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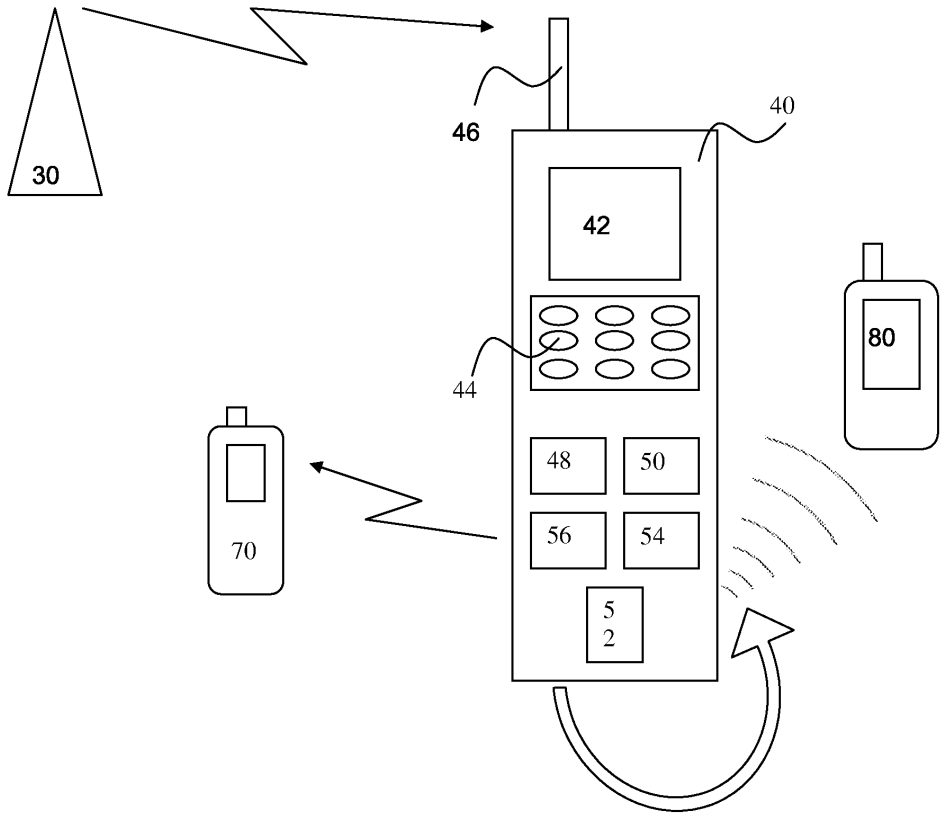
(54) **Digital radio receiver**

(57) Digital radio receiver for DAB, DAB+, T-DMB, DRM (Digital Radio Mondiale) or similar standards, able to reproduce a music file demodulated and/or decoded from a received signal, comprising processing means for managing the functions thereof designed to allow the reproduction of a received audio and/or graphics file subject to deduction of a predetermined amount from stored data which represents a residual credit of the user. A person who hears a piece of music on the radio is thus able to buy it in order to listen to it again as and when required after it has been transmitted, purchase listening rights (DRM rights) and decide whether to give it as a present or allow someone else to hear it.



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Description

[0001] The invention relates to a digital radio receiver.

[0002] Portable audio and visual reproduction devices with the capacity for recording and transferring digital audio and video information, typically downloaded from a personal computer or via an Internet connection from direct sales sites, are known.

[0003] A particular type of such device consists in digital radio receivers which use DAB (Digital Audio Broadcasting), T-DMB (Terrestrial Digital Multimedia Broadcasting) and DRM (Digital Radio Mondiale) reception protocols or some other equivalent technology.

[0004] With these devices it is possible to achieve the high-quality reproduction of a music or sound signal and display images on an integrated display. Although they are convenient and portable, they are still, however, mere receivers.

[0005] In view of the growing use of Internet in order to transfer digitally audio and in particular music and video files, record companies are also interested in broadcasting via radio those pieces of music which listeners may then purchase; for this purpose the preferred broadcasting means are public digital radio transmitters.

[0006] It would be extremely convenient for persons who hear a piece of music on the radio to have the opportunity of purchasing it in order to listen to it again, as and when they wish, after it has been played.

[0007] However, the abovementioned digital radio receivers are not suitable for this function.

[0008] The invention therefore deals with the problem of providing a digital radio receiver of the type described which is able to solve the technical problems of economic transaction and data management associated with the purchase of audio and/or graphic files contained in the radio signal.

