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(54) DAB-FM electronic unit for receiving audio data as a Digital Audio Broadcasting (DAB) signal and remodulating this audio data as an FM broadcast signal

(57) A DAB-FM electronic unit (1) is described, adapted to acquire audio data in Digital Audio Broadcasting, DAB, so that they can be re-converted into standard audio data in stereo Frequency Modulation, FM, radio-broadcasting;: this unit (1) comprises: a receiver (DAB Rec) of DAB audio data; a micro-controller (M) capable of managing an internal processor for performing a radio DAB digital radio/stereo FM conversion; a modulator (FM M) of audio data in stereo FM radio-broadcasting, capable of modulating said data, converting them and transmitting them through an audio system on a vehicle by means of a OEM or aftermarket car radio; and a device (SW) for managing the unit (1) through OEM or aftermarket controls (2) on a steering wheel of the vehicle; this electronic unit (1) is embedded into the system for managing and controlling the vehicle.

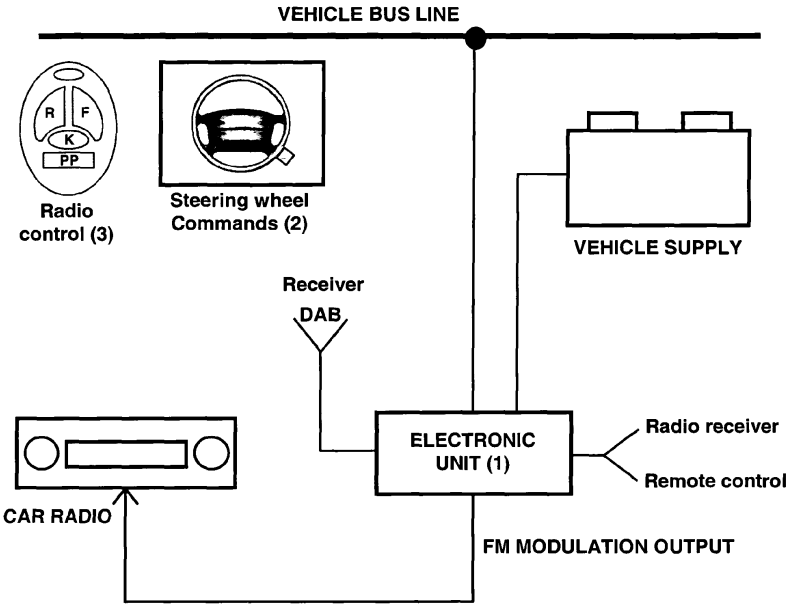

FIG. 1

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Description

[0001] The present invention refers to an electronic unit called "DAB-FM" aimed to acquire audio data in Digital Audio Broadcasting (DAB) and to reconvert such data into audio data in Frequency Modulation (FM) radio-broadcasting, that contains a device that makes such unit capable of being driven through the controls on the vehicle steering wheel (if they are present).

[0002] Documents US-A1-2008/214101, EP-A2-1571766 and WO-A1-2005/086394 disclose electronic units according to the preamble of Claim 1.

[0003] More in detail, the invention deals with an electronic unit capable of performing a conversion of the signal in Digital Audio Broadcasting (DAB, that allows multiplexing the signal, namely allows making many signals share the same channel, and consequently allows many users to share the same transmission means without interference therebetween), making such signal ocmpatible with the Frequency Modulation stereo standard (FM, that consists in modulating the radio signal frequency that has to be used for the transmission in a way that is proportional to the signal width that has to be transmitted), received by any car radio and that can be managed by using OEM or after-marked controls on the steering wheel, if they are present on the vehicle.

[0004] Herein below, the description will be aimed to be applied to a car radio, but it is clear how this description must not be deemed limited to such specific use, since everywhere there is the chance of picking-up the schedule of radio-broadcasting networks, the present invention could be applied, obtaining anyway the same peculiar function disclosed in the present application.

[0005] Currently, a user has not the possibility of interacting, through controls on the vehicle steering wheel, with DAB broadcasters, since there are no systems that are capable of converting the above DAB signal into a stereo FM signal through the traditional car radios operating under the stereo FM standard.

[0006] In view of what is stated above, object of the present invention is providing an interface that is able to acquire, process and code audio data in Digital Audio Broadcasting so that they can be re-converted into stereo Frequency Modulation audio data, modulated through an interface managed through steering wheel controls.

