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(54) **Hearing device and a method for receiving wireless audio streaming**

Hörgerät und Verfahren zum drahtlosen Empfangen von Audioströmen

Dispositif auditif et procédé de réception de flux audio sans fil

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Description

[0001] The present invention relates to a hearing device configured for receiving audio streaming and an associated method, in particular a hearing device and a method for receiving an audio stream from an audio system transmitting using a plurality of transmitters.

BACKGROUND

[0002] Wireless communication to and from hearing devices has been increasing in continuation of the developments within wireless communication technology. In a crowded environment where audio is distributed to the crowd, for example in an airport or in a movie theatre, it is known to stream audio via a telecoil solution having a limited bandwidth with limited possibilities of separating different audio streams. The limited transmission range of known transmitters is a limiting factor for a user moving in a larger area, e.g. an airport. Further, the limited battery power of hearing devices compared to e.g. a smartphone, sets a limit to the possibilities of wireless communication.

[0003] The document US 2012/321112 is considered to be the closest prior art which discloses a portable device ranking multiple wireless connections for audio streaming based on the signal strength of each of the wireless connections.

SUMMARY

[0004] There is a need for a hearing device that enables reception of audio streams and a method that enables the hearing device of a moving user to continue the receiving of the audio stream when the user moves from a transmission area of one transmitter to a transmission area of a second transmitter.

[0005] Despite the known solutions there is still a need for a method of efficiently switching between receiving from one transmitter to receiving from a second transmitter with a minimum or at least a reduced power consumption of the hearing device.

[0006] Accordingly, a hearing device as in claim 13 is provided, the hearing device comprising an antenna; a receiver unit coupled to the antenna and configured to wirelessly receive audio packages and pilot packages of audio streams; a processing unit coupled to the wireless receiver unit for receiving data via the antenna; and a receiver coupled to an output of the processing unit for conversion of an output signal into an output audio signal. The processing unit is configured to receive audio packages of a primary audio stream from a primary transmitter unit with a primary transmitter unit address via the wireless receiver unit and to evaluate a first parameter of the primary audio stream. If the first parameter fulfills a search criterion, the processing unit is configured to search for pilot packages from available transmitter units; determine and select an optimum transmitter unit based on one or more one pilot package parameters of pilot packages from available transmitter units; and receive audio packages of an audio stream from the optimum transmitter unit according to one or more pilot packages from the optimum transmitter unit.

[0007] Also disclosed is a method as in claim 1 for receiving wireless audio streams in a hearing device.

[0008] The method comprises receiving audio packages of a primary audio stream from a primary transmitter unit having a primary transmitter unit address, and evaluating a first parameter of the primary audio stream. If the first parameter fulfils a search criterion, the method comprises searching for pilot packages from available transmitter units; determining and selecting an optimum transmitter unit, e.g. based on one or more one pilot package parameters of pilot packages from available transmitter units; and receiving audio packages of an audio stream from the optimum transmitter unit according to one or more pilot packages from the optimum transmitter unit.

[0009] It is an advantage of the present invention that simple switching between different transmitter units is provided substantially without affecting the quality of the audio stream.

[0010] It is an important advantage of the present invention that transmission of data from the hearing device to the first and/or second transmitter is limited or not required (no handshaking) for switching between wireless audio streams, which provides a power efficient receipt of wireless data.

[0011] The hearing device may comprise a processing unit configured to compensate for hearing loss or disability of the hearing device user.

[0012] According to the invention an easy and efficient method of a hearing device switching between wireless transmitters in response to fading signals or signal quality is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The above and other features and advantages of the present invention will become readily apparent to those skilled in the art by the following detailed description of exemplary embodiments thereof with reference to the attached drawings, in which:

Fig. 1 schematically illustrates an exemplary hearing device,

Fig. 2 schematically illustrates an exemplary hearing device,

Fig. 3 schematically illustrates use of an exemplary hearing device,

Fig. 4 schematically illustrates an electromagnetic signal,

Fig. 5 schematically illustrates receiving in a hearing device an electromagnetic signal from one of a plurality of transmitter units,

Fig. 6 schematically illustrates receiving in a hearing device an electromagnetic signal from one of a plurality of transmitter units,

Fig. 7 is a flow diagram of an exemplary method according to the invention,

Fig. 8 is a flow diagram of an exemplary method according to the invention,

Fig. 9 (a) to (d) illustrate exemplary audio blocks. and

Fig. 10 (a) and (b) illustrate an exemplary audio package and an exemplary pilot package.

