APPARATUS FOR ACTIVE RADIO FREQUENCY IDENTIFICATION OF A PLURALITY OF TAG TRANSPONDERS

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APPARATUS FOR ACTIVE RADIO FREQUENCY IDENTIFICATION
OF A PLURALITY OF TAG TRANSPONDERS

This invention relates to apparatus for active radio frequency identification of a plurality of tag transponders. More especially, this invention relates to apparatus for active radio frequency identification of a plurality of tag transponders, which apparatus operates such that air time data transmission is utilised to control operation of the tag transponders.

Short range wireless systems operate in the unlicensed portion of the radio spectrum. The short range wireless systems usually operated at 433MHz, 868MHz, 915MHz or 2.4GHz industrial, scientific and medical band. Short range wireless systems can be combined with systems wired to the Internet in order to provide communication over longer distances via an access point.

Short range wireless communications systems find use in automatic identification systems. Radio frequency identification apparatus is one embodiment of automatic identification systems. The radio frequency identification apparatus finds use in short range wireless communications apparatus specified as Low Rate Wireless Personal Area Network (LR-WPAN) from the IEEE 802.15.4 standard 2003. Typical radio frequency identification apparatus includes a radio frequency identification reader and a radio frequency identification tag transponder. Typically the reader and the tag transponder are linked together by a radio frequency generated by the
reader. The reader and the transponder may be linked together by a radio
frequency generated by the tag transponder or by the reader. The tag
transponder is usually attached or coupled to an item for identification
purposes. The item may be a manufactured product or any other suitable
and appropriate item.

The transmission of data over a radio frequency medium occurs by use
of a transceiver method to modulate the radio frequency medium. This
transceiver method has some fixed parameters depending upon operation of
the transceiver. Data is transmitted within the radio frequency identification
apparatus. In both active radio frequency identification apparatus and
passive radio frequency identification apparatus, there may be utilised a
single direction of transmission from the tag transponder to the reader and in
this case an arbitrary controlling method is required. However, in an active or
passive radio frequency identification system in which two-way
communication is required between the tag transponder and the reader, then
arbitrary controlling methods are insufficient.

It is an aim of the present invention to obviate or reduce the above
mentioned problem.

Accordingly, in one non-limiting embodiment of the present invention
there is provided apparatus for active radio frequency identification of a
plurality of tag transponders, which apparatus operates such that air time data
transmission is utilised for controlling operation of the tag transponders, and
which apparatus comprises:
(a) tag transponder unique identifier means;
(b) reader unique identifier means;
(c) message sequence number means;
(d) command means;
(e) data means;
(f) source device controlling version means; and
(g) fixed total size and sub-field size.

The apparatus of the present invention may be such that two-way communication between the tag transponder and the reader is implemented using a data structure and format for the data transmitted which facilitates the following.

(i) Controlling the reading or writing of the tag transponder data between the tag transponder and the radio frequency identification apparatus, or an external network in a standard format.

(ii) Transmission of identification data in a highly efficient manner in order to reduce power consumption and on air time.

(iii) Allowing modification to the operation of the tag transponder through control of the radio frequency medium.

The apparatus of the present invention may provide the required data structure and format to facilitate the controlling of the reading and writing of
data to a tag transponder, and to enable externally applied data to be communicated within the radio frequency identification environment.

For an active radio frequency identification reader and an active radio frequency identification tag transponder to communicate between each other over a radio frequency, control with a series of parameters as indicated above is required. The apparatus of the present invention is able to provide a set of data packets that convey information or actions between the reader and the tag transponder. The commands may allow, for example, alteration of the operation of the tag transponder by supplying data to change the operation of controlling software of the tag transponder, or the provision of commands to activate decisions in the controlling software of the tag transponder or to provide means for replacing the controlling software of the tag transponder through data transmitted over the radio frequency medium.

The apparatus of the present invention enables tag transponders and readers to communicate effectively by the provision of a clear set of rules for undertaking the communication. The rules may set out circumstances under which a tag transponder and a reader can pass information, and request actions to be undertaken, and the structure of the data format in which the rules are conveyed.

