

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
3 November 2005 (03.11.2005)

PCT

(10) International Publication Number  
**WO 2005/104360 A1**

- (51) International Patent Classification<sup>7</sup>: **H03G 3/30**, H04H 1/00
- (21) International Application Number:  
PCT/GB2005/001520
- (22) International Filing Date: 21 April 2005 (21.04.2005)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
0408875.3 21 April 2004 (21.04.2004) GB
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— with international search report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*



**WO 2005/104360 A1**

(54) Title: RADIO RECEIVER VOLUME CONTROL SYSTEM

(57) Abstract: A method and system for adjusting the audio volume of an electronic device such as a digital audio broadcast radio receiver is described. The gain of an amplifier is adjusted according to additional data received with the signal, preferably a radio signal, so that the output volume level of a channel can be automatically adjusted.

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Radio receiver volume control system

This invention relates to a method for adjusting the volume levels of radio broadcasts in radio receiver systems.

5           Radio receiver systems for automotive audio systems in which volume adjustment is provided in response to the electromagnetic field strength of the channel at the receiver are well known. British patent application number 762922 describes a method of reducing the audio volume of  
10 the receiver if the radio channel field strength at the receiver is particularly weak. In such circumstances, high-power amplifiers are required to amplify the weak signal and this results in a large quantity of interference being heard by the user. In this case it is advantageous to  
15 reduce the volume of the received channel so that the interference reproduced by the loudspeaker system is never higher than a predetermined volume level.

          More recently, US patent number 6473604 describes an automotive audio system in which the output volume level of  
20 the speaker system is adjusted according to the input level from various different input sources such as AM/FM tuners, cassette tape players or compact disc systems. This is achieved by first creating a reference output level from the CD, radio, or tape player by inputting a reference  
25 input signal to these sources. The input source offset is then based on the resulting reference output level. By measuring the output levels electronically, the offset to be applied to each source can be stored electronically and applied each time the source changes.

30           A problem not addressed by this document is that radio stations broadcast at different volume levels, so that changing between radio stations can result in an inaudible sound on one channel while a neighbouring channel may be too loud or quiet for the user.

35           Preferred embodiments of the present invention overcome these problems.

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In accordance with the present invention there is provided a method for adjusting the audio volume of an audio electronic device comprising the steps of receiving a signal, receiving additional data associated with the signal, and adjusting the gain applied to an amplifier for the received signal in dependence on the received additional data.

Preferably, the electronic device is a digital audio broadcast radio receiver.

The embodiment disclosed here has the advantage that the output volume level of a received radio channel can be automatically adjusted according to a user's preferences regardless of the transmit volume level selected by the broadcaster. Additionally, a user can opt to have the output volume level of different radio channels at different levels based on user-stored preferences. Furthermore, different output volume levels can be selected from the stored user preferences for different programme types. Such an arrangement overcomes the problem of a large variation in output volume level associated with changing radio channels or the change in volume levels required by the user when listening to different radio programmes within the same channel.

An embodiment of the invention will now be described in detail by way of reference to the accompanying drawing, in which:

Figure 1 shows a block diagram of apparatus embodying the invention.

Referring to figure 1, there is shown 1 a radio transmitter 1 and antenna 3 from which radio waves propagate and which are received by a user with an antenna 7 and receiver 9. A processor 11 then analyses the input signal and determines the source of the received signal. The determination of the source can be achieved in a variety of ways.

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Preferably, the radio waves are broadcast using the Digital Audio Broadcast (DAB) digital radio service. Apart from usual advantages of digital technology, this service allows programme-associated data to be transmitted along with sound information. Such data can simply be text data indicating the current channel or can be other information relating to the current broadcast or a menu of future broadcasts. With this channel identifying information, the processor 11 can then access a memory unit 13 and retrieve appropriate level data stored in the memory unit 13. This level data is then used by the processor 18 to adjust the gain applied to an amplifier 17 for the signal so that an acceptable volume level is produced by from the speakers 19. In one embodiment substantially the same average value is produced for each channel.

In a further embodiment the Digital Audio Broadcast (DAB) digital radio service can be used to send information relating to the broadcast e.g. the broadcast level of a particular channel or even a particular programme can be included in the broadcast data. Such information allows the processor 11 to calculate the gain adjustment required so that the output volume level is maintained at a predetermined, possibly user determined level by adjusting the gain of the amplifier 17. The processor calculates the gain adjustment required and applies it to the amplifier so that the output volume level is maintained at the user preferred level, based on the data received from the broadcaster, and user preferences also stored in the memory unit. The gain adjustment can be such that the output volume of the channels is substantially the same level no matter what the broadcast level of the radio station or the channel selected by the user.

In a further embodiment the memory unit stores additional information relating to a user defined gain to be applied to each channel which may be different for each channel, in addition to the gain adjustment information that allows the user to change the channel and have the

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output level at a preferred default value for all channels. For example, some users may wish to listen to one channel quite loudly, while they may wish to listen to another channel rather more quietly. Accordingly, the user can vary the output volume of the channel according to the channel. In this case the user would program the radio receiver and store his volume preferences in the memory unit 13. Such an embodiment allows the user to change channels and allows him to listen to a variety of channels at his preferred different volume levels.

