Abstract: Disclosed is a transponder for use in an RFID system, comprising a loop-type antenna having a foldable part and a semiconductor chip electrically connected to the loop-type antenna and storing predetermined identification information. The loop-type antenna cannot form a loop structure when it is folded at the foldable part, and is thus inactivated.
Description

TRANSPONDER FOR RADIO FREQUENCY IDENTIFICATION SYSTEM

Technical Field
[1] The present invention relates to a transponder used in a radio frequency identification system.

Background Art

[2] The transponder can be called a various names based on the application fields of radio frequency identification (RFID) systems. For example, a non-contact smart card which is used as an identification card, or traffic card, or a tag attached to a product are transponders.

[3] FIG. 1 illustrates structure of a transponder having a loop-type antenna. As shown in FIG. 1, the transponder 10 includes a loop-type antenna 20 and a semiconductor chip 40 storing predetermined identification information therein. The loop-type antenna 20 and the semiconductor chip 40 are formed on a base plate 13. The transponder further includes a housing 30 which protects the loop-type antenna 20 and the semiconductor chip 40 from external shock and supports the base plate 13.

[4] The transponder 10 having the loop-type antenna 20 is used as a non-contact smart card, which is generally used as a traffic card or an identification card.

[5] The RFID system comprises two elements: a transponder, which is an object to be identified, and a reading/writing device (generally called a reader), which reads and writes some information from and into the transponder.

[6] As shown in FIG. 2, the RFID system includes the above transponder 10 and an RFID reader 50, called a reader, which reads information stored in the transponder 10.

[7] The RFID reader 50 of the RFID system generates some magnetic alternating field, and the transponder 10 receives the magnetic alternating field generated through the loop-type antenna 20, thereby obtaining driving power. Then, the transponder 10 and the RFID reader 50 mutually perform data transmission, by modulating the magnetic field.

[8] FIG. 3 illustrates magnetic flux passing through the loop-type antenna 20 of the transponder 10. The loop-type antenna 20 serves as an antenna only when magnetic flux passes through the loop. The conventional transponder 10 is activated by receiving the magnetic field generated by the RFID reader 50, and sends data stored in the semiconductor chip through a wireless communication method.

[9] Such an RFID system is convenient to use because it is a wireless system. However, it has a drawback in that data transmission can be easily hacked or tracked because it is
performed in a wireless communication way. In detail, even in the case in which a card user does not use a non-contact smart card, such as a traffic card in which a transponder is embedded, a person with bad intentions can pay a traffic fare using the RFID reader of the traffic card without the owner of the traffic card noticing it. Accordingly, in the RFID system, a transponder, which is not activated when a user does not want to use a card in which the transponder is embedded, and is only activated when a user wants to use the card, is required.

Disclosure of Invention

Technical Problem

[10] In order to solve the above problems, it is an object of the present invention to provide a transponder which is capable of stopping function of an antenna thereof when it is not used in order to prevent illegitimate payment, hacking or tracking thereof.

Technical Solution

[11] In order to achieve the above objects and advantageous effects, according to one aspect of the present invention, there is provided a transponder which is used in an RFID system, comprising a loop-type antenna having a foldable part and a semiconductor chip electrically connected to the loop-type antenna and storing predetermined identification information therein. Here, when the loop-type antenna is folded by the means of the foldable part, the transponder cannot be activated because the loop-type antenna does not have a loop form.

[12] According to another aspect of the present invention, there is provided a transponder used in an RFID system, comprising a loop-type antenna divided into a left loop antenna zone and a right loop antenna zone based on a foldable part, a semiconductor chip electrically connected to the loop-type antenna and storing predetermined identification information therein, and a contact switch for connecting the left and right loop antenna zones to each other. The loop-type antenna is configured in a manner such that the left loop antenna zone and the right loop antenna zone are separated from each other so that they cannot form a closed loop and the antenna is not activated when the loop-type antenna is folded by the means of the foldable part.

[13] According to further another aspect of the present invention, there is provided a transponder used in an RFID system, comprising an antenna for receiving and transmitting radio frequency waves and a semiconductor chip connected to the antenna and storing predetermined identification information, a foldable part disposed between the antenna and the semiconductor chip, and a contact switch corresponding to the foldable part for electrically connecting the antenna to the semiconductor chip, wherein the antenna and the semiconductor chip are electrically disconnected by the contact
switch when the transponder is folded by the foldable part.

