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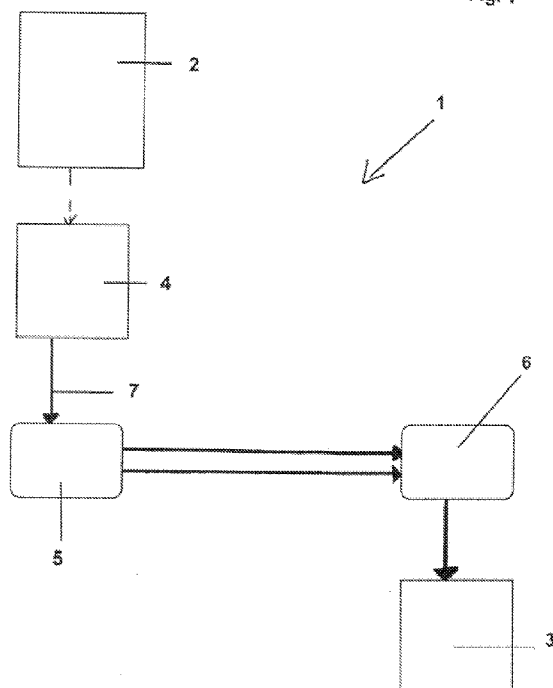
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[Continued on next page]

(54) Title: DEVICE AND METHOD TO REDUCE POWER CONSUMPTION

Fig. 1



- 1 device
- 2 input stage
- 3 output stage
- 5 analyzing stage
- 6 stage to change the signal content
- 7 incoming signal

(57) Abstract: The invention relates to a method and a device (1), especially an audio rendering device, including an input stage (2), and an output stage (3), comprising furthermore a stage (5) to analyse the signal content of the signal to identify the parts of a signal not perceivable by a human listener and a alteration stage (6) to delete the parts of the signal identified as not perceivable by a human listener.

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DEVICE AND METHOD TO REDUCE POWER CONSUMPTION

FIELD OF THE INVENTION

The invention relates to an electronic device and a method to reduce power consumption in audio rendering devices.

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BACKGROUND OF THE INVENTION

Some of the known audio compression techniques use so-called psycho-acoustic masking effects and technologies to determine frequency bands in an audio signal that are not perceived or perceivable by the human auditory perceptual system. Since the human auditory perceptual system is the combination of ear and brain, the known techniques especially try to identify frequency bands that people normally can not hear.

10

Such known audio compressing techniques code these frequency bands with less bits and thus increases the quantisation noise of the mentioned frequency bands.

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The technique to reduce the data information of selected frequency bands still causes power consumption in audio rendering devices since the frequency bands do have a data content which has to be read and handled.

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WO 2005/071830 A1 discloses a system for audio signal processing comprising high pass and low pass filters. This system does not provide an effective filtering to effectively reduce the power consumption.

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US 2006/0023907 A1 discloses a power saving mode for hearing aids comprising a high pass filter and again this document does not disclose a system with an effective reduction in power consumption.

OBJECT AND SUMMARY OF THE INVENTION

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It is an object of the invention to create an electronic device and a method to minimise the power consumption of audio rendering devices.

The above mentioned problems will be solved with the features of claim 1 and/or claim 6 accordingly.

Therefore the problem according to the device will be solved using an electronic device, especially an audio rendering device, including an input stage, and an output stage, comprising furthermore a stage to analyse the signal content of the signal to
5 identify the parts of a signal not perceivable by a human listener and a alteration stage to delete the parts of the signal identified as not perceivable by a human listener.

According to the invention, it is advantageous that the analysing stage and the alteration stage are included within the electronic device.

10 Additionally it is of advantage that the analysing stage and the alteration stage assembled in a separate device connected to an audio rendering device.

According to the invention it is purposive that the analysing stage includes a
15 psycho-acoustic model to identify signal content not perceivable by a human listener. And additionally it is advantageous that the psycho-acoustic stage identifies a signal content as not perceivable by a human listener if a part of a signal falls below a predefined threshold.

Therefore the problem according to the method will be solved using a method
20 of reducing the signal content of an electronic signal of an audio rendering device to reduce power consumption, the electronic device comprises an input stage, and an output stage, the device comprises furthermore a stage to analyse the signal content of the signal to identify the parts of a signal not perceivable by a human listener and a alteration stage to delete the parts of the signal identified as not perceivable by a human listener, wherein the analysing
25 stage analyses the signal and identifies a signal content that is not perceivable by a human listener and the alteration stage deletes the identified signal content as being identified as not perceivable by an human listener.

