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(54) **DEVICE AND METHOD FOR EMISSION OF RADIOFREQUENCY SIGNALS FROM
ELECTROMAGNETIC SIGNALS**

(57) This invention refers to a device for emission of radiofrequency signals from electromagnetic signals comprising: (1) means for reception of electromagnetic signals containing numerical messages; (2) means for emission of a radiofrequency signal between 20 and 868 MHz; (3) means for transformation of said electromag-

netic signals received containing numerical messages into a signal that allows the means of emission emitting a radiofrequency signal; and (4) means for power supply. The present invention also refers to a method which uses said device and to its use.

EP 3 561 781 A1

Description

[0001] Device and method for emission of radiofrequency signals from electromagnetic signals.

[0002] The present invention refers to the telecommunications field. In particular, it refers to a device for emission of radiofrequency signals previously processed, which can be used, for example, for opening of mechanisms such as garage and parking lot doors, from an electromagnetic signal transmitted, for example, through Bluetooth.

[0003] Nowadays, there are systems or remote control devices using ultrasonic, radiofrequency or infrared transducers. Said devices are common in many applications, including security systems for buildings and vehicles, and opening devices for building front doors and garage doors operated by remote control.

[0004] There are remote control devices with radiofrequency transducers which allow the storage of a unique radiofrequency code in each device, and the activation of its emission from an electromagnetic signal, usually by radiofrequencies between 433 MHz and 868 MHz. These unidirectional transmission systems used nowadays have two important drawbacks: (a) the transmitted codes are usually fix codes, limiting its security and (b) the number of possible code combinations is relatively small.

[0005] Nowadays, there are also rolling code and variable code systems in order to overcome the limitations of said fix code systems (see ZA Patent number 91/4063 and US Patent US5103221). In said patents, transmitters using algorithms to generate a different transmission every time that the transmitter is activated, are described. When a code is received and decoded, a decoder only responds if a valid transmission was made. In some cases, a special algorithm with a stored key for decoding a coded reception is used. The decoded value is then compared with a stored value to determine whether the transmission is legitimate or not.

[0006] In order to overcome the limitations of the prior art devices, the inventors of the present invention have developed a device that allows receiving instructions through electromagnetic signals, for example by Bluetooth from a mobile phone or a tablet, being these instructions previously stored in a database, and converting the received information to emit specific radiofrequency signals. This allows 1) using one particular device for more than one door, since it does not require any ad-hoc configuration, 2) activating the opening mechanism in doors and other devices with variable code, since more than one code can be transmitted.

[0007] Therefore, the present invention discloses a device for emission of radiofrequency signals from electromagnetic signals comprising (1) means for reception of electromagnetic signals containing numerical messages; (2) means for emission of a radiofrequency signal between 20 and 868 MHz; (3) means for transformation of said electromagnetic signals containing numerical

messages into a signal that allows the emission means to emit a radiofrequency signal; and (4) means for power supply.

[0008] In the present invention, said means for the reception of electromagnetic signals can be either unidirectional or bidirectional means, preferably bidirectional means. If bidirectional, the reception means can interact, for example, with a mobile phone or a tablet in both directions, through an application installed in them. Besides, said electromagnetic signals can be transmitted via Bluetooth, Bluetooth Low Energy (BLE), LTE-CAT cellular connections, Wifi, sub-1GHz radiofrequencies (LoRa, Sigfox), among others, all them known by a skilled person. Preferably, said electromagnetic signals received by the reception means are transmitted via Bluetooth. More preferably, said electromagnetic signals received by the reception means are transmitted via BLE. In one embodiment, said means for reception can be a CC2642T microcontroller (Texas Instruments, USA), with Bluetooth reception and low energy, or, if more connection options are integrated, a Fipy module (Pycom LTD, United Kingdom), with BLE, Wifi, LoRa, Sigfox and LTE-M (CAT M1 and NBIoT) reception.

[0009] In one embodiment, said means for emission of a radiofrequency reproduce the opening signals of the mechanisms to be activated. Said radiofrequency signals emitted by the emission means have a frequency between 20 MHz and 868 MHz. Preferably, said radiofrequency signals can be in a multichannel range between 280 MHz and 868 MHz. Also preferably, said radiofrequency signals can be low frequency transmission systems between 20 MHz and 280 MHz. In one embodiment, said emission means can be a PCB board with an integrated antenna, capable of transmitting in a range of frequencies between 280 MHz and 868 MHz. There is a large amount of PCB board manufacturers (such as Fast PCB SL, Spain) with the knowledge for producing these boards with an integrated antenna. Regarding the emission in the 20-280 MHz range, there are manufacturers like Geyer Electronic e.k. (Germany) that produce oscillators and quartz crystals to emit these frequencies.