[0009] These problems are solved by a digital radio receiver for DAB, DAB+, T-DMB, DRM (Digital Radio Mondiale) or similar standards, which is able to reproduce a music file demodulated and/or decoded from a received signal and comprising processing means for managing the functions thereof, characterized in that the processing means are able to allow the reproduction of a received audio and/graphic files subject to the deduction of a predetermined amount from stored data which represents a residual credit of the user.

[0010] By processing internally information which represents the user's credit and/or using it in order to enable or disable certain functions in the receiver (e.g. unrestricted reproduction of certain files or reproduction on a time basis), the receiver is provided with all the characteristics necessary for the transmission/sale against payment of files via digital radio.

[0011] Preferably the receiver has a memory for storing the data which represents a residual credit of the user, so as to facilitate verification or modification of the value which is "local".

[0012] The processing means are able to modify both the data in the local memory and the data contained in a memory external to the receiver in which said data, which represents a residual credit of the user, is stored. This solution ensures that it is not possible to alter (fraudulently or otherwise) a user's credit.

[0013] The receiver may also comprise means for setting said stored data to a predefined value. Conveniently, the amount to be entered, although it may be permanently fixed at the factory and then gradually used up, may be topped up as required, resulting in practically unlimited autonomy in terms of credit. The input means may consist in suitable programming of the processing means or chips and/or dedicated interfaces.

[0014] The receiver may comprise a data communications interface for a short-range personal wireless network, preferably based on a Bluetooth, Wi-Fi or similar industrial standard, suitable for said input/setting operation. This facilitates user management of the credit, being based on a widely adopted standard and resulting in practice in more or less infinite possibilities and solutions for updating the credit.

[0015] The receiver may also comprise data transmission means which use NFC (Near Field Communication) technology or any other wireless technology which allows communication between short-range devices able to perform said input/setting operation in a secure and protected manner.

[0016] Advantageously, the receiver may comprise means for recognizing an identifier in said received audio and/or graphics file. The identifier may serve both for management and ordering of the incoming data or files as well as "tagging" of the files which may be purchased.

[0017] Advantageously, the receiver may comprise means for allowing reproduction of said received audio/or video files subject to a non-zero value of a counter preset to a value derived from said identifier and decreased with each playback. In this way it is possible to allow playback of a piece of music such that it can be listened to again only a predefined number of times. After it has been played back, it will be disabled by the processing means and it will only be possible to listen to it again by purchasing it.

[0018] Advantageously the receiver may comprise a memory for storing, permanently or otherwise, one or more received audio and/or files. It is thus possible to expand the capacity and functionality of the receiver which may permanently or temporarily contain the files purchased by the user.

[0019] Advantageously, listening rights may be associated with the purchased file. The management of these rights is known by the term DRM (Digital Right Management); below the listening rights will be referred to as DRM rights.

[0020] Advantageously, once a piece of music and the associated listening rights have been downloaded onto a receiver, it is very convenient to transfer them to another apparatus, so as to be able to decide whether to give it as a present or simply allow other people to hear the

piece of music:

- in the case where one wishes only to allow other people to hear the piece of music, in the device which receives the file it will be cancelled automatically or will be no longer utilisable within a certain time period or after a predetermined number of times that it has been listened to;
- in the case where the piece of music is to be given as a present, it will be transferred together with the rights.

[0021] Advantageously, the receiver may comprise means for extracting from the captured signal self-installing data packets for updating the program implemented by the processing means. As a result it is possible to prevent tampering and/or reverse-engineering aimed at fraudulently modifying the payment system.

[0022] The invention also relates to a transmitting station which is able to send a digital radio signal using a transmission standard and data protocol which is specific for a receiver as described above.

[0023] The invention also relates to a method for allowing the acquisition of an audio and/or graphics file via a digital radio receiver for DAB, DAB+, T-DMB, DRM (Digital Radio Mondiale) or similar standards, characterized by:

- recognizing by means of a particular identifier a file which can be acquired from a received digital radio signal containing files tagged with associated identifiers; and
- deducting a predetermined amount from stored data which represents a residual credit of the user whenever he/she intends acquiring the file so as to be able to make use of it permanently.

[0024] Advantageous variants of the method, which may be implemented singly or in combination, are as follows:

- permanent reproduction of the file is possible only after deduction of the credit;
- the data representing the residual credit of the user is stored in the receiver;
- in order to perform said deduction the data contained in a memory external to the receiver which stores the data representing the residual credit of the user is modified;
- said stored data is set to a predefined value;
- reproduction of the audio and/or video file which can be purchased is allowed subject to a non-zero value of a counter preset to a value derived from the respective identifier of the file and decreased with each playback;
- self-installing data packets for updating the receiver management program are extracted from the received signal;
- once a piece of music and the associated listening rights have been downloaded onto a receiver it is very convenient to transfer them to another apparatus, so as to be able to decide whether to give it as a present or merely allow other people to hear the piece of the music;
- in the case where one wishes only to allow other people to hear the piece of music, in the device receiving it the file will be automatically cancelled or will be no longer utilisable within a certain period of time or after a predefined number of times that it has been listened to;
- in the case where the piece of music is to be given as a present, it will be transferred together with the rights.