The apparatus may be one in which the command means operates with the following control operations.

(i) Alteration of the operation of the tag transponder or the reader by supplying data means linked to a command means to change the operation of the electronic control of the reader.
(ii) Provide command means to activate decisions in the electronic control of the tag transponder or the reader.

(iii) Provide means for replacing the electronic control of the tag transponder or the reader through command and data means transmitted over a radio frequency medium.

The apparatus of the present invention may operate with the following field sizes:

(i) tag transponder unique identifier means fixed to 4-bytes;

(ii) reader unique identifier means fixed to 4-bytes;

(iii) message sequence number means fixed to 2-bytes;

(iv) command means fixed to 1-byte;

(v) data means fixed to 4-bytes;

(vi) source device controlling version means fixed to 4-bytes; and

(vii) fixed total size of 16-bytes.

The apparatus of the present invention may be one in which:

(i) the tag transponder unique identifier means has values controlled by class A internal IPv4 address standard; and
(ii) the reader unique identifier means has values controlled by a class A internal IPv4 address standard.

An embodiment of the invention will now be described solely by way of example and with reference to the accompanying drawing.

Referring to the drawing, there is shown apparatus 2 for active radio frequency identification of a plurality of tag transponders 4. In the drawing, three of the tag transponders 4 are shown. More or less of the tag transponders 4 may be employed. The apparatus 2 operates such that air time data transmission 6 is utilised for controlling operation of the tag transponders 4.

The apparatus 2 may be considered as having a data structure and format section 8 comprising tag transponder unique identifier means 10, reader unique identifier means 12, message sequence number means 14, command means 16, data means 18 and source device controlling version means 20. Data from the data structure and format section 8 is shown passing as data 22 to a reader 24.

The tag transponders 4 are shown as having a transceiver 26 receiving and transmitting data 28. The reader 24 is shown having a transceiver 30 transmitting and receiving data 32. The precise operation of the apparatus 2 will now be appreciated from the following detailed description of a preferred embodiment of operation of the apparatus of the invention.
It is to be appreciated that the following detailed description is of a preferred embodiment and is not intended to be of limiting scope.

**Controlling method constants**

All communications between the reader and the tag transponder, and the tag transponder and the reader in an active radio frequency identification apparatus conform to one standard data packet control format. The data packet format may change in data size depending on the implementation of the active radio frequency identification apparatus as described previously. However, the controlling fields remain constant and are defined in the preferred embodiment of the art. This does not limit the controlling method to a particular embodiment of the active radio frequency identification apparatus.

**Size of the controlling method data packet**

The controlling method data packet will always be of a predefined length, with each field of the controlling method data packet also being of a fixed length which is defined in the electronic controlling method of the tag transponder and reader of the active radio frequency identification apparatus. Therefore no means of identifying the length of the data transmission or data of the individual fields of the controlling method 1 is required to be transmitted in the controlling protocol.

The last byte in a controlling method data packet will always be a version index number. This version number will be linked to the version of the electronic controlling method operating and controlling the device indicated by the source (either tag or reader) unique identifier field of the received
controlling method data packet within the Active radio frequency identification apparatus. This could be from tag transponder to reader, or vice versa, or from external to the radio frequency identification apparatus to the reader. For example in this preferred embodiment, when a tag transponder or a reader receives the controlling method data packet, the device (tag or reader) can immediately inspect the electronic controlling method version of the 'sending' devices electronic controlling method, and when required take actions as a result.

**Byte orders of the controlling method data packet**

The byte order of every byte of the controlling method data packet is defined as left to right. This is not to be confused with Most Significant Bit. However it follows the same rules, where the most significant bit would be to the left and the least significant bit would be to the right.

In one embodiment of the controlling method, a controlling method data packet is received and it contains 4 bytes of information, and each byte was a value with a specific purpose. The first byte to the left would be the first byte of information, the next would be the second etc. until the last byte (to the right) would be the fourth and final value.

