column 4-5.	1,7,12
A		2-6,8-11,13-15
X	US 2005-56704 A1 (Kim. K) 17.03.2005 * See abstract, page 2-4.	1,7,12
A		2-6,8-11,13-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

25 JULY 2006 (25.07.2006)

Date of mailing of the international search report

25 JULY 2006 (25.07.2006)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, Seung Joo

Telephone No. 82-42-481-8186



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2006/001360

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US2004164170A1	26.08.2004	EP1597696A2 W02004077335A2	23.11.2005 10.09.2004
W00231762A1	18.04.2002	AU200188581A1 BR200114811A CN1503957A EP01325467A1 JP16520642 KR1020030072334 MXPA03003260A US6883715BA	22.04.2002 09.12.2003 09.06.2004 09.07.2003 08.07.2004 13.09.2003 03.12.2004 26.04.2005
US 2005-56704 A1	17.03.2005	None	