[0025] The advantages of the invention will emerge more clearly from the following description of a preferred embodiment, illustrated in the accompanying drawing which shows a receiver and the associated radio system.

[0026] A receiver 40 according to the invention is capable of receiving with an antenna 46 the digital radio signal emitted by a transmitter 30. The signal is processed (namely demodulated and/or decoded and/or interpreted) by a microprocessor 48 which drives and/or manages the following components (the connections between the components are not shown):

- a display or equivalent graphics interface 42 by means of which operating data or data relating to the station 30 or relating to the piece of music or file reproduced may be displayed;
- data input means 44, namely a set of pushbuttons or a touch wheel via which the user enters commands performed by the microprocessor 48;
- a memory 50 inside which data corresponding to the user's credit is stored (may also be inside the microprocessor 48);
- a memory 52 - which may also be internal to the microprocessor 48 - in which one or more audio and/graphics files to be reproduced (via reproduction means, such as a loudspeaker , not shown, or the display 42) are stored;
- a communications interface 56 able to assist the microprocessor 48 with processing and/or modification of the data contained in a memory which is external to the receiver 40 and in which the residual user credit is stored. The interface 56 functions in accordance with known standards (Wi-Fi, Bluetooth, etc.) and may interact with a nearby mobile phone 70 and the data may be stored in it or may be accessed via it;
- an integrated circuit or control system 54 using NFC technology for secure updating of the credit information in the memory 52.

[0027] The receiver 40 may have various functions, some of which are mentioned below.

[0028] The station 30, when one wishes to allow others

to hear a given piece of music, prior to transmission indicates the possibility of being able to store in the receiver 40 the piece of music itself via the input means 44. The message is also encoded in the radio signal and is processed by the microprocessor 48 which activates a configuration and options menu on the display 42.

[0029] During digital transmission, the piece of music is tagged with an identifier which allows storage thereof in the receiver 40 for a given period of time, or a given number of times, after which it can no longer be listened to. The microprocessor recognizes the identifier in the received audio and/or video file and via the program assigns to a counter a value derived from said identifier which represents the maximum number of playbacks permitted. It then decrements the counter with each playback and allows reproduction of the audio and/or video file only in the case of a non-zero value of this counter. In another mode a maximum time (for example number of days) for free use of the file may be determined.

[0030] The user, prior to expiry, may in any case acquire the file and keep it inside the receiver 40, authorizing purchase thereof when required. The associated commands are entered via the means 44 and/or selection menu on the display 42.

[0031] Alternatively, the owner of the receiver 40 may acquire via (digital) radio a piece of music (paying the corresponding DRM listening rights) and decide whether to give it as a present or allow others to hear it; activation of the purchasing function is performed, for example, by pressing a suitable "buy" key provided on the receiver 40.

[0032] Transfer from the receiver 40 to a further apparatus 80 is performed using wireless technology. The further apparatus 80 has, in turn, at least the file reception and playback functions which the receiver 40 has and may in turn transmit the file to other apparatus; in this case, activation of the transfer function is performed, for example, by pressing a suitable "exchange" key provided on the receiver 40.

[0033] More generally, the files may be transferred in a network of receiving/playback apparatus 40, 80.

[0034] According to the invention, during transfer between the receiver 40 and the further apparatus 80, the file is subject to software control via a DRM (Digital Right Management) controller in order to determine the presence or absence of the DRM rights and, depending on the case, is transferred assigning a value to a tag which contains the information as to the presence or absence of the associated rights.

[0035] If the transferred file does not also contain the listening rights, the recipient will be allowed to listen to the piece of music for a limited period of time or a given number of times or subject to other restrictions depending on the type of associated DRM (Digital Right Management) protection; it will be automatically cancelled or will be no longer utilisable after the predetermined period of time or given number of listening times.

[0036] In the case where one wishes to give the piece of music as a present, the listening rights will be also be transferred together with the file; the software will then manage deduction from the residual credit in the memory of the amount for the associated listening rights.

[0037] In this case, the sender of the piece of music (receiver 40) must assume the cost for it as though it had been purchased again from the transmitter 30.

[0038] In both cases an image or personal message may be associated with the piece of music.