To illustrate for one embodiment of the controlling protocol, if 4 bytes were of the value 255.255.255.0 in the controlling protocol, the received data packet order would be (in hex):- 0xFF 0xFF 0xFF 0x00.
If a packet was transmitted and the controlling protocol payload was of
the value 255.0.255.0, the transmission would contain 0xFF, 0x00, 0xFF,
0x00.

This is true for the following defined the fields in the controlling method
data packet:

- Tag transponder Unique Identifier means
- Reader Unique Identifier means
- Command means
- Source Device controlling version means

The only two fields that DO NOT conform to this approach are:

- Message Sequence Number means
- Data means

The message sequence number is a word value (Most Significant Bit
the left and Least Significant Bit to the right) denoting an integer number
between 0 and 65536.

The data field format is specific to the value of the command field
being processed, and its size depends on the embodiment of the active radio
frequency identification apparatus.

**Unique Identifier means:**

In the preferred embodiment of the controlling method, it provides the
means of uniquely addressing devices within the active radio frequency
identification apparatus to enable unique devices to communicate through the
radio frequency channel. The preferred embodiment of this addresses, but
not limited to, is an implementation of the IPv4 protocol for uniquely
identifying both the tag transponder and reader within the active radio
frequency identification apparatus with a field of length 4 bytes. To implement this form of addressing requires that conflicts with 'External Internet Addresses' be avoided and this is achieved by treating the unique identifier field range as one which must comply with the standard for an internal IPv4 range. As a result in this preferred embodiment of the unique identifier means, the range of fields are limited to the 3 private address ranges established by InterNIC the standard body responsible for the IPv4 standard.

**Class Networks**

<table>
<thead>
<tr>
<th>Class</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10.0.0.0 through 10.255.255.255</td>
</tr>
<tr>
<td>B</td>
<td>172.16.0.0 through 172.31.0.0</td>
</tr>
<tr>
<td>C</td>
<td>192.168.0.0 through 192.168.255.0</td>
</tr>
</tbody>
</table>

Ref: Internic IPv4 Protocol

In the preferred embodiment described herein the use of 16,777,216 unique addresses in the CLASS A private range 10.x.x.x will be utilized for the internal IPv4 range.

The use of an IPv4 addressing scheme for the unique identifying means, also allows internet techniques to be applied to the addresses being used. For example DNS lookups could be implemented to provide alternative meaningful names for the underlying IP address, illustrated here in the method that 134.29.3.2 could map to www.barcode.EA 123 85 86.

Within the preferred embodiment of the controlling method data packet unique identifier field range, three special addresses will be utilized as follows.

10.0.0.1
This is the default of value of the unique identifier of the transponder tag provided in its controlling software, until modified by the controlling method or by other means.

255.255.255.255

This is the value of a tag transponder unique identifier used to communicate from one reader to all tag transponders within the active radio frequency identification apparatus.

255.255.255.254

This is the value of a reader unique identifier used to communicate from one tag transponder to all readers within the active radio frequency identification apparatus.

Controlling method data packet format

Each fixed data packet can contain any number of bytes with any number of bytes being implemented in each field as long as the overall size and field size is fixed. The controlling method is illustrated in the preferred embodiment; other embodiments are possible depending on the embodiment of the active radio frequency identification apparatus. In the preferred embodiment, it will be defined as 16 bytes in size and described through the use of some preferred field values. The fixed the structure of the controlling method format must confirm to the fields illustrated in the following table layout.
<table>
<thead>
<tr>
<th>Bytes</th>
<th>Structure</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag unique Identifier Means</td>
<td>4</td>
<td>10.0.0.0</td>
<td>10.255.255.255</td>
<td>unsigned bytes</td>
</tr>
<tr>
<td>Reader Unique Identifier Means</td>
<td>4</td>
<td>0.0.0.0</td>
<td>255.255.255.254</td>
<td>unsigned bytes</td>
</tr>
<tr>
<td>Message Sequence Number Means</td>
<td>2</td>
<td>0</td>
<td>65536</td>
<td>unsigned bytes</td>
</tr>
<tr>
<td>Command Means</td>
<td>1</td>
<td>0</td>
<td>256</td>
<td>unsigned bytes</td>
</tr>
<tr>
<td>Data Means</td>
<td>4</td>
<td>based on the command</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Source device controlling version unsigned means</td>
<td>1</td>
<td>0</td>
<td>256</td>
<td>unsigned bytes</td>
</tr>
</tbody>
</table>