[0014] The figures are schematic and simplified for clarity, and they merely show details which are essential to the understanding of the invention, while other details have been left out. Throughout, the same reference numerals are used for identical or corresponding parts.

DETAILED DESCRIPTION

[0015] The present invention relates to a hearing device and a method enabling receipt of audio stream(s) representing audio track(s) from an audio system and capable of automatic switching, i.e. switching without user input, between receiving a primary audio stream representing a first audio track from a primary transmitter unit to receiving a secondary audio stream representing the first audio track from a secondary transmitter unit.

[0016] In an audio system, one or more transmitter units are configured for broadcasting or transmitting audio stream(s), e.g. to one or more hearing devices. A transmitter unit may transmit one or more audio streams. A transmitter unit is identified by a transmitter unit address.

[0017] An audio track is an audible signal. Exemplary audible signals are an airport call, a movie sound track, speech or a piece of music.

[0018] An audio stream is an electromagnetic signal representative of an audio track. An audio stream is represented by a number of audio blocks each comprising one or more audio packages. An audio package comprises a finite part of an audio stream.

[0019] An audio block comprises one or more audio packages (see also Fig. 9(a) to (d) and corresponding description). An audio block may comprise one or more primary audio packages and/or one or more secondary audio packages. A secondary audio package may constitute a copy of a primary audio package allowing a hearing device to recover lost packages. Further, an audio block may comprise first audio packages and/or second audio packages for example constituting audio stream data for a left or a right ear, respectively. An audio block may comprise a first primary audio package and/or a second primary audio package. Further, a first secondary audio package and/or a second secondary audio package may be included in an audio block. Sending the same audio data in two or more audio packages provides improved quality of sound at the receiver

[0020] An audio stream comprises a number of pilot packages. A pilot package comprises information about a subsequent such as the following or next audio block.

[0021] An audio frame (see also Fig. 4 and corresponding description) comprises an audio block with one or more audio packages, and optionally one or more pilot packages including a primary and/or a secondary pilot package. An audio frame may comprise a tertiary pilot package to further improve handover between transmitter units. An audio block may have a length between 0.240 ms and 8.0 ms, such as in the range from 0.380 ms to 6.8 ms, such as in the range from 2.0 ms to 3.5 ms, e.g. 2.85 ms.

[0022] An audio package (see also Fig. 10 (a) and corresponding description) may comprise an audio stream identifier, which may comprise one or more elements such as audio track identification, transmitter unit address, audio group identification etc. Audio track identification may enable selection of audio streams representative of the same audio

track, and audio group identification may identify a certain group of audio tracks or audio streams e.g. an audio group may be audio tracks in the same or similar language, e.g. English, Danish or Chinese.

[0023] An audio package may comprise transmitter unit address of the transmitter unit transmitting the audio package, thus enabling the hearing device to sort out audio packages sent from other transmitter units.

[0024] A pilot package (see also Fig. 10 (b) and corresponding description) may comprise information enabling receipt of a subsequent such as the following audio block from the transmitter unit sending the audio stream in question. A pilot package comprises one or more time offsets indicative of timing between packages in the audio stream. Further, a pilot package may comprise a channel identifier. A channel identifier indicates the channel (RF) of audio package(s) in a subsequent such as the following or next audio block. Even further, a pilot package may comprise transmitter unit address and/or audio stream identifier. A pilot package may comprise network identifier or other data indicative of a group of transmitter units, thereby enabling a hearing device to select or limit searching for pilot packages of a group of transmitter units. A pilot package from a transmitter unit enables a hearing device to receive a subsequent such as the following audio block from the transmitter unit in question by configuring the hearing device in accordance with information comprised within the received pilot package. A primary pilot package in an audio block may comprise transmitter unit address, a primary time offset, and channel identifier of the first primary audio package of a subsequent such as the following audio block. A secondary pilot package in an audio block may comprise transmitter unit address, a secondary time offset, and channel identifier of the first primary audio package of a subsequent such as the following audio block.