Accordingly it is of advantage that the analysing stage uses a psycho-acoustic
30 model to identify signal content not perceivable by a human listener. Additionally it is of advantage that the psycho-acoustic stage identifies a signal content as not perceivable by a human listener if a part of a signal falls below a predefined threshold.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the invention will be apparent from the following description of an exemplary embodiment of the invention with reference to the accompanying drawings, in which:

Fig. 1 shows a schematic view of an inventive device and

Fig. 2 shows a diagram of an inventive method.

DESCRIPTION OF EMBODIMENTS

Figure 1 shows a schematic view of the device 1 according to the invention. An audio rendering device 1 comprises different stages of signal processing. In a signal processing chain, there is an input stage 2, one or more signal processing stages 4 and an output stage 3. In Figure 1 stage 4 represents the last stage of normal signal processing in the normal signal processing path.

According to the invention, the input and output stages as well as the signal processing stages can be analogue or digital and in the embodiment of Figure 1 the device has digital signal processing stages and therefore the audio signal between the last processing stage 4 and the output stage is a digital signal. According to the invention the output stage can be a digital stage or a Digital-to-Analogue converter.

Between the last processing stage 4 and the output stage 3 there are arranged two new stages 5 and 6 according to the invention.

Stage 5 is a stage or device to analyse the signal content of the incoming signal 7 and stage or device 6 is responsible to change the signal content of the signal 7.

The analysis part of said stage 5 consists of a psycho-acoustic model which identifies the signal content that will not be perceivable by a human listener. The threshold of what is perceivable and what is not perceivable can be adjusted by the operator or can be adjusted according to the abilities of the normal human listeners.

After having identified parts of the signal not perceivable by human listeners, the inventive device 1 deletes the respective signals. The parts of the signals left out will lead to a significant reduction of the power consumption of the audio system compared to the

technique of only reducing the data content and to increase the quantisation noise of such parts of the signal, since these signals have to be transmitted anyway and according to the present invention, the deleted parts of the signal will not lead to power consumption. Therefore the over all power consumption will be reduced.

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The psycho-acoustic model may be implemented such that the system comprises a transformation of signals to the frequency domain, followed by application of a predetermined masking threshold to the transformed signal. In case that a part of a signal falls below the threshold this part of the signal will be accepted and marked as imperceptible by a human listener.

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In stage 6 the device alters the signal content of the incoming signal. In this block, the signal content that will not be perceived by a human listener are removed from the signal.

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This can be done in the time domain or in the frequency domain. Since the signal is already transferred to the frequency domain in block 5, this representation of the signal is additionally an interface between the blocks 5 and 6.

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After the alteration and the deletion of the non perceivable parts of the signal, the signal will be transformed back to the time domain and outputted by the output block 3.

In cases where the signal processing path does comprise an audio encoding module- like a MP3- or WMA-encoder, the device may use the psycho-acoustic model from the audio encoder or the device may be in signal communication with a stand-alone device comprising the psycho-acoustic model to analyse a signal and to alter a signal according to the invention.

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Figure 2 displays the method 10 according to the invention by way of an embodiment. In block 11 the signal is transferred to the frequency domain. Within the frequency domain the analysing stage analyses in block 12 the signal content of the signal and identifies the parts of the signal not perceivable by the human listener. This signal is transferred to the alteration stage and the alteration stage deletes the part of the signal or the signal content not perceivable by the human listener, see block 13. Block 15 in between 13 and 14 transforms the signal back from the frequency domain to the time domain. In block

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14, the remaining signal is outputted at the output.