**Controlling method data packet fields**

The controlling method data packet can be broken down into fixed length fields. Each field has a specific length and responsibility, each is described in more detail below.
Tag transponder unique identifier means

Every controlling method data packet will contain a tag transponder unique identifier.

If this is a transmission from a tag transponder to a reader, this field value will be the tag transponder’s unique identifier means, which in this preferred embodiment will be a 4 byte value corresponding to the internal IPv4 address standard assigned to the tag by its controlling software under normal operation.

If the telegram is being transmitted from a reader to an individual tag transponder, then this will contain a tag transponder’s unique identifier means in order for the transmission to be identified by the unique tag transponder alone.

If a reader is transmitting a controlling method data packet to all tag transponders within the active radio frequency identification apparatus then in this specific embodiment, it will be unique identifier means with a field value of 255.255.255.255.

Within this specific embodiment, the tag transponder unique identifier means cannot take the value of 255.255.255.254 as this would cause a duplicate of value with the specific embodiment of the reader unique identifier means.

Reader unique identifier means

Every controlling method data packet will contain a reader unique identifier. If this is a transmission of a controlling method data packet from a
reader to a tag transponder, this field value will be the reader unique identifier means, which in this preferred embodiment will be a 4 byte value corresponding to the internal IPv4 address standard assigned to the reader by its electronic controlling method under normal operation.

If this is a transmission of a controlling method data packet from a tag transponder to a reader, this field value will be the reader unique identifier means, which in this preferred embodiment will be a 4 byte value corresponding to the internal IPv4 address standard, this value will be set to the value of the reader unique identifier means in the controlling method data packet last received by the tag transponder.

If a tag transponder is transmitting a controlling method data packet to all readers within the active radio frequency identification apparatus then in this specific embodiment, it will be unique identifier means with a field value of 255.255.255.254.

Within this specific embodiment, the reader unique identifier means cannot take the value of 255.255.255.255 as this would cause a duplicate of value with the specific embodiment of the tag transponder unique identifier means.

**Message sequence number means**

The message sequence number is designed to assist in sending and receiving data payloads greater than a single data payload that is contained within a controlling method data packet, which within this specific embodiment of the art is 4 bytes in length. If a reader or tag transponder within the active
radio frequency identification apparatus wishes to communicate more than 4 bytes of information, it will have to send more than one controlling method data packet. The message sequence number means allows the recipient of the controlling method data packet to order the received data within the controlling payload into the correct sequence.

In this preferred embodiment, the value of the message sequence number means takes a default value of 0x01, however depending on the implementation of the active radio frequency identification apparatus commands within the controlling protocol may require the transmission of data payloads greater that the size fixed in the controlling protocol data field length. The message sequence number means design allows for multi data payload command types that may be required by the specific embodiment of an active radio frequency identification apparatus.

The message sequence number means would be used to ensure that transmissions with multiple data payload are received in the correct sequence and importantly to determine if data payload telegrams are lost.