[0010] On the other hand, radiofrequency signals emitted by the device of the present invention, can be fix code signals, variable code signals or a combination thereof. Preferably, fix code radiofrequency signals are binary signals, ternary signals, fast signals, slow signals, Mastercode signals, among others. Preferably, variable code radiofrequency signals are Keeloq, Mutancode, Jcm, Neo, Pujol, Vario, Norton, Roper, Erreka, Doormatic, Celinsa, Aprimatic, TR, Gibidi, Dea, Nice, Smilo, Beninca, Seav, among others.

[0011] In another embodiment, said transformation means allow the conversion of the electromagnetic signals with the numerical message received by the device through electromagnetic signals, such as Bluetooth, into data that can be processed by the radiofrequency emission mean. In one embodiment, said means for transformation, for example, is a microcontroller CC1130 RF

Transceiver (Texas Instruments, USA), which allows managing the data received, for example via Bluetooth, and transform them into radiofrequency signals.

[0012] In the present invention, said power supply means can be rechargeable batteries via USB, batteries with connection to a socket or to a vehicle, alternating current, among others. In one embodiment, said power supply means can be a 1000 mAh lithium battery. A skilled person knows all possible kinds of electrical battery suitable for the device of the present invention.

[0013] In one embodiment of the device of the present invention allows the opening of garage doors that are activated by radiofrequency signals, as well as other mechanisms activated in the same manner, through the transmission of the opening codes emitted by a connection, preferably via Bluetooth, with a mobile phone or a tablet, made through an application installed in them, prior identification and authorization of the user that is using the mechanism.

[0014] The device of the present invention is conceived, among other reasons, to facilitate the opening of these access mechanisms without the need of having a remote control, as well as allowing the access for authorized users that do not possess one. The device is also conceived either for being able to be attached to garage doors, walls and ceilings, or for being carried out by its user in his or her vehicle.

[0015] The modules that comprise the device of the present invention can be protected by a plastic case that protects the device against humidity, dust, bumps and other conditions that could affect its operation. A skilled person knows possible variety of suitable cases for the device of the present invention, and there is a wide number of manufacturers, such as SMINN (Elson Electronic SA, Spain).

[0016] In another aspect, the present invention discloses a method that uses the device previously mentioned which comprises the steps of:

- a) receiving electromagnetic signals containing numerical messages;
- b) transforming the electromagnetic signals containing numerical messages from step a) into a signal that allows the emission means to emit a radiofrequency signal; and
- c) emitting a radiofrequency signal between 20 and 868 MHz.

[0017] In the method of the present invention, the electromagnetic signals received in the step a) can be generated from a database with the radiofrequency signals to be emitted. This database can be delivered by the owner or the manufacturer of the device to be operated with said radiofrequency signals. If there is not a radiofrequency signal database, it could be obtained by a capture method, in which the characteristics of the radiofrequency signal that emits a radiofrequency emission device, for example a remote control for garage doors and

shutters among others, are captured. The data captured and stored in a database are the frequency and the modulation in which the device emits, and the signal sent via radiofrequency signal. The capture of this data can be done by antenna sniffing, or through a circuit logic analyzer device, tapping of the circuit or even through its writing and creation, among others.

[0018] In cases in which the device uses a variable code, as many codes as considered suitable will be stored, identifying each emission separately, so that each data previously mentioned can be stored: data emitted, frequency of emission and modulation.

[0019] Thus, each data emission made by the device of the present invention is stored in the database containing the following information:

- frequency in which the radiofrequency signal is emitted;
- modulation in which the radiofrequency signal is emitted;
- data emitted by the radiofrequency signal.

[0020] Additionally, said information can contain one or more of the following information:

- identification of the device and the user owner of the information;
- channel used;
- pulse number of said channel (in the case of variable emission devices).

[0021] For example, when a user desires to emit a radiofrequency signal, he or she will need to identify himself or herself, through an application installed in his or her mobile phone or tablet, which manages the database, and subsequently request the transmission of the desired radiofrequency signal. The management system linked to the application that the user uses, analyzes that the user is authorized to emit the signals (being the owner of them, or having been authorized by him or her). In the case of having this authorization, the system makes an internal search for the signal that the user desires to emit, finding the radiofrequency code to be emitted (for example, the one immediately consecutive to the last one used). This is: data to be emitted, the frequency of this signal and the modulation in which to emit. Once the authorization is validated, the application communicates with the transmitter device, preferably via Bluetooth, to request the emission of the radiofrequency signal. This is done through the application installed in the user's mobile phone or tablet.

[0022] When requesting the transmission of the signal, a user's mobile phone or tablet can contact the transmitting device of the present invention with which he or she desires to emit the radiofrequency signal, both identifying themselves, using for example the Bluetooth protocol. In this step, the device can inform the managing system of data of interest for it, such as the status of the power

supply means.

[0023] After confirming the identification, the mobile phone or tablet application communicates the device of the present invention which is the radiofrequency code it requests for transmission, which is the frequency in which it is to be transmitted, and which modulation to use to send this data.