[0025] A time offset comprised within the pilot package may indicate the time of transmittal of a subsequent such as the following audio block. The time offset may e.g. be the time from start of transmission of the pilot package to the time of start of transmission of a subsequent such as the following audio block and/or to the time of start of transmission of an audio package in a subsequent such as the following audio block.

[0026] The channel identifier or RF channel identifier comprised within the pilot package may be indicative of the channel where the following audio block is transmitted. A channel is indicative of the frequency or frequency range on which an (first) audio package of the following audio block is sent.

[0027] The transmitter unit address comprised within the pilot package may be transmitter unit address of the transmitter unit from where the pilot package was transmitted, thus enabling the hearing device to identify the transmitter unit from where it may receive following audio packages corresponding to the pilot package in question.

[0028] An audio frame may have a time duration or period length T. Period length T may be defined as being from start of transmission of an audio block to the start of transmission of the following audio block. T may be defined as being the time from start of transmission of the first primary audio package of the first audio block to the start of transmission of the first primary audio package of the second audio block. The period length T may be fixed e.g. be a time of between 2 ms and 20 ms, such as between 5 ms and 12 ms or such as between 6 ms and 10.2 ms, or between 6 ms and 6.5 ms, or between 7.2 ms and 7.7 ms, or between 9.8 ms and 10.2 ms. A long period length T may be beneficial for providing increased possibility of power saving in a hearing device, as a long period length T provides for a long duration where the receiver may be switched off. However, a long T leads to an increased latency, meaning that a long T is not sufficient if the audio needs to be synchronized with e.g. a movie. Hence a short T is beneficial if the audio is to be synchronized with another input, or is to be happening as close to real time as possible.

[0029] The audio system may comprise a first transmitter unit and optionally a second transmitter unit or optionally any number of a plurality of transmitter units.

[0030] Transmitting and receiving the wireless audio stream may be achieved by using wireless technology, thus transmitting/receiving audio blocks at one or more frequencies, e.g. in the range from 2.4 GHz to 2.5 GHz, in the range from 800 MHz to 1 GHz, in the range from 3.6 GHz to 3.7 GHz, and/or in the range from 4.9 GHz to 5.9 GHz.

[0031] A pilot package is sent and/or received on a pilot channel. Pilot packages may be transmitted and/or received on pilot channels selected from one or more available channels. The pilot channel for a pilot package may be selected from a subset of available channels, thus further reducing load on the hearing device during search for available transmitter units, by allowing the hearing device to only need to listen for pilot packages of available transmitter units at known pilot channel(s). The channel(s) for pilot packages may be at one or more frequencies, e.g. in the range from 2.4 GHz to 2.5 GHz, in the range from 800 MHz to 1 GHz, in the range from 3.6 GHz to 3.7 GHz, and/or in the range from 4.9 GHz to 5.9 GHz.

[0032] Pilot package(s) may be transmitted/received in the same frequency range as audio blocks. Alternatively or in combination, pilot packages may be transmitted in a different frequency range than audio blocks and/or by using a different modulation scheme. Pilot package(s) may be transmitted/received within an audio block, i.e. a pilot package may be interleaved within an audio block.

[0033] Transmission and/or receipt of pilot packages may be performed using a frequency hopping scheme, i.e. the pilot channel may be selected according to a frequency hopping scheme, for example between three or more channels. The frequency hopping scheme may be random or pseudo-random or predetermined.

[0034] The first parameter of the primary audio stream may be a parameter indicative of signal strength and/or signal quality of the primary audio stream or one or more audio blocks or audio packages of the primary audio stream. The

first parameter of the primary audio stream may be a parameter indicative of or including signal strength or signal quality of pilot packages of the primary audio stream. The first parameter may be Received Signal Strength Indication (RSSI) of the primary audio stream or of one or more selected audio and/or pilot packages of the primary audio stream.

[0035] In exemplary method(s), the first parameter may be or comprise Received Channel Power Indicator (RCPI).

[0036] In exemplary method(s), the search criterion may be fulfilled if the first parameter is below or above a search threshold value, for example if the RSSI of the primary audio stream is below or above a search threshold value, e.g. a first threshold value, depending on whether a high or low RSSI, respectively, indicates high signal quality.