In yet a further embodiment, the user can store personal values in the memory unit relating to a desired volume level for different types of programme within the same channel. Such an embodiment works in a similar manner to the previous embodiment.

Preferably the user is able to select which of the methods of gain adjustment is to be applied by means of a selection device provided on the receiver and its processor.

The present invention is described with reference to a DAB radio receiver. However those skilled in the art will appreciate the applicability of the invention to conventional analogue radio on the VHF/FM wavebands. For these wavebands additional information (e.g. text information) can be transmitted to a receiver. This is achieved by using an encoder to inject a Radio Data System (RDS) message on the normal FM radio signal modulated just above the stereo audio signal. To receive the RDS message during the broadcast, the microprocessor-controlled tuner is retuned to receive the RDS data, during which the audio signal is muted. This operation occurs within a few mS and so the user is unaware of any break in the broadcast.

The RDS system allows programme service (PS) information to be encoded into the broadcast signal and detected by receivers where the name of the station currently tuned to can be read.

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5 The processor can then adjust the gain and the output volume level based upon the programme service information, and the preferred values stored by the user during the set-up or by the manufacturer in the memory unit as described previously.

10 The RDS system also allows programme type information (PTY) whereby radio stations can assign different programme types to their shows e.g. NEWS, ROCK MUSIC, or CLASSICS. An embodiment of the invention as described above takes this text information and matches the text part to a corresponding text string used to look up information stored in the memory unit 13 relating to user preferences according to the type of programme. Then for example, if a user in a vehicle is listening to one type of programme at  
15 a background level, and the user has set the preferences that news programmes are to be turned up to a higher volume level, then the receiver will automatically adjust the gain to be applied according to the type of broadcast. A similar procedure could also be performed with traffic programme  
20 (TP) and traffic announcement (TA) data.

Alternatively, in this case, the channel volume broadcast offset information can be stored at the time of manufacture from information obtained from the broadcaster.

25 The present invention is described with reference to a radio receiver. However those skilled in the art will appreciate the applicability of the invention to other receiving equipment such as mobile phones, and televisual broadcasts. Additionally, the invention can also be used in a wide variety of electronic devices such as CD players,  
30 MP3 players, and mini disc players where an "average" volume field can be incorporated into the header information of the track so that the appropriate offset can be applied according to the track average volume level and to the user's preferences.

CLAIMS

1. A method for adjusting the audio volume of an audio  
5 electronic device comprising the steps of:  
receiving a signal;  
receiving additional data associated with the  
signal; and  
adjusting the gain applied to an amplifier for the  
10 received signal in dependence on the received  
additional data.
2. A method for adjusting the audio volume according to  
claim 1 in which the electronic device is a digital audio  
15 broadcast radio receiver.
3. A method for adjusting the audio volume according to  
claim 1 in which the electronic device is an analogue  
radio equipped with radio data system decoding.  
20
4. A method according to claim 1, 2, or 3 in which the  
step of adjusting the gain comprises the step of  
retrieving stored data relating to the received signal  
and deriving an adjustment from the gain of the amplifier  
25 from the stored data.
5. A method according to claims 1 to 4 in which the  
gain adjustment derived when applied to the amplifier  
produces substantially the same output level for each  
30 received signal.
6. A method according to claims 1 to 5 in which the  
gain adjustment is derived in dependence on a user  
defined volume preference for each received signal.  
35
7. A method according to claims 1 to 6 in which the  
gain adjustment is derived in dependence on programme

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data received in the additional information associated with the received signal.

5 8. A method according to claims 4 to 7 in which the user may select the method of gain adjustment.

9. A system for adjusting the audio volume of an audio electronic device comprising:

means for receiving a signal;

10 means for receiving additional data associated with the signal; and

means for adjusting the gain applied to an amplifier for the received signal in dependence on the received additional data.

15

10. A system for adjusting the audio volume according to claim 9 in which the electronic device is a digital audio broadcast radio receiver.

20 11. A system for adjusting the audio volume according to claim 9 in which the electronic device is an analogue radio equipped with radio data system decoding.

25 12. A method for adjusting the output audio volume of an electronic device substantially as herein described with reference to the drawing.