[0024] The device of the present invention allows transmitting a particular radiofrequency signal, which is stored in a database. The data for the emission of the radiofrequency signal are received by the device through an electromagnetic signal, for example via Bluetooth, processing them internally, so that it is possible to transmit them using radiofrequency, as explained in the step b) of the method that uses the device of the present invention. In this way, the radiofrequency signals operating a device (a garage door, a shutter, among others) that had been stored in a database, have been reconverted into radiofrequency signals exactly identical to the original, as explained in the step c) of that method.

[0025] Once the device has transmitted the radiofrequency signal, it can be linked, for example via Bluetooth, to the application installed in the mobile phone or tablet managing the codes, so that it can communicate the user that the emission of the radiofrequency signal has been successfully made.

[0026] On the other hand, after finishing the operation, the radiofrequency transmitter device will delete the data that were sent to it by the mobile phone or the tablet.

[0027] The method of the present invention allows the transmission of radiofrequency signals previously stored in databases accessible through the Internet, prior authorization of the user who wants to transmit them by their owner, communicating the data in order to be able to replicate these transmissions from an application installed in the user's mobile phone or tablet who privately communicates, for example via Bluetooth, with a device that manages the data received and transmits a radiofrequency signal exactly identical to the one stored in the database.

[0028] An advantage of the method of the present invention is that the data of the electromagnetic signal is not stored either in the user's mobile phone or tablet, nor in the device of the present invention transmitting the radiofrequency signal, increasing the security of the transmissions.

[0029] Moreover, in order to carry out this method it is not necessary to configure the radiofrequency transmitting device, since the interaction of the user with it is nonexistent, for being all the communications between the mobile phone or tablet and the transmitting device automatically made by the application in the first device.

[0030] Finally, the present invention discloses the use of the device previously mentioned for the opening of garage doors, other type of doors, fences, shutters and similar devices.

Claims

1. Device for emission of radiofrequency signals from electromagnetic signals, **characterized in that** it comprises:
 - means for reception of electromagnetic signals containing numerical messages;
 - means for emission of a radiofrequency signal between 20 and 868 MHz;
 - means for transformation of said electromagnetic signals containing numerical messages received into a signal that allows the emission means to emit a radiofrequency signal; and
 - means for power supply.
2. Device, according to claim 1, **characterized in that** said means for reception are bidirectional means.
3. Device, according to claims 1 or 2, **characterized in that** said electromagnetic signals received by the means for reception are transmitted via Bluetooth, Low Energy Bluetooth, LTE-CAT cellular connections, Wifi, Sub-1Ghz radiofrequencies (LoRa, Sigfox), among others.
4. Device, according to claim 3, **characterized in that** said electromagnetic signals received by the means for reception are transmitted via Bluetooth or Low Energy Bluetooth.
5. Device, according to any one of the preceding claims, **characterized in that** said radiofrequency signals are multichannel range between 280 MHz and 868 MHz.
6. Device, according to any one of the preceding claims, **characterized in that** said radiofrequency signals are low frequency transmission systems between 20 MHz and 280 MHz.
7. Device, according to any one of the preceding claims, **characterized in that** said radiofrequency signals are fix code signals, variable code signals or a combination thereof.
8. Device, according to claim 7, **characterized in that** said fix code radiofrequency signals are binary signals, ternary signals, fast signals, slow signals and Mastercode signals, among others.
9. Device, according to claim 7, **characterized in that** said variable code radiofrequency signals are KeeLoq, Mutancode, Jcm, Neo, Pujol, Vario, Norton, Roper, Erreka, Doormatic, Celinsa, Aprimatic, TR, Gibidi, Dea, Nice, Smilo, Beninca, Seav, among others.
10. Device, according to any one of the preceding

claims, **characterized in that** said means for power supply are rechargeable batteries via USB, batteries with connection to a socket or to a vehicle, alternating current, among others.

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11. Method for emission of radiofrequency signals that uses a device according to claims 1 to 10, **characterized in that** it comprises the steps of:

- a) receiving electromagnetic signals containing numerical messages; 10
- b) transforming the electromagnetic signals containing numerical messages from step a) into a signal that allows the emission means to emit a radiofrequency signal; and 15
- c) emitting a radiofrequency signal between 20 and 868 MHz.

12. Method, according to claim 11, **characterized in that** the information of said numerical messages is: 20

- frequency in which the radiofrequency signal is emitted;
- modulation in which the radiofrequency signal is emitted; 25
- data emitted by the radiofrequency signal.

13. Method, according to claims 11 or 12, **characterized in that** the information contained in said numerical messages additionally contain one or more of the following information: 30

- identification of the device and the user owner of the information;
- channel used; 35
- pulse number of said channel (in the case of variable emission devices).

14. Method, according to claims 11 to 13, **characterized in that** the data comprised in the electromagnetic signals containing numerical data from step a) are not store in the device according to claims 1 to 10. 40

15. Use of the device, according to claims 1 to 10, for the opening of garage doors, other type of doors, fences, shutters and similar devices. 45

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EUROPEAN SEARCH REPORT

Application Number
EP 18 38 4001

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EP 18 38 4001

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