[0007] The above and other objects and advantages of the invention, as will appear from the following description, are obtained by an electronic unit as claimed in Claim 1. Preferred embodiments and non-trivial variations of the present invention are claimed in the dependent Claims.

[0008] It is intended that all enclosed claims are an integral part of the present disclosure.

[0009] A specific subject matter of the present invention is a DAB-FM unit and control means inside the unit that operate with steering wheel controls, if present on the vehicle.

[0010] The unit of the present invention can also be managed through remote control from radio-control.

[0011] Preferably, according to the invention, the apparatus for reproducing audio data is the audio system normally used in motor vehicles, namely the stereo FM one.

[0012] The present invention will be better described by some preferred embodiments thereof, given as a non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 shows an internal block diagram of the DAB-FM unit; and
- Figure 2 shows a block diagram of the connection of the DAB-Fm electronic unit to the vehicle.

[0013] It will be immediately obvious that numerous variations and modifications (for example related to shape, sizes, arrangements and parts with equivalent functionality) could be made to what is described, without departing from the scope of the invention as appears from the enclosed claims.

[0014] With reference to Figure 1, it is possible to note that the DAB-FM electronic unit 1 of the invention contains therein:

- a receiver (DAB Rec) of audio signals in Digital Audio Broadcasting;
- a micro-controller (M) capable of managing the internal processor for data conversion;
- a device (SW) for managing the unit 1, that allows operating through controls on a steering wheel, if they are present on the vehicle;
- a modulator (FM M) of signals in stereo Frequency Modulation radio-broadcasting;
- a power supply (A);
- a radio receiver (REC) for the remove control from a radio-control.

[0015] Every element composing the unit 1 obviously must have a connection network (not shown) with the power supply (A).

[0016] Figure 2 shows how such unit 1 has: an input (In) coming from the source of the Digital Audio Broadcasting signal; a stereo FM audio output (Out) connected to the vehicle car radio; an input (12V, GND) for the supply cable for supplying the unit 1; an antenna (REC) for picking-up 433.9 MHz radio waves coming from the dedicated radio-control 3.

[0017] This electronic unit 1 further has, as stated, an internal device (SW) for managing its operation through controls 2 on the steering wheel, if they are present on the vehicle.

[0018] This electronic unit 1 also has, as seen above, a radio-control 3 for controlling the various functions.

[0019] Summarising, the DAB-FM electronic unit 1 of the invention is adapted to acquire audio data in Digital Audio Broadcasting, DAB, so that they can be re-converted into standard audio data in stereo Frequency Mod-

ulation, FM, radio-broadcasting; this unit 1 comprises:

- a receiver (DAB Rec) of Digital Audio Broadcasting audio data;
- a micro-controller (M) capable of managing an internal processor for performing a radio DAB digital radio/stereo Frequency Modulation FM conversion;
- a modulator (FM M) of audio data in stereo FM radio-broadcasting, capable of modulating said data, converting them and transmitting them through an audio system on a vehicle (not shown) by means of a OEM or aftermarket car radio; and
- a device (SW) for managing the unit 1 through OEM or aftermarket controls 2 on a steering wheel of the vehicle.

[0020] In order to perform the functions for which it is foreseen, the electronic unit 1 of the invention is embedded into the system (not shown) for managing and controlling the vehicle.

[0021] With reference to the previous description, it can be observed that the major advantage of the present invention is allowing to acquire DAB audio data in order to convert them into the more common stereo FM modulation, making them compatible with the stereo FM modulation of the car radios, that otherwise could not be used, and to allow the use of functionalities that are proper of the present invention through OEM or aftermarket steering wheel controls 2.

Claims

1. DAB-FM electronic unit (1) adapted to acquire audio data in Digital Audio Broadcasting, DAB, so that they can be re-converted into standard audio data in stereo Frequency Modulation, FM, radio-broadcasting, comprising:

   - a receiver (DAB Rec) of Digital Audio Broadcasting audio data;
   - a micro-controller (M) capable of managing an internal processor for performing a radio DAB digital radio/stereo Frequency Modulation FM conversion;
   - a modulator (FM M) of audio data in stereo FM radio-broadcasting, capable of modulating said data, converting them and transmitting them through an audio system on a vehicle by means of a OEM or aftermarket car radio; and
   - a device (SW) for managing the unit (1) through OEM or aftermarket controls (2) on a steering wheel of the vehicle;

   characterised in that the electronic unit (1) is embedded into the system for managing and controlling the vehicle.