[0039] In the same mode, the station 30 may provide the service consisting in sending pictures of live events subject to prior purchase of the service or participation in games with prizes which can be downloaded via radio. If a prize is won, the receiver 40 keeps the game data stored in the memory 50 and the associated prize may be claimed in the form of credit or the like from one of the authorized outlets for the operation.

[0040] The system for payment of the receiver 40, via which the audio, image and other contents transmitted by the station 30 are purchased, may take the forms described below.

[0041] The top-up may be made via the integrated circuit 54 or equivalent credit top-up card system. The user goes to at an authorized outlet for the operation (tobacconist, newspaper kiosk, lottery agency, etc.) and here, via a special device, is able to send signals to the integrated circuit 54; these signals, once they have been interpreted as commands by the microprocessor 48, update the credit data in the memory 50.

[0042] Alternatively a wireless connection 56 (Bluetooth, Wi-Fi or the like) with the mobile phone 70 is used, deducting the residual credit from the corresponding top-up card or assigning payment for the top-up to a bill in the event of payment by means of bills.

[0043] Other functions of the microprocessor 48 consist in extraction from the captured signal of self-installing data packets for updating its internal program.

Claims

1. Digital radio receiver (40) for DAB, DAB+, T-DMB, DRM (Digital Radio Mondiale) or similar standards, able to reproduce a music file demodulated and/or decoded from a received signal, comprising processing means (48) for managing the functions thereof and designed to implement the method according to Claims 11 to 16,
   characterized in that the processing means are designed to allow reproduction of a received audio and/or graphics file subject to deduction of a predetermined amount from stored data which represents a residual credit of the user.

2. Receiver according to Claim 1, comprising a memory (50) inside which said data which represents a residual credit of the user is stored.

3. Receiver according to Claim 1 or 2, in which said

processing means (48) are designed to modify data contained in a memory (70) external to the receiver or a memory (50) internal to the receiver where said data representing a residual credit of the user is stored.

4. Receiver according to Claim 3, comprising a data communications interface (56) for a short-range wireless personal network, preferably based on the Bluetooth, Wi-Fi or similar industrial standard, designed for said input/setting operation.

5. Receiver according to Claim 2 or 3, comprising NFC technology data transmission means (54) for secure updating of the credit information in the memory.

6. Receiver according to any one of the preceding claims, comprising processing means (48) which are able to recognize an identifier in said received audio and/or video file and allow reproduction of said received audio and/or video file subject to a non-zero value of a counter preset to a value derived from said identifier and decreased with each playback.

7. Receiver according to any one of the preceding claims, comprising a memory (52) for storing one or more received audio and/or video files.

8. Receiver according to any one of the preceding claims, comprising means (48) for extracting from the received signal self-installing data packers for updating the program implemented by the processing means.

9. Receiver according to any one of the preceding claims, in which said processing means (48) comprise a DRM (Digital Right Management) controller designed to monitor the presence of the DRM rights during transfer of the file to a further apparatus (80), the latter having characteristics similar to those of the playback apparatus (40).

10. Transmitting station (30) designed to send a digital radio signal using a transmission standard and data protocol specific for a receiver as claimed in the previous claims.

11. Method for enabling purchase of an audio and/or graphics file via a digital radio receiver for DAB, DAB+, T-DMB, DRM (Digital Radio Mondiale) or similar standards, **characterized by**:

- recognizing, via a particular identifier, a file which can be acquired by means of a received digital radio signal containing files tagged with corresponding identifiers and
- deducting a predetermined amount from stored data which represents a residual user credit should the user wish to purchase the file in order to have access to it permanently.

12. Method according to Claim 11, in which the digital radio receiver (40) is allowed to perform the permanent reproduction of the file only following deduction and, once deduction has been performed, the data which represents the residual credit of the user is modified in the digital radio receiver (40).

13. Method according to one of Claims 11 or 12, in which, in order to perform said deduction, the data contained in a memory (50, 70) is modified, said memory being associated with the digital radio receiver (40) storing the data which represents a residual credit of the user previously set to a predefined value.

14. Method according to one of Claims 11 to 13, in which, in the event of promotion of the audio/or video file, reproduction of the said file which can be purchased is allowed subject to a non-zero value of a counter preset to a value derived from the respective file identifier and decreased with each playback.