[0037] The search criterion may comprise a combination of one or more logical expressions evaluating whether one or more parameters is above, below and/or equal to one or more search threshold values, respectively.

[0038] A pilot package parameter (p) is a parameter indicative of one or more characteristics of a pilot package, such as signal strength. A pilot package parameter may be a function of one or more characteristics of pilot packages from respective transmitter units. The pilot package parameter may be based on RSSI of one or more pilot package.

[0039] The first pilot package parameter from each available transmitter unit may be a function of the signal strength (RSSI) of one or more pilot packages from the respective transmitter unit. The first pilot package parameter may comprise an averaging function, for example based on RSSI values for pilot packages.

[0040] The first pilot package parameter may be a function of pilot package characteristics for pilot packages from two or more audio frames. Accordingly, searching for pilot packages from available transmitter units and determining and selecting an optimum transmitter unit may be performed, while the hearing device receives and processes audio blocks from the primary transmitter unit. Including characteristics from a plurality of pilot packages may ensure an improved switching scheme since random packet losses or errors may be taken into account, e.g. in order to avoid unnecessary switching between transmitter units.

[0041] Receiving audio packages of a primary audio stream comprises receiving audio packages from a primary transmitter unit (not shown) with a transmitter unit address.

[0042] Evaluation of the first parameter may comprise evaluation of one or more different characteristics such as signal strength, signal quality and/or rate of errors.

[0043] Searching for pilot packages may be initiated if the first parameter fulfills a search criterion. The processing unit may return to receiving audio packages/evaluation of the first parameter, if the first parameter does not fulfill the search criterion. The search criterion may be such as whether or not the signal strength of the received audio packages from the first transmitter is satisfactory, e.g. if signal quality is below a given threshold, if the error rate is above a certain threshold and/or if a predetermined timeout has passed. Incorporating a predetermined timeout in the search criterion enables setting a maximum time between searches, e.g. to ensure that the search is initiated on a regular basis, e.g. at least every 10 seconds. Alternatively or additionally, a minimum time between consecutive searches may also be incorporated in the search criterion, in order to reduce power consumption.

[0044] The pilot packages may be received from available transmitter units and evaluated according to one or more parameters including but not limited to signal strength, signal quality, audio stream identifier, and/or rate of errors.

[0045] Determining and selecting an optimum transmitter unit may comprise evaluating at least one pilot package parameter, including a first pilot package parameter, for one or more pilot packages from available transmitter units. Evaluating at least one pilot package parameter may comprise comparing a first pilot package parameter of pilot packages from the primary transmitter unit with a first pilot package parameter of pilot packages from available secondary transmitter units. Further, if the at least one pilot package parameter fulfils a switch criterion, the method may comprise selecting a secondary transmitter unit from the available transmitter units as the optimum transmitter unit.

[0046] The method may comprise selecting the primary transmitter unit as the optimum transmitter unit if the at least one pilot package parameter does not fulfil the switch criterion, i.e. the hearing device continues to receive audio packages from the primary transmitter unit if a better transmitter unit is not found.

[0047] The switch criterion may be fulfilled if the first pilot package parameter of an available secondary transmitter unit is larger than the first pilot package parameter of the primary transmitter unit. The secondary transmitter unit with the best first pilot package parameter, e.g. largest RSSI, may then be selected as the optimum transmitter unit.

[0048] In the method, selecting the optimum transmitter unit may be based on the evaluation of at least one pilot package parameter of available transmitter units including the primary transmitter unit if available.

[0049] Receiving audio packages of an audio stream from the optimum transmitter unit may be based on the time offset of a pilot package. Accordingly, the processing unit may be configured to control the receiver unit according to the time offset in a pilot package.

[0050] Determining and selecting an optimum transmitter unit may be based on the audio stream identifier. Thereby is prevented that a transmitter unit sending a different audio stream is selected. Transmitter units not sending the desired audio stream or not belonging to the desired group of transmitter units may be filtered out in the receiver unit during searching for pilot packages in order to reduce processing in the processing unit.