**Advantageous Effects**

[14] As described above, the transponder according to the present invention is constructed in a manner such that the antenna can be easily folded or unfolded. Accordingly, in the method of using the transponder according to the present invention, a user uses the transponder only in a state in which the antenna is unfolded, but the user stores the transponder in a state in which the antenna is folded so that the antenna is inactivated. As a result, the transponder is safe from illegitimate transactions, hacking and tracking which may occur when it is not being used, because the transponder according to the present invention is in inactivated state when it is not used.

**Brief Description of the Drawings**

[15] FIG. 1 is a schematic view illustrating a transponder according to the conventional art;

[16] FIG. 2 is a schematic view illustrating an RFID system comprising an RFID reader and a transponder according to the conventional art;

[17] FIG. 3 is a schematic view illustrating the concept such that the transponder recognizes radio frequency waves;

[18] FIG. 4 is a plan view illustrating a transponder according to the present invention;

[19] FIG. 5 is a schematic view illustrating the transponder of which an antenna is in a folded state, according to the present invention;

[20] FIG. 6 is a schematic view illustrating the concept of the transponder according to the present invention recognizing radio frequency waves in a state in which the antenna thereof is folded;

[21] FIG. 7 is a perspective view and a cut-away view illustrating a transponder according to a first embodiment of the present invention;

[22] FIG. 8 is a perspective view and a cut-away view illustrating a transponder according to a second embodiment of the present invention;

[23] FIG. 9 is a perspective view and a cut-away view illustrating a transponder according to a third embodiment of the present invention;

[24] FIG. 10 is a perspective view and a cut-away view illustrating a transponder according to a fourth embodiment of the present invention;

[25] FIG. 11 is a perspective view and a cut-away view illustrating a transponder according to a fifth embodiment of the present invention; and

[26] FIG. 12 is a perspective view and a cut-away view illustrating a transponder according to a sixth embodiment of the present invention.

**Best Mode for Carrying Out the Invention**

[27] Embodiments of the present invention will be described with reference to the ac-
companying drawings in sufficient detail that a person having ordinary skill in the art could easily reproduce them. However, the present invention is not limited to the embodiments, but can be modified in a variety of ways.

Generally, transponders are classified into a passive transponder group, which receives driving power from an RFID reader, and an active transponder group which has its own power supply. The following description with regard to the embodiment of the present invention relates to the passive transponder for the sake of convenience, but idea of the present invention can also be applied to the active transponder.

With reference to FIG. 4 through FIG. 6, transponder according to the present invention will be described in detail.

As shown in FIG. 4, the transponder 100 according to the present invention comprises a loop-type antenna 200 having a foldable part 210, and a semiconductor chip 300.

The loop-type antenna 200 is not limited to any particular form as long as the loop-type antenna 200 includes the foldable part 210. The loop-type antenna 200 can be made in a manner such that a wire covered with an insulation layer on the surface thereof is spirally wound in an almost rectangular form, or in a manner such that an aluminum thin film or a copper thin film is formed on a base plate and unnecessary portions of the film are removed through an etching or a punching method so that a spiral coil having an almost rectangular form remains. Still further, a loop-type antenna 200 can be made through a direct printing method in which a conductive material is directly printed on a base plate, having a predetermined antenna pattern.

The semiconductor chip 300 is electrically connected to the loop-type antenna 200 and contains identification information used in an RFID system. The identification information includes user information and application information. The application information includes amounts of money or products according to the kinds of application.

FIG. 5 illustrates the loop-type antenna 200 of the transponder 100, which is folded at the foldable part 210, according to the present invention.

FIG. 6 illustrates that the loop-type antenna 200 which is folded state at the foldable part 210, is located at a magnetic field generated from an RFID reader. In this instance, as shown in FIG. 6, the loop-type antenna 200 of the transponder 100 according to the present invention does not form a closed loop surrounding magnetic flux. Accordingly, the function of the loop-type antenna 200 is inactivated, so that the RFID reader cannot supply power to the transponder 100 and cannot communicate with the transponder 100.

In the loop-type antenna 200 of the present invention, the foldable part 210 is preferably located at a center portion thereof. More preferably, two parts of the loop-
type antenna 200 are symmetrical with respect to the foldable part 210. However, the foldable part 210 is not necessarily located at the exact center of the antenna 200, but can be located at around center portions as long as the magnetic flux, which can render the semiconductor chip 300 inactive, passes the closed loop of the antenna 200 but do not provide enough driving power with the semiconductor chip when the antenna 200 is folded.