**Command means**

The command means allows a unique identifier to allow decisions to be made in the recipient of the controlling method data packet. The commands allow but are not limited to the following: alteration of the operation of the recipient of the controlling method data packet by supplying data to change the operation of the controlling software of the recipient device within the active radio frequency identification apparatus; provision of
commands to create decisions in the controlling software of the recipient device within the active radio frequency identification apparatus; or provision of means of replacing the controlling software of the recipient device within the active radio frequency identification apparatus via data transmitted over the radio frequency medium. In this specific embodiment, the command means is a single byte in size and can take the following values depending on required operation. For transmissions of controlling method data packet's between the reader and the tag transponder of the active radio frequency identification apparatus, the command means can take the value of 0 to 127, for communications between the tag transponder and the reader within the active radio frequency identification apparatus the command means can take the value of 128 to 255. In this specific embodiment, a response command means to a command means received from the reader to a tag transponder will be the received command means value with an additional offset of 128. In this embodiment of the command means, two values are considered reserved and are used for special commands between devices in the active radio frequency identification apparatus. The command means value of 0x80 is used for reserved controlling protocol commands transmitted from a tag transponder to a reader. The command means value of 0x00 is used for reserved controlling protocol commands transmitted from a reader to a tag transponder.

**Data means**

The data means allows the controlling method data packet to transmit data that may or may not be related to the command means, for the purpose
of transmitting data between devices within the radio frequency identification apparatus. The data means may be of any size and may take any value depending on the specific implementation of the active radio frequency identification apparatus. However, in this preferred implementation of the controlling method data packet data means, its size is fixed as 4 bytes, and the data value is specific to the value of the command means. As a default condition, the values of the data means are set to 0x00.

Source device controlling version means

The source device controlling version means is a means of identifying the controlling process used by the device that transmits the controlling method data packet that is received by another device. In the preferred embodiment this is a single unsigned byte containing a value which uniquely identifies the device controlling software of the transmitting device.

Examples of the preferred embodiment command means and resulting controlling method data packet and transmissions between devices.

Use of a command means to receive controlling method data packet from all tag transponders within an active radio frequency identification apparatus embodiment. Within that embodiment are the values of command means and data means in response to the command means of the transmitting reader device.

The tag transponder in this example that responds has a preferred embodiment of the tag unique identifier means with a value of address of 10.200.0.1 and the reader which transmits the controlling method data packet
with the command means, unique identifying means with a value of 192.168.111.1. The tag transponder and reader both set the source device controlling version means to an arbitrary value of 23. The controlling method data packet received from tag transponder in the reader in the preferred embodiment is 16 bytes in length.

### Reader to tag transponder control method transmission

<table>
<thead>
<tr>
<th>Tag unique identifier means</th>
<th>Reader unique identifier means</th>
<th>Message sequence number means</th>
<th>Command means</th>
<th>Data means</th>
<th>Source device controlling version</th>
</tr>
</thead>
<tbody>
<tr>
<td>255.255.255.255</td>
<td>192.168.111.1</td>
<td>0x00 0x01</td>
<td>0x04</td>
<td>0x00,0x00,0x00,0x00</td>
<td>23</td>
</tr>
</tbody>
</table>

The reader sets the tag unique identifier means to the value of 255.255.255.255, sets its own unique identifier means value, a message sequence number means value to 0x01 and a command means to a value of 0x04 with a data means set to 0x00 (default conditions) and the reader’s source device controlling version means value.

### Tag transponder to reader control method data packet transmission response

<table>
<thead>
<tr>
<th>Tag unique identifier means</th>
<th>Reader unique identifier means</th>
<th>Message sequence number means</th>
<th>Command means</th>
<th>Data means</th>
<th>Source device controlling version</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.200.0.1</td>
<td>192.168.111.1</td>
<td>0x00 0x01</td>
<td>0x84</td>
<td>0x00,0x00,0x00,0x0A</td>
<td>23</td>
</tr>
</tbody>
</table>
A tag transponder with the tag unique identifier means with a value of 10.200.0.1 response to the transmitted reader controlling method data packet. The tag transponder sets the reader unique identifier means to the value of 192.168.111.1, which was received in the transmitted controlling method data packet, a message sequence number means value to 0x01, and a command means to a value of 0x84, which is the correct response command means value to the received command means value of 0x04. The tag transponder then sets the data means to the required value defined by the device controlling software in response to the command means value of 0x04. Finally, the tag transponder source device controlling version means value is set.