[0051] In methods employing a switch criterion, the method may return to receiving audio packages from the primary transmitter unit if the switch criterion is not fulfilled. The switch criterion may be such as whether or not the pilot package

parameters for secondary transmitter unit pilot packages are larger than pilot package parameter of the primary transmitter unit pilot packages.

[0052] If the switch criterion is fulfilled and/or a secondary transmitter unit is selected as the optimum transmitter unit, the processing unit configures the wireless receiver unit for receiving audio packages from the secondary transmitter unit according to information in pilot packages (time offset and RF channel identifier) received from the secondary transmitter unit.

[0053] The processing unit may be configured to turn off the wireless receiver unit in one or more time intervals of an audio frame, e.g if the first parameter does not fulfil the search criterion. The wireless receiver unit may be configured to receive audio packages of audio streams at frequencies in the range from 2.4 GHz to 2.5 GHz and/or in the range from 800 MHz to 1 GHz.

[0054] Fig. 1 schematically illustrates an exemplary hearing device. The hearing device 2 comprises a loudspeaker or receiver 4, a processing unit 6, an antenna 8 and a wireless receiver unit 10. The wireless receiver unit 10 is coupled to the antenna 8 and configured to receive audio packages of an audio stream and pilot packages of a plurality of audio streams. The processing unit 6 is configured to compensate for hearing loss or hearing disability of the hearing device user and is coupled to the wireless receiver unit 10 for receiving data via the antenna 8 and/or for exchanging control signals between the receiver unit 10 and the processing unit 6. The loudspeaker 4 is coupled to an output port of the processing unit for conversion of an output signal into an output audio signal. The processing unit 6 is configured to receive audio packages of a first audio stream via the wireless receiver unit 10, and evaluate a first parameter of the first audio stream. In the hearing device 2, RSSI (Received Signal Strength Indicator) is the first parameter, and the receiver unit 10 calculates RSSI and feeds RSSI to the processing unit 6. Other parameters indicative of signal quality or combinations thereof may be used as a first parameter. If the first parameter fulfills a search criterion, e.g. if RSSI falls below a search threshold value, i.e. the signal quality is dropping below an acceptable level (high RSSI indicates good signal quality), the processing unit 6 searches for pilot packages from available transmitter units by controlling the receiver unit 10 accordingly. After searching, e.g. for a predetermined time period or number of audio frames, or until a number of pilot packages are received, the processing unit 6 determines and selects an optimum transmitter unit, e.g. based on one or more one pilot package parameters including a first pilot package parameter ($p_{1,1}$, ..., $p_{1,N}$) of pilot packages from N available transmitter units.

[0055] Upon selection of an optimum transmitter unit, the processing unit 6 controls the wireless receiver unit 10 to receive audio packages of an audio stream from the optimum transmitter unit according to at least the latest pilot package from the optimum transmitter unit. The processing unit 6 is optionally configured to compensate the received audio stream for hearing loss or disability of the hearing device user.

[0056] Fig. 2 schematically illustrates an exemplary hearing device. The hearing device 2' comprises the same features as the hearing device 2 in Fig. 1. Additionally, the hearing device 2' comprises a microphone 12. The microphone 12 is coupled to the processing unit 6 for conversion of an acoustic audio signal into an electronic representation of the acoustic audio signal 14 that is sent to the processing unit 6. The processing unit 6 is configured to compensate the received audio stream and/or the electronic representation for hearing loss or disability of the hearing device user.

[0057] Fig. 3 schematically illustrates use of an exemplary hearing device for receiving audible information from an audio system comprising a plurality of transmitter units 51, 52, 53, 54, 55. The transmitter units 51, 52, 53, 54, 55 are distributed in an area.

[0058] A user wearing a hearing device (not shown), is located in a first position 50 in the area and receives an audio stream from a first transmitter unit 51 acting as the primary transmitter. When the user moves to a second position 50' or e.g. the user turns his/her head or the receiving conditions otherwise change, the audio stream signal transmitted from the first transmitter unit 51 may become weak, e.g. due to the limited transmission range of the transmitter unit or limited penetration properties of the wireless signal. The hearing device detects that the signal quality is decreasing (search criterion fulfilled) and performs a search for available transmitter units, which is facilitated by receiving pilot packages of available transmitter units of the plurality of transmitter units 51, 52, 53, 54, 55. As illustrated, the hearing device identifies the fourth transmitter unit 54 as the optimum transmitter unit transmitting the same audio track by evaluating at least one pilot package parameter, e.g. RSSI, of received pilot packages, and selects the fourth transmitter unit 54 as the optimum transmitter unit and starts receiving audio packages therefrom according to one or more pilot packages from the fourth transmitter unit 54.