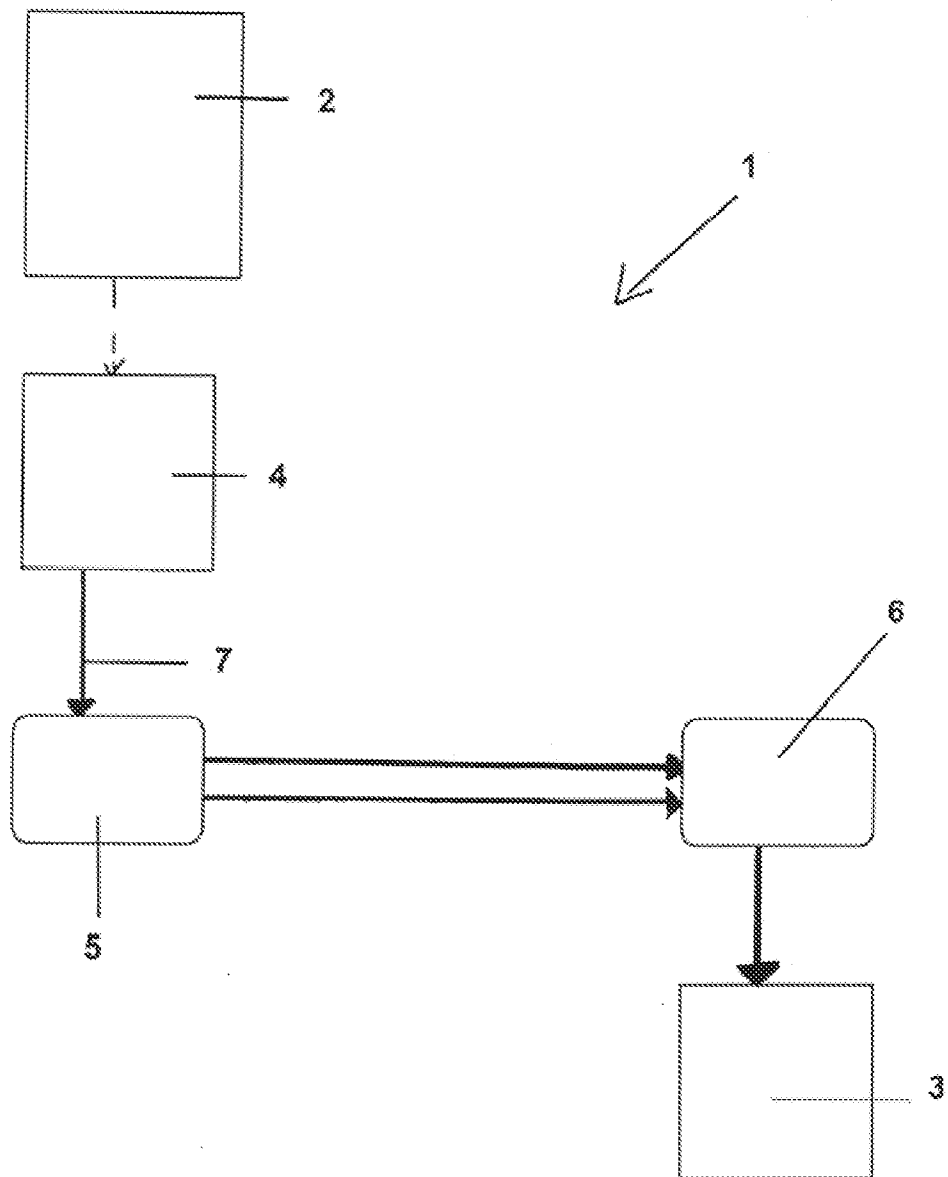
CLAIMS:

1. Electronic device (1), especially an audio rendering device, including an input
5 stage (2), and an output stage (3), comprising furthermore a stage (5) to analyse the signal content of the signal to identify the parts of a signal not perceivable by a human listener and a alteration stage (6) to delete the parts of the signal identified as not perceivable by a human listener.
- 10 2. Electronic device according to claim 1, wherein the analysing stage (5) and/or the alteration stage (6) are included within the electronic device (1).
3. Electronic device according to claim 1, wherein the analysing stage (5) and/or
15 the alteration stage (6) assembled in a separate device connected to an audio rendering device.
4. Electronic device according to claims 1 to 3, wherein the analysing stage (5)
includes a psycho-acoustic model to identify signal content not perceivable by a human
20 listener.
5. Electronic device according to claim 4, wherein the psycho-acoustic stage or
model (5) identifies a signal content as not perceivable by a human listener if a part of a
signal falls below a predefined threshold.
- 25 6. Method of reducing the signal content of an electronic signal of an audio rendering device (1) to reduce power consumption, the electronic device (1) comprises an input stage (2), and an output stage (3), the device comprises furthermore a stage to analyse the signal content of the signal to identify the parts of a signal not perceivable by a human listener and a alteration stage to delete the parts of the signal identified as not perceivable by
30 a human listener, wherein the analysing stage analyses the signal and identifies a signal content that is not perceivable by a human listener and the alteration stage deletes the identified signal content as being identified as not perceivable by an human listener.
7. Method according to claim 6, wherein the analysing stage uses a psycho-
35 acoustic model to identify signal content not perceivable by a human listener.

8. Method according to claim 6 or 7, wherein the psycho-acoustic stage identifies a signal content as not perceivable by a human listener if a part of a signal falls below a predefined threshold.