2. DAB-FM electronic unit (1) according to claim 1, containing a radio receiver (REC) useful for interacting with a possible radio-control (3) that performs the remove control of said unit (1).

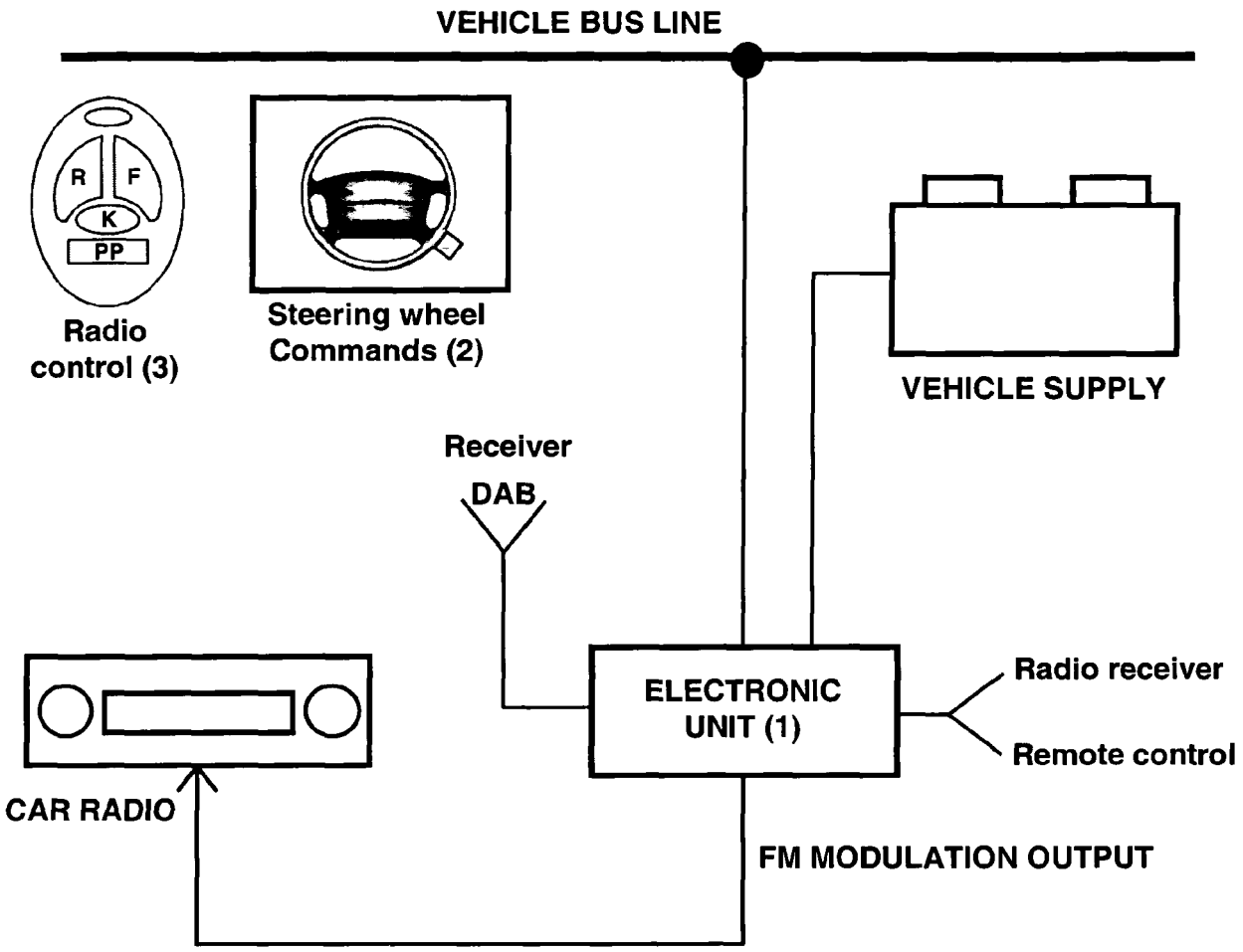
VEHICLE BUS LINE
R
F
K
PP
Radio control (3)
Steering wheel Commands (2)
VEHICLE SUPPLY
Receiver DAB
ELECTRONIC UNIT (1)
Radio receiver
Remote control
CAR RADIO
FM MODULATION OUTPUT