[0059] Fig. 4 schematically illustrates a part of an exemplary audio stream as an electromagnetic signal 100 transmitted from any of the transmitter units 51, 52, 53, 54, 55 as illustrated in Fig 3.

[0060] The audio stream/electromagnetic signal 100 represents an audio track and is divided into audio frames 104, 114, 124. Each audio frame comprises an audio block 101, 111, 121, a primary pilot package 102, 112, 122, and optionally a secondary pilot package 103, 113, 123. The audio blocks 101, 111, 121 comprise at least a first primary audio package (not shown) and may in addition comprise any number of audio packages. The number of audio packages does not need to be the same for all audio blocks.

[0061] The first audio frame 104 starts by a first primary audio package of the first audio block 101 being transmitted.

After transmitting the first primary audio block 101, a first primary pilot package 102 is transmitted. Optionally, a first secondary pilot package 103 is transmitted in the first audio frame. The first secondary pilot package 103 may be transmitted at an arbitrary time during the first audio frame, preferably between transmission of the first primary pilot package and transmission of the second audio block 111. A primary pilot package may be transmitted within the audio block of the respective audio frame.

[0062] The first primary pilot package 102 comprises information as to how (channel identifier) and when (time offset) to receive the first primary audio package of the second audio block 111. The first primary pilot package 102 comprises a first primary timeoffset 106 indicating the time from transmittal of the first primary pilot package 102 to transmittal of the first primary audio package of the second audio block 111 of the second audio frame 114.

[0063] The first secondary pilot package 103 comprises, as the first primary pilot package, information as to how (channel identifier) and when (time offset) to receive the first primary audio package of the second audio block 111. Among a number of information the first secondary pilot package 103 comprises a first secondary timeout 108 indicating the timeout from transmittal of the first secondary pilot package 103 before transmittal of the first primary audio package of the second audio block 111 of the second audio frame 114.

[0064] In an exemplary electromagnetic signal, the duration or period length of an audio frame 104, 114, 124 is constant, and may e.g. be a time of between 2 ms and 20 ms, such as between 5 ms and 12 ms or such as between 6 ms and 10.2 ms, or between 6 ms and 6.5 ms, or between 7.2 ms and 7.7 ms, or between 9.8 ms and 10.2 ms.

[0065] The primary pilot packages 102, 112, 122 may be transmitted at a time within the audio frame resulting in that the primary time offset 106, 116, 126 is fixed and equal for all audio frames 104, 114, 124. The secondary pilot packages 103, 113, 123 may be transmitted at a time chosen randomly or pseudo randomly, resulting in a random or pseudo random secondary time offset 108, 118, 128. It is to be understood that the time offsets of pilot packages within the same audio frame indicates to the same transmittal time of the first primary audio package of the following audio block.

[0066] Fig. 5 schematically illustrates receiving in a hearing device an audio stream/electromagnetic signal from one or more of a plurality of available transmitter units. Fig. 5 illustrates three transmitter units 51, 52, 53 each transmitting an electromagnetic signal in accordance with the description of the electromagnetic signal 100 of Fig. 4.

[0067] A hearing device, e.g. hearing device 2, 2', receives audio packages of audio blocks 101' from the second transmitter unit 52 acting as primary transmitter unit in receive period 212. If an evaluation of the received audio packages in audio block 101' yields a demand for an alternative audio source, i.e. if the search criterion is fulfilled, the hearing device 2, 2' searches for pilot packages sent from available transmitters 51, 52, 53 in one or more search periods 214 followed by an evaluation of the pilot package parameter(s). In the illustrated example, the evaluation shows that the second transmitter unit 52 despite the low signal quality still provides the best available signal quality and the hearing device continues to receive audio blocks from the second transmitter unit acting as primary transmitter unit, i.e. a new transmitter unit is not selected. The receive periods 212 of the hearing device may be extended such that primary pilot packages from the primary transmitter are received in order to evaluate the signal quality (first parameter) based on primary pilot packages 102', 112' and 122' from the primary transmitter unit.