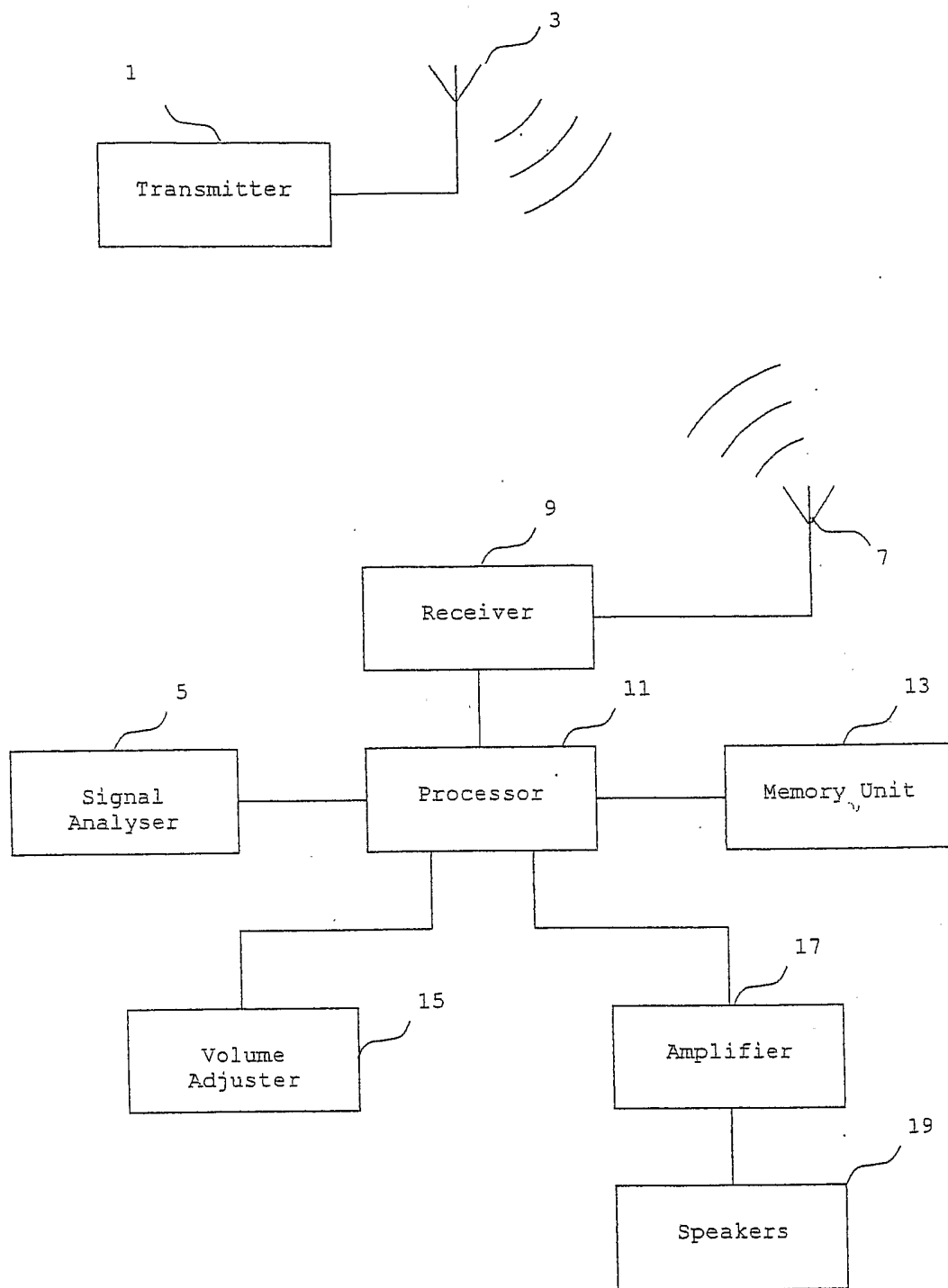


Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No  
PC.1. CB2005/001520

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 H03G3/30 H04H1/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 H03G H04H		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ, COMPENDEX, INSPEC		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 503 154 A (PIONEER ELECTRONIC CORPORATION) 16 September 1992 (1992-09-16)	1, 3, 4, 6-9, 11
A	abstract; figure 3 column 2, line 51 - column 3, line 56 column 5, line 58 - column 6, line 36 column 7, line 29 - line 44	2, 5, 10
X	EP 0 972 340 B (ROBERT BOSCH GMBH) 19 January 2000 (2000-01-19)	1, 2, 4, 7, 9, 10
A	paragraph '0016! - paragraph '0019!  paragraph '0030! - paragraph '0032!	3, 5, 6, 8, 11
X	DE 42 37 005 A1 (INSTITUT FUER RUNDfunkTECHNIK GMBH, 80939 MUENCHEN, DE) 5 May 1994 (1994-05-05) the whole document	1, 4-6, 9
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
° Special categories of cited documents :		
*A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *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 *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *Z* document member of the same patent family		
Date of the actual completion of the international search  28 July 2005		Date of mailing of the international search report  03/08/2005
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer  Wichert, B

INTERNATIONAL SEARCH REPORT

International Application No  
 PCT/GB2005/001520

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 03, 30 March 2000 (2000-03-30) & JP 11 346165 A (KENWOOD CORP), 14 December 1999 (1999-12-14) abstract -----	1,2,9,10
X	GB 2 215 927 A (* BRITISH BROADCASTING CORPORATION) 27 September 1989 (1989-09-27) the whole document -----	1,3,4,6, 7,9,11

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB2005/001520

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International Application No  
PC 17 GB2005/001520

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		ES 2166151 T3	01-04-2002
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JP 11346165	A	14-12-1999 JP 3485468 B2	13-01-2004
GB 2215927	A	27-09-1989 NONE	