FIG. 1

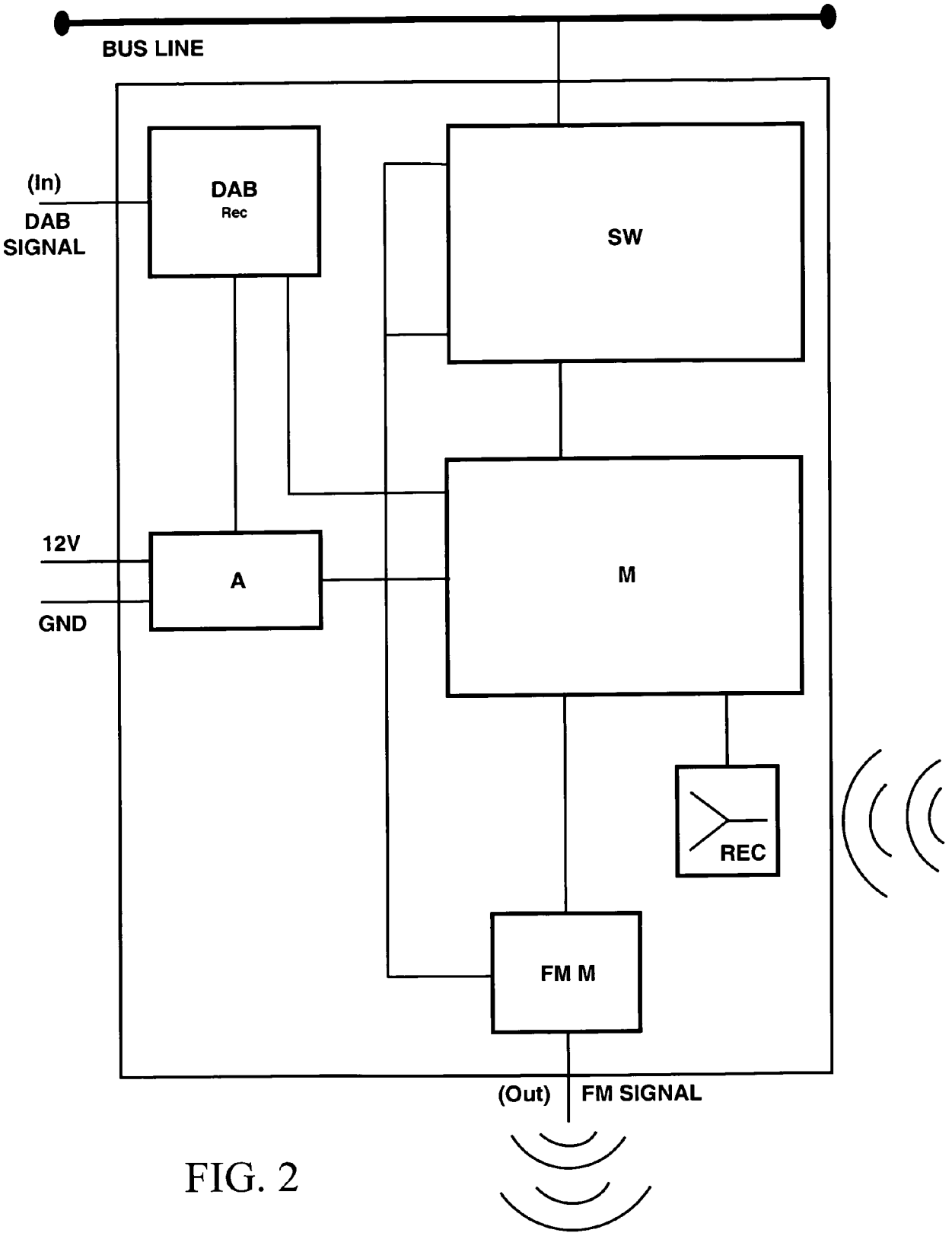
BUS LINE
(In)
DAB
SIGNAL
DAB
Rec
SW
12V
GND
A
M
REC
FM M
(Out)
FM SIGNAL

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2008214101 A1 **[0002]**
- EP 1571766 A2 **[0002]**
- WO 2005086394 A1 **[0002]**