[0068] The search period 214 may vary in time and/or in duration, and may be conducted when the hearing device 2, 2' is not receiving audio packages 212. In the example of Fig. 5, the search during search periods 214 leads to reception of pilot packages from two alternative transmitter units 51, 53..

[0069] Fig. 6 schematically illustrates receiving in a hearing device an electromagnetic signal from one of a plurality of available transmitter units. Fig. 6 illustrates a similar transmission setup as described in Fig. 5. No search is initiated after receipt of the first audio block 101' and optionally first primary pilot package 102' during receive period 212 since the RSSI is high and the search criterion not fulfilled. Accordingly, the hearing device 2, 2' continues receiving the second audio block 111' and optionally the second primary pilot package from the second transmitter unit 52 acting as primary transmitter unit. The hearing device then determines that the search criterion is fulfilled and searches 214' for available transmitter units by searching for pilot packages on one or more pilot channels. Upon receipt of the pilot package 113", the hearing device selects the third transmitter unit 53 as the optimum transmitter unit and starts receiving during receive period 212' the audio package 121" from the third transmitter unit 53 according to information included in the pilot package 113", such as time offset and channel identifier. The reception of pilot package 113" during search period 214' leads to a switch of transmitter unit, thus the following reception 212' of audio package is configured according to parameters of the pilot package 113" received during search 214' and audio package 121" is received from the third transmitter unit 53. A reason for not switching according to an earlier received pilot package, e.g. pilot package 113", may be such as a too weak signal and/or an incorrect audio track.

[0070] Fig. 7 is a flow diagram of an exemplary method according to the invention. The method 400 illustrated is designed to be performed while the user of e.g. a hearing device continuously receives an audio stream, hence do not interrupt the receiving and playback of an audio stream. The method 400 comprises receiving 401, e.g. via a wireless receiver unit, audio packages of a primary audio stream from a primary transmitter unit having a primary transmitter unit address. The method comprises evaluating 402 at least a first parameter of the audio stream being received from the primary transmitter. The parameter evaluation 402 may comprise different elements such as signal strength, signal

quality and/or error rate. If the first parameter fulfils a search criterion 404, the method comprises searching 406 for pilot packages from available transmitter units. Searching for pilot packages may comprise searching for pilot packages with predetermined properties, e.g. a transmitter unit address and/or audio stream identifier, network identifier or other data indicative of a group of transmitter units. Searching for pilot packages may comprise searching for pilot packages on one or a set of pilot channels. Pilot packages may be received on channels different from the audio channels used for receipt of audio blocks/packages. The search criterion may comprise one or more logical expressions, e.g. whether or not the first parameter is below or above a search threshold and/or if a predetermined timeout has passed. The first parameter may be indicative of or comprise error rate. If the search criterion is not met, the method 400 proceeds with receiving 401 audio packages from the primary transmitter unit. Receiving audio packages from the primary transmitter and searching for pilot packages may be performed in parallel or in a multiplexing scheme during on or more audio frames.

[0071] Upon searching for pilot packages from available transmitter units, the method 400 proceeds to determining and selecting 414 an optimum transmitter unit based on one or more one pilot package parameters of pilot packages from available transmitter units. In the method 400, determining and selecting 414 comprise evaluating the received pilot packages found during searching 406 by evaluating 408 at least one pilot package parameter, including a first pilot package parameter, for one or more pilot packages from each available transmitter unit. If a switch criterion is fulfilled 410, i.e. if a secondary transmitter unit different from the primary transmitter unit provides a better signal or higher signal quality, the method 400 proceeds to selecting the secondary transmitter unit as new transmitter unit, i.e. switching to a new transmitter unit. The switch criterion may be fulfilled if a pilot package parameter of the primary transmitter unit is less than a pilot package parameter of the secondary transmitter unit having the largest pilot package parameter. The switch criterion may be fulfilled if a pilot package parameter of the primary transmitter unit is larger than a pilot package parameter of the secondary transmitter unit having the lowest pilot package parameter.