Use of a command means to transmit multiple data means within a controlling method data packet from a reader to a unique tag transponder within an active radio frequency identification apparatus embodiment. Within that embodiment are the values of command means and data means in response to the command means of the transmitting reader and tag transponder device.

The controlling method data packet utilised in the active radio frequency identification apparatus is the preferred embodiment of 16 bytes in length.
Reader to tag transponder control method data packet transmission

<table>
<thead>
<tr>
<th>Tag unique identifier means</th>
<th>Reader unique identifier means</th>
<th>Message sequence number means</th>
<th>Command means</th>
<th>Data means</th>
<th>Source device controlling version means</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x01</td>
<td>0x06</td>
<td>0x00,0x02,0x00,0x0B</td>
<td>23</td>
</tr>
</tbody>
</table>

As with the previous example of the command means, the fields are set to the required values for transmission. In this example of the preferred embodiment, the data means are set to values that allow the tag transponder controlling device software to anticipate the message sequence number means value ranges of future received controlling method data packet.

Tag transponder to reader method data packet transmission response.

<table>
<thead>
<tr>
<th>Tag unique identifier means</th>
<th>Reader unique identifier means</th>
<th>Message sequence number means</th>
<th>Command means</th>
<th>Data means</th>
<th>Source device controlling version means</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x01</td>
<td>0x86</td>
<td>0x00,0x00,0x00,0x00</td>
<td>23</td>
</tr>
</tbody>
</table>

The tag transponder transmits a command means response value to reader confirming its readiness to accept the/a series of controlling method data packet with message sequence number means from the reader with a starting sequence of 0x00 0x02, and an end sequence of 0x00 0x0B.
<table>
<thead>
<tr>
<th>Tag Unique Identifier Means</th>
<th>Reader unique identifier means</th>
<th>Message sequence number means</th>
<th>command means</th>
<th>data means</th>
<th>Source device controlling version means</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x02</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x03</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x04</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x05</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x06</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x07</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x08</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x09</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x0A</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
<tr>
<td>10.1.1.1</td>
<td>192.168.111.1</td>
<td>0x00 0x0B</td>
<td>0x07</td>
<td>0xFF, 0xFF, 0xFF, 0xFF</td>
<td>23</td>
</tr>
</tbody>
</table>

It is to be appreciated that the embodiments of the invention described above have been given by way of example only and that modifications may be effected.
**CLAIMS**

1. Apparatus for active radio frequency identification of a plurality of tag transponders, which apparatus operates such that air time data transmission is utilised for controlling operation of the tag transponders, and which apparatus comprises:
   
   (a) tag transponder unique identifier means;
   (b) reader unique identifier means;
   (c) message sequence number means;
   (d) command means;
   (e) data means;
   (f) source device controlling version means; and
   (g) fixed total size and sub-field size.

2. Apparatus according to claim 1 in which the command means operates with the following control operations:

   (i) alteration of the operation of the tag transponder or the reader by supplying data means linked to a command means to change the operation of the electronic control of the reader;

   (ii) provide command means to activate decisions in the electronic control of the tag transponder or the reader; and
(iii) provide means for replacing the electronic control of the tag transponder or the reader through command and data means transmitted over a radio frequency medium.

3. Apparatus according to claim 1 or claim 2 and comprising the following field sizes.

(i) tag transponder unique identifier means fixed to 4-bytes;
(ii) reader unique identifier means fixed to 4-bytes;
(iii) message sequence number means fixed to 2-bytes;
(vi) command means fixed to 1-byte;
(v) data means fixed to 4-bytes;
(vi) source device controlling version means fixed to 4-bytes; and
(vii) fixed total size of 16-bytes.

4. Apparatus according to any one of the preceding claims and in which:

(i) the tag transponder unique identifier means has values controlled by class A internal IPv4 address standard; and

(ii) the reader unique identifier means has values controlled by a class A internal IPv4 address standard.