**Mode for the Invention**

[36] Hereinafter, transponders according to embodiments of the present invention will be described with reference to FIG. 7 through FIG. 11.

[37] First, with reference to FIG. 7, the transponder 100 according to a first embodiment of the present invention will be described.

[38] As shown in FIG. 7, the transponder 100 according to a first embodiment of the present invention includes a loop-type antenna 200, a semiconductor chip 300, a base plate 110 and a housing 130.

[39] Here, the loop-type antenna 200 has a foldable part 210 at a center portion thereof.

[40] The loop-type antenna 200 and the semiconductor chip 300 are mounted on the base plate 110, and the base plate 110 has a foldable part 120 in a center portion thereof, in which the foldable part 120 of the base plate 110 and the foldable part 210 of the antenna 200 correspond to each other in their positions.

[41] The housing 130 supports the base plate 110 and has a bent part at a position where the foldable part 120 is disposed.

[42]

[43] In the transponder 100 according to the first embodiment of the present invention, the foldable part 210 of the loop-type antenna 200, the foldable part 120 of the base plate 110, and the bent part of the housing 130 correspond to each other in their positions, so that the transponder 100 can be folded in half.

[44] In the case in which the transponder 100 according to the first embodiment of the present invention is folded in half, the loop-type antenna 200 has the folded form shown in FIG. 6. As a result, the antenna 200 cannot form a closed loop surrounding magnetic flux. Accordingly, the transponder 100 cannot receive power from the RFID reader or perform data communication with the RFID reader.

[45] When a user wishes to use the transponder 100 according to the first embodiment, the user unfolds the loop-type antenna 200 and then uses it. However, when the user does not wish to use the transponder 100, the user stores the transponder 100 after folding the antenna 200 thereof. Accordingly, when a user with bad intentions tries to hack or track data in the transponder, using the RFID reader, hacking and tracking is prevented because the antenna 200 is not activated.
In the transponder 100 according to the first embodiment, the foldable part 210 of the antenna 200, the foldable part 120 of the base plate 110 and the bent part of the housing 130 may be easily damaged. Accordingly, the loop-type antenna 200 must be made of conductive material having good flexibility so that the antenna 200 is not split after being folded many times.

The foldable part 120 of the base plate 110 and the bent part of the housing 130 are also made of material having good flexibility, such as plastic, so that they are also not split after being folded many times. For example, if a thin flexible printed circuit board (hereinafter, referred as flexible PCB) which may be used to electrically connect a folder part and a main body part of a mobile phone, is used to constitute the loop-type antenna 200 and the base plate 110, the loop-type antenna 200 and the base plate 110 can be folded and unfolded without splitting.

According to the first embodiment of the present invention, even though the loop-type antenna 200 and the semiconductor chip 300 are mounted on the base plate 110, the base plate 110 can be omitted. That is, the loop-type antenna 200 and the semiconductor chip 300 can be directly mounted on the housing 130. Depending on the application field and form, manufacturing process, and manufacturing cost of the transponder 100, the housing 130 can be made to perform the function of the base plate 110.

For example, since the loop-type antenna, having a coil type prepared by winding a wire coated with an insulation layer several times, has sufficient strength to support itself, the base plate 110 can be omitted. On the loop-type antenna having the above described structure, the semiconductor chip 300 can be attached to the housing 130. Further, the loop-type antenna 200 can be formed through a method in which conductive material is directly printed on the inner surface of the housing 130 to have a predetermined pattern, and then the semiconductor chip 300 can be connected to the printed pattern. The wire and the pattern of the loop-type antenna can be made of a material which is not easily split even after many repeated folding and unfolding motions.

In order to prevent the transponder 100 according to the first embodiment of the present invention from being automatically unfolded in the case where the transponder 100 is folded along the foldable part 210, combining structures can be provided to left and right end portions of the housing 130. The combining structures restrain the housing 130 so that the housing 130 is unfolded only when a physical force greater than a predetermined intensity is applied to the housing 130. The combining structure is preferably a male-female combination structure, such as a snap button. When the housing 130 is folded, the male button and female button are combined with each other, and the male button and the female button are separated from each other when
physical force greater than a predetermined intensity is applied to the housing 130 so that the housing 130 is unfolded. Accordingly, the housing 130 is prevented from being automatically unfolded. Thus, it is easy to carry the transponder in a folded state.