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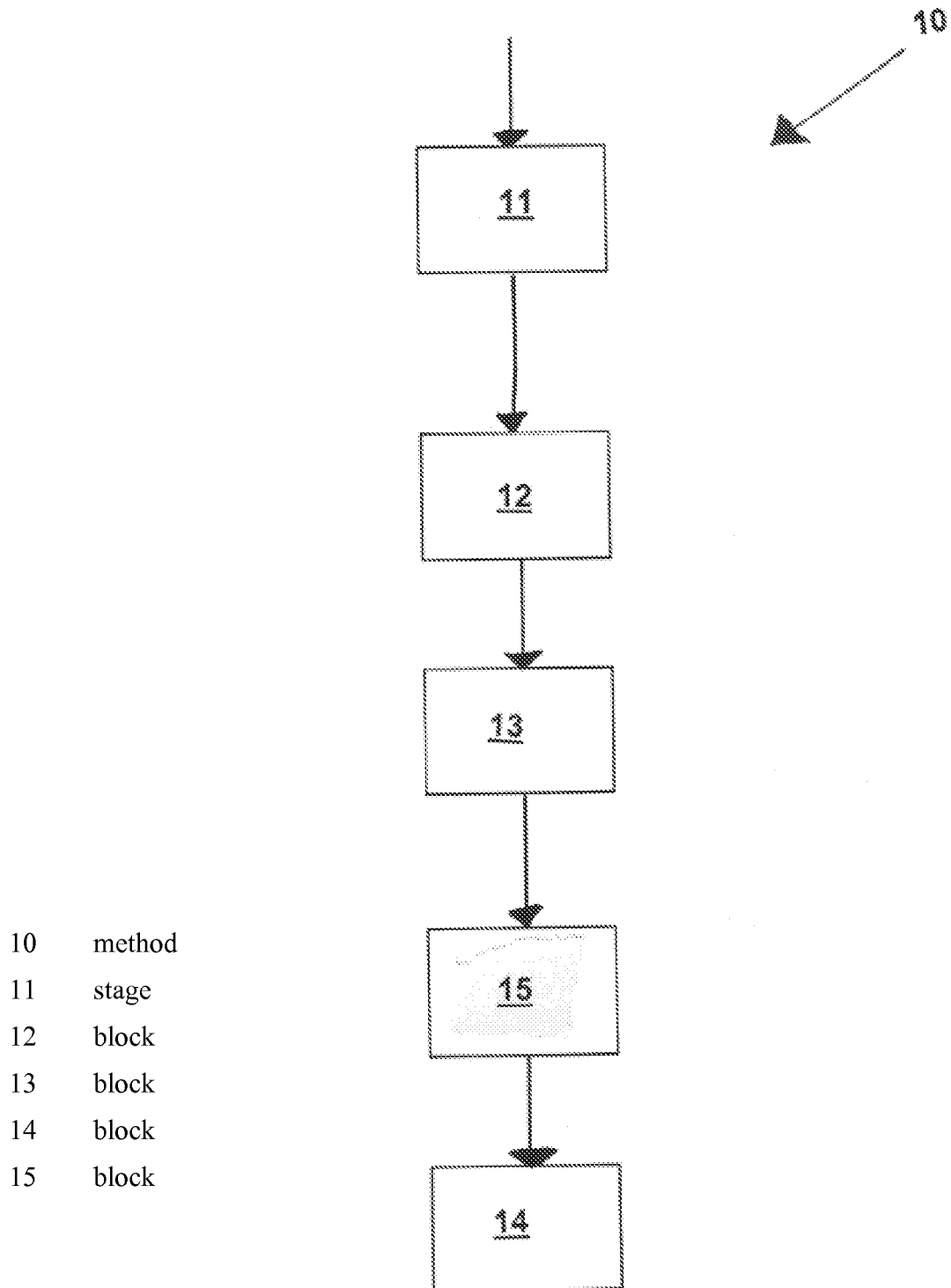
Fig. 1



- 1 device
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- 3 output stage
- 5 analyzing stage
- 6 stage to change the signal content
- 7 incoming signal

2/2

Fig. 2



INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/051581

A. CLASSIFICATION OF SUBJECT MATTER
INV. G10L19/02 H04B1/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G10L H04B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 661 821 A (SHARP KK [JP]) 5 July 1995 (1995-07-05) column 1, lines 48-56 column 2, lines 18-34 column 4, lines 5-11 figure 1	1-8
X	JP 2005 148539 A (MATSUSHITA ELECTRIC IND CO LTD) 9 June 2005 (2005-06-09) the whole document	1-8
X	JP 2006 023658 A (MATSUSHITA ELECTRIC IND CO LTD) 26 January 2006 (2006-01-26) the whole document	1-8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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- *P* document published prior to the international filing date but later than the priority date claimed

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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