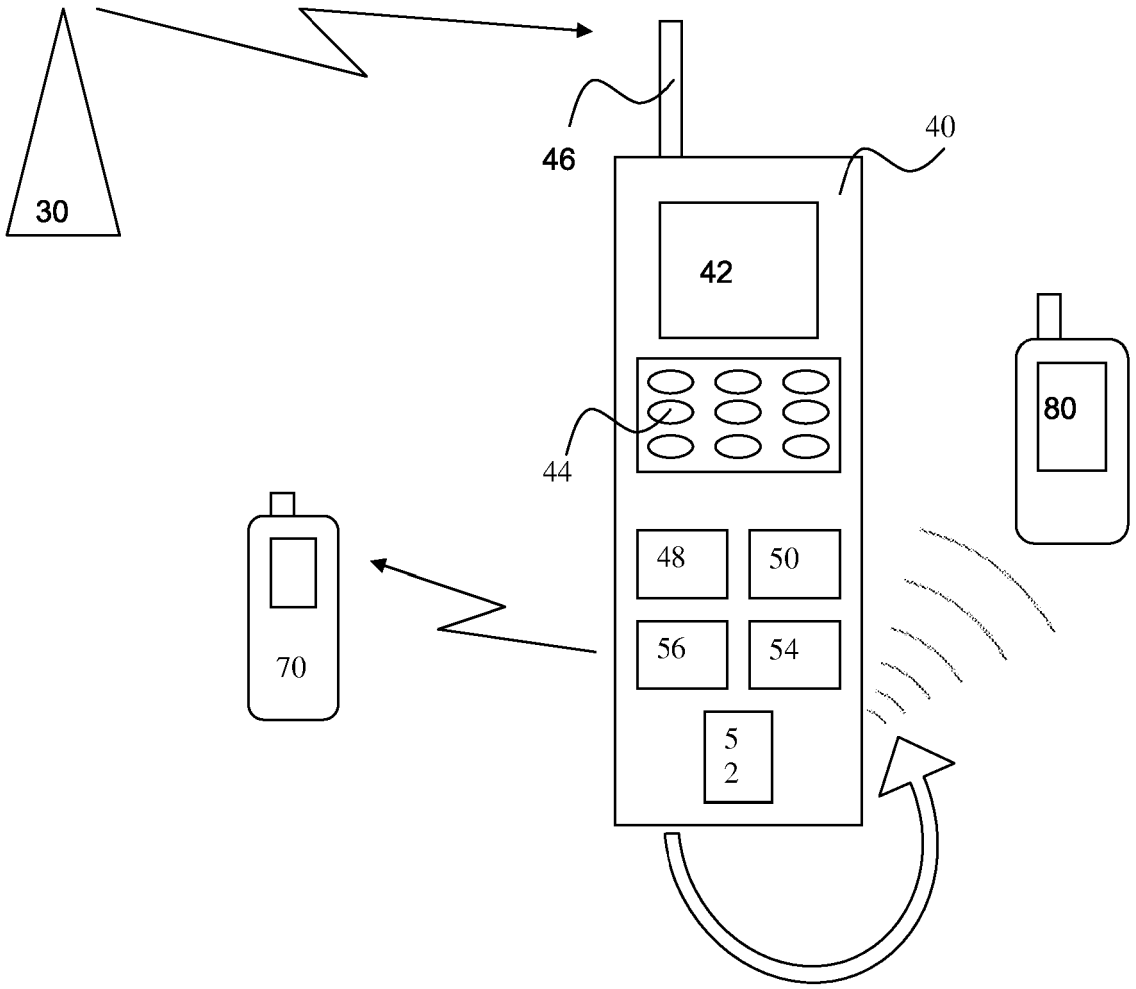
15. Method according to Claim 11, comprising the step of exchanging said digital file with associated DRM rights, comprising furthermore the steps of:

- receiving the file with DRM rights from a transmitting digital radio station (30) via a receiver/playback device (40);
- transferring said file to a further apparatus (80);
- checking for the presence of the DRM rights via a DRM (Digital Right Management) controller together with the transferred file in order to identify the type of transfer.

16. Method according to Claim 15, in which, if the DRM rights are present, then the digital radio receiver (40) is allowed to transfer the file, as a gift, to a further apparatus (80), following payment by the digital radio receiver (40) of the associated rights to the transmitting radio station and consequent reduction of the residual credit in the memory, but with the possibility for unrestricted listening in the apparatus (80).

17. Method according to Claim 15 in which, if the DRM rights are not present, then transfer of the file is allowed for promotional purposes, i.e. with limited possibility for playback, from the digital radio receiver (40), to the further apparatus (80).

18. Method according to Claim 11, in which purchase of the file by the digital radio receiver (40) is performed by pressing a suitable "buy" key provided on the said receiver, while transfer of the file from the receiver (40) to the other apparatus (80) is performed by pressing a suitable "exchange" key provided on the said receiver.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