Hereinafter, with reference to FIG. 8, the transponder 100 according to the second embodiment of the present invention will be described in detail.

As shown in FIG. 8, the transponder 100 according to the second embodiment of the present invention has the same structure as the transponder 100 according to the first embodiment of the present invention, except that the housing 130 of the transponder 100 according to the present embodiment comprises two parts, a left part and a right part, and a hinge unit 410 provided between the left and right parts of the housing 130.

The hinge unit 410 is a generally known one. The hinge unit 410 is not limited to particular types, but preferably has a structure which is generally used in a mobile phone and is folded and unfolded in a manner such that the hinge is automatically fully unfolded when a bent angle is greater than a predetermined degree, and is automatically completely folded when the bent angle is less than the predetermined degree. The shape and structure of the hinge unit 410 is diversely designed so that the hinge unit 410 can protect the loop-type antenna 200 and can easily and safely be folded and unfolded. Preferably, the hinge unit 410 is made of nonconductive material, such as plastic, in order to minimize the interference with radio frequency waves, or the material for the hinge unit 410 may contain a minimal amount of conductive substance. When the hinge unit 410 is attached to the housing 130, the attachment method is not particularly limited.

In the case in which a portion 111 of the base plate 110, which is around the hinge unit 410, is removed, a space in which the hinge unit 410 is mounted is provided. In this case, it is possible to prevent the base plate 110 and the hinge unit 410 from colliding with each other whenever the transponder 100 is folded and unfolded.

The base plate 110 on which the loop-type antenna 200 and the semiconductor chip 300 are mounted can be made of a flexible PCB like the base plate 110 of the transponder 100 according to the first embodiment of the present invention. In the case in which the base plate 110 is made of a flexible PCB, the transponder according to the present invention can stably operate in a state in which the loop-type antenna 200 and the base plate 110 do not break even after many folding and unfolding motions.

As described above, the transponder 100 according to the second embodiment includes the hinge unit 410 provided between the left and right parts of the housing 130, so that the transponder 100 can be easily folded and unfolded, and durability of the transponder 100 is improved.

According to the second embodiment, the wire of the loop-type antenna 200,
extending in a gap between the left and right parts of the housing 130, may not require the base plate 110. As described with reference to the transponder according to the first embodiment, the base plate 110 can be omitted depending on the application field, form, manufacturing process, and manufacturing cost of the transponder 100. Since the loop-type antenna prepared by winding a wire coated with insulation film several times has intrinsic strength and can support itself, it need not be mounted on the base plate 110 but can be arranged to extend along a gap between the left and right parts of the housing 130. However, in the case in which the antenna is prepared by printing conductive material in a predetermined pattern form, it is obvious that the antenna requires a base plate 110 on which the pattern is printed, so that the pattern of the loop antenna can pass between the left and right parts of the housing 130. The wire and pattern forming the loop-type antenna can be made of material which is not split even after many folding and unfolding motions.

According to the second embodiment, activation and inactivation states of the transponder can be selected by a simple motion of folding and unfolding the loop-type antenna of the transponder. In this case, the transponder can be more easily and safely folded and unfolded and easily carried using the hinge unit.

Edges of the left and right parts of the housing 130 of the transponder according to the second embodiment can be connected to each other at portions other than the portion where the hinge unit is provided. In the case in which the left and right parts of the housing 130 are connected in such a manner, the left and right parts of the housing 130 can protect the loop-type antenna 200 arranged above/under the hinge unit 410. At this time, the connection part between the left and right parts of the housing 130 may have the bent part, corresponding to the foldable part 210, in order to smoothly and easily fold and unfold the transponder, as in the first embodiment.

Hereinafter, with reference to FIG. 9, the transponder 100 according to the third embodiment will be described in detail.

As shown in FIG. 9, the transponder 100 according to the third embodiment of the present invention is the same as the transponder 100 according to the second embodiment, except that it includes a contact switch 250 provided at the center portion of a loop-type antenna 200.

The loop-type antenna 200 of the transponder 100 according to the third embodiment is separated into a left antenna zone and a right antenna zone based on center portion. The contact switch 250 connects the left antenna zone to the right antenna zone.

The contact switch 250 is divided into a male part 252 and a female part 254, and the male part 252 and the female part 254 are respectively connected to both ends 251 of the left and right antenna zones. The male part 252 has a protrusion 253 and the
female part 254 has a recess for receiving the protrusion of the male part 252. The protrusion 253 can be implemented as a spring (not shown). The spring makes it easy for the protrusion 253 of the male part 252 to come into contact with the female part 254.

In the case in which the transponder 100 according to the third embodiment is unfolded, the protrusion 253 of the male part 252 is received in the recess of the female part 254. At this time, the loop-type antenna 200 forms a closed loop, and can recognize a magnetic field generated from the RFID reader. On the contrary, in the case in which the transponder 100 is folded, the protrusion 253 of the male part 252 is displaced from the recess of the female part 254 and the left and right antenna zones of the antenna are separated from each other, so that the antenna 200 cannot form a closed loop, and cannot recognize a magnetic field generated from the RFID reader.

In detail, the transponder 100 according to the third embodiment enables connection and disconnection of the loop-type antenna using the contact switch 250 through simple motions of folding and unfolding the hinge unit 410. As a result, the loop-type antenna 200 can be placed in active and inactive states.

There is an alternative manner in which the left and right antenna zones of the antenna are connected and disconnected. That is, the function of the antenna is interrupted when the wire of the loop-type antenna is cut, and is normally conducted when the wire of the loop-type antenna is reconnected. In this case, when the hinge unit and the contact switch are used, the loop-type antenna can be easily connected and disconnected and the antenna can be easily carried.

According to the third embodiment of the present invention, the loop-type antenna 200 and the semiconductor chip 300 are directly mounted on the housing 130. As in the transponder according to the first embodiment, whether the base plate 110 is used can be determined based on the application field and form, manufacturing process and manufacturing cost of the transponder 100.

Hereinafter, with reference to FIG. 10, the transponder 100 according to the fourth embodiment of the present invention will be described in detail.

As shown in FIG. 10, the transponder 100 according to the fourth embodiment of the present invention is almost the same as the transponder 100 according to the third embodiment of the present invention except that a contact switch 250 is formed at left and right wings of the hinge unit 420.

An electrical connection between the contact switch 250, integrated with the hinge unit 420 and left and right antenna 200, can be achieved using a through-hole wire 260.

In detail, since the transponder 100 is attached to the housing 130 in a state in which the hinge unit 420 and the contact switch 250 are integrated into a body, it is possible to make the female part 254 and the protrusion 253 of the male part 252 precisely
contact each other in the contact switch 250.

According to the fourth embodiment of the present invention, the loop-type antenna 200 and the semiconductor chip 300 are directly mounted on the housing 130. The use of the base plate is determined based on the application field and form, the manufacturing process, and the manufacturing cost of the transponder 100 as described with reference to the first embodiment.

According to the third and fourth embodiments of the present invention, as shown in FIG. 9 and FIG. 10, the hinge unit 410, 420 and the contact switch 250 are positioned at a center portion of the loop-type antenna, but the positions thereof are not particularly limited. That is, the hinge unit 410, 420 and the contact switch 250 can be positioned anywhere as long as the antenna cannot form a closed loop when the transponder 100 is folded.

With reference to FIG. 11, the transponder 100 according to the fifth embodiment of the present invention will be described.

As shown in FIG. 11, the transponder 100 according to the fifth embodiment of the present invention is almost the same as the transponder 100 according to the fourth embodiment except that the hinge unit 420 and the contact switch 250 are provided between the loop-type antenna 200 and the semiconductor chip 300.

In the transponder 100 according to the fifth embodiment of the present invention, the loop-type antenna 200 and the semiconductor chip 300 are connected via the contact switch 250.

In the operation of the transponder 100 according to the fifth embodiment of the present invention, in the case in which the transponder 100 is unfolded, the loop-type antenna 200 and the semiconductor chip 300 are electrically connected, so that the semiconductor chip 300 receives power and a signal from the loop-type antenna 200 and thus operates. Conversely, in the case in which the transponder 100 is folded, the loop-type antenna and the semiconductor chip 300 are electrically disconnected, and the semiconductor chip 300 cannot receive any signal from the loop-type antenna 200.

The transponder 100 according to the fifth embodiment shown in FIG. 11 includes two contact switches. That is, the contact switch 250 has a simple structure. Accordingly, the incidence of failure of the contact switch is remarkably reduced.

Further, because the loop-type antenna 200 does not include a hinge unit 420 inside it, there is no interference with radio frequency waves. Accordingly, the characteristics and performance of the antenna are prevented from degrading.

The transponder according to the fifth embodiment is operated in a different way from the above-described embodiment(s). The function of the transponder is interrupted by cutting the connection wire between the antenna and the semiconductor chip, and the function of the transponder is restored by reconnecting the antenna and
the semiconductor chip. At this time, using the hinge unit and the contact switch, the connection and disconnection between the antenna and the semiconductor chip can be easily and conveniently conducted, and the transponder can be conveniently carried.

Further, the fifth embodiment is not limited to a transponder having a loop-type antenna, but can be applied to a transponder having a dipole antenna. That is, it is possible to cease the operation of the transponder by disconnecting the dipole antenna and the semiconductor chip using the contact switch and the hinge unit. It is obvious that the transponder does not operate, because the antenna for sending and receiving radio frequency waves and the semiconductor chip are disconnected.

According to the fifth embodiment, the loop-type antenna 200 and the semiconductor chip 300 are directly mounted on the housing 130. Like the transponder according to the first embodiment, the use of the base plate 110 is determined depending on the application field and form and the manufacturing process and manufacturing cost of the transponder 100.

In this embodiment, the contact switch 250 can be manufactured to have a variety of forms based on the electrical and mechanical characteristics thereof. That is, the contact switch 250 can be effectively implemented in a manner such that the antenna and the semiconductor chip are electrically connected when the transponder 100 is unfolded, whereas the antenna and the semiconductor chip are electrically disconnected when the transponder 100 is folded.

Hereinafter, with reference to FIG. 12, the transponder 100 according to the sixth embodiment of the present invention will be described.

As shown in FIG. 12, the transponder 100 according to the sixth embodiment is almost the same as the transponder 100 according to the second embodiment, except that it has a through hole 150 in a side of the housing 130, a ring 160 is engaged with the through hole 150, and a recess 140 is formed in a corner of the housing 130.

In detail, the transponder 100 according to the sixth embodiment can be easily carried using the ring 160 engaged with the through hole 150. Further, in the state of being folded, since the through hole 150 corresponding to the recess 140 is protruded, it is possible to easily unfold the folded transponder 100.

According to the embodiment, the loop-type antenna 200 and the semiconductor chip 300 are mounted on the base plate 110, and the base plate 110 can be omitted based on the application field and form and the manufacturing process and the manufacturing cost of the transponder 100.

Even though the embodiments of the present invention are explained above, the present invention is not limited to the above described embodiments, but may be practiced in diversely modified forms within the scope defined by the following claims, the detail description and the accompanying drawings. The modifications are in
the scope of the present invention.

Industrial Applicability

The transponder according to the present invention can be used in fields using an RFID system. In particular, it can be used in a non-contact smart card, which is used as a traffic card or an identification card or a tag attached to a product.

Since the transponder according to the present invention has a structure in which an antenna can be easily folded and unfolded, a user uses the transponder by unfolding the antenna only when he or she desires to use the transponder, and stores the transponder in a state in which the antenna is folded. Accordingly, when the transponder is not being used, since the antenna is in an inactivated state, illegitimate transactions, hacking and tracking, which can occur when the transponder is not used, can be prevented.
Claims

[1] A transponder for use in an RFID system, comprising:
 a loop-type antenna having a first foldable part; and
 a semiconductor chip which stores predetermined identification information and is connected to the loop-type antenna,
 wherein the loop-type antenna cannot form a loop structure when the loop-type antenna is folded at the first foldable part.

[2] The transponder according to claim 1, further comprising:
 a power supply unit for supplying power to the loop-type antenna and the semiconductor chip.

[3] The transponder according to claim 1 or claim 2, further comprising:
 a housing on which the loop-type antenna and the semiconductor chip are mounted,
 wherein the housing has a bent portion corresponding to the first foldable part.

[4] The transponder according to claim 1 or claim 2, further comprising:
 a base plate, on which the loop-type antenna and the semiconductor chip are mounted; and
 a housing for supporting the base plate,
 wherein the base plate has a second foldable part corresponding to the first foldable part, and
 the housing has a bent portion corresponding to the second foldable part.

[5] The transponder according to claim 1 or claim 2, further comprising:
 a housing on which the loop-type antenna and the semiconductor chip are mounted, the housing being divided into a left part and a right part thereof based on the foldable part; and
 a hinge unit for coupling the left and right parts of the housing to each other.

[6] The transponder according to claim 1 or claim 2, further comprising:
 a base plate on which the loop-type antenna and the semiconductor chip are mounted;
 a housing divided into a left part and a right part thereof based on the foldable part, for supporting the base plate; and
 a hinge unit for connecting the left and right parts of the housing to each other.

[7] The transponder according to claim 1 or claim 2,
 wherein the transponder has a through hole in an edge portion thereof and a ring engaged with the through hole.

[8] A transponder for use in an RFID system comprising:
 a loop-type antenna divided into a left loop antenna zone and a right loop
antenna zone based on a foldable part;
a semiconductor chip electrically connected to the loop-type antenna and storing predetermined identification information; and
a contact switch for connecting the left loop antenna zone to the right loop antenna zone,
wherein the antenna cannot form a closed loop because the left and right loop antenna zones are separated when the loop-type antenna is folded at the foldable part.

[9] The transponder according to claim 8, further comprising:
a power supply unit for supplying power to the loop-type antenna and the semiconductor chip.

[10] The transponder according to claim 8 or claim 9, further comprising:
a left and a right housing corresponding to the left and right loop antenna zones, respectively; and
a hinge unit for connecting the left and right housings,
wherein the contact switch includes a male part and a female part coupled to the left and right loop antenna zones, respectively and
the male part and the female part are disconnected from each other when the loop-type antenna is folded, but the male part and the female part are connected to each other when the loop-type antenna is unfolded.

[11] The transponder according to claim 8 or claim 9, further comprising:
a left and a right base plate corresponding to the left and right loop antenna zones, respectively;
a left housing and a right housing corresponding to the left and right base plates, respectively; and
a hinge unit for connecting the left and right base plates or the left and right housings to each other,
wherein the contact switch includes a male part and a female part connected to the left and right loop antenna zones, respectively and
the male part and the female part are separated from each other when the loop-type antenna is folded, and the male part and the female part are connected to each other when the loop-type antenna is unfolded.

[12] The transponder according to claim 8 or claim 9, wherein the transponder has a through hole in an edge thereof, and a ring engaged with the through hole.

[13] A transponder for use in an RFID system, comprising:
an antenna for sending and receiving radio frequency waves;
a semiconductor chip electrically connected to the antenna and storing predetermined identification information;
a foldable part provided between the antenna and the semiconductor chip; and
a contact switch corresponding to the foldable part, for electrically connecting
the antenna and the semiconductor chip to each other,
wherein the antenna and the semiconductor chip are electrically disconnected by
the contact switch when the antenna is folded at the foldable part.

[14] The transponder according to claim 13, further comprising:
a power supply unit for supplying power to the antenna and the semiconductor chip.

[15] The transponder according to claim 13 or claim 14, further comprising:
a first housing and a second housing, corresponding to the antenna and the semiconductor chip, respectively; and
a hinge unit for connecting the first housing and the second housing to each other,
wherein the contact switch includes a male part and a female part connected to
the antenna and the semiconductor chip, respectively, and the male part and the female part are separated from each other when the hinge unit is folded, but are connected to each other when the hinge unit is unfolded.

[16] The transponder according to claim 13 or claim 14, further comprising:
a first base plate and a second base plate, corresponding to the antenna and the semiconductor chip, respectively; and
a first housing and a second housing corresponding to the first base plate and the second base plate, respectively; and
a hinge unit for connecting the first housing and the second housing to each other,
wherein the contact switch includes a male part and a female part connected to
the antenna and the semiconductor chip, respectively, and the male part and the female part are separated from each other when the hinge unit is folded, but are connected to each other when the hinge unit is unfolded.

[17] The transponder according to claim 13 or claim 14, having a through hole in an edge portion thereof and a ring engaged with the through hole.
A. CLASSIFICATION OF SUBJECT MATTER

H04B 1/59(2006.01)1

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 H04B 1/59

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

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)

eKIPASS (KIPO internal), "foldable, foled, antenna and similar terms"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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See patent family annex

* Special categories of cited documents
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**E** earlier application or patent but published on or after the international filing date
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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

05 JUNE 2007 (05 06 2007)

Date of mailing of the international search report

05 JUNE 2007 (05.06.2007)

Name and mailing address of the ISA/KR

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Facsimile No 82-42-472-7140

Authorized officer

SHIM, SONG HAK

Telephone No 82-42-481-8117

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