[0072] If the switch criterion is not met, the method 400 or hearing device returns to receiving audio packages from the primary transmitter. If the switch criterion 410 is met, a secondary transmitter unit is selected 412 as the optimum transmitter unit, and audio packages are received 401 from the secondary transmitter unit according to a time offset and a channel identifier included in the pilot package from the secondary transmitter unit.

[0073] Fig. 8 is a flow diagram of an exemplary method 400' according to the invention. The method comprises determining the optimum transmitter unit by selecting the transmitter unit with the best pilot package parameter (e.g. max or min) from the received pilot packages.

[0074] Fig. 9 (a) to (d) illustrate four different exemplary audio blocks 200, 200', 200", 200"' sent from transmitter units. Fig. 9(a) illustrates an audio block 200 comprising a primary audio package 202, e.g. a mono audio signal. Fig. 9(b) illustrates an audio block 200' of an exemplary mono signal comprising a primary audio package 202 and a secondary audio package 204. The secondary audio package 204 may be a copy of the primary audio package 202, to enhance chances of a successful reception of data in a hearing device. Fig. 9(c) illustrates an audio block 200" of an exemplary stereo signal. The audio block 200" in Fig. 9(c) comprises a first primary audio package 206 and a second primary audio package 208 for right and left ear, respectively. The audio block 200" illustrated in Fig. 9(c) further comprises a first secondary audio package 210 and a second secondary audio package 212. The first secondary audio package 210 may be a copy of the first primary audio package 206, and the second secondary audio package 212 may be a copy of the second primary audio package 208. Fig. 9(d) illustrates an audio block 200"' of an exemplary stereo signal. The audio block 200"' illustrated in Fig. 9d comprises a first tertiary audio package 214 and a second tertiary audio package 216. The first tertiary audio package 214 may be a copy of the first secondary right audio package 210 and/or the first primary audio package 206. The second tertiary audio package 216 may be a copy of the second secondary audio package 212 and/or the second primary audio package 208. A "copy of" means that at least the audio data of the audio packages are identical.

[0075] Fig. 10(a) illustrates an exemplary audio package comprising transmitter unit address, optional audio stream identifier, and audio stream data. Transmitter unit address may be indicative of the transmitter unit from which the audio package was transmitted. Audio stream identifier may comprise data indicative of the audio stream, e.g. audio track identification, audio group identification etc. Audio stream data comprises a finite part of the audible information forming the audio stream.

[0076] Fig. 10(b) illustrates an exemplary primary and/or secondary pilot package comprising transmitter unit address, channel identifier, time offset, optional audio stream identifier, and optional network identifier. Transmitter unit address may be indicative of the transmitter unit from which the pilot package was transmitted. Channel identifier may be indicative of the channel where the next audio block of the audio stream is transmitted, i.e. the channel identifier may be a frequency or a number indicating a frequency. Time offset may be indicative of when the next audio block is transmitted. Audio stream identifier may comprise data indicative of the audio stream, e.g. audio track identification, audio group identification etc. Network identifier may be indicative of a group of transmitter units, e.g. a network identifier may comprise a subnet address. The information comprised within a pilot package may enable the hearing device to receive a subsequent such as the following or next audio block from the transmitter unit transmitting the audio stream in question by configuring the hearing device in accordance with the information.

LIST OF REFERENCES

[0077]

2, 2’	hearing device
4	receiver/loudspeaker
6	processing unit
8	antenna
10	wireless receiver unit
12	microphone
14	converted audio signal
50	first position for a user of a hearing device
50’	second position for a user of a hearing device
51	first transmitter unit
52	second transmitter unit
53	third transmitter unit
54	fourth transmitter unit
55	fifth transmitter unit
100	electromagnetic signal
101, 101’, 101"	first audio block (A_1)
102, 102’, 102"	first primary pilot package ($P_{1,1}$)
103, 103’, 103"	first secondary pilot package ($P_{1,2}$)
104	first audio frame
106	first primary time offset ($\Delta t_{1,1}$)
108	first secondary time offset ($\Delta t_{1,2}$)
111, 111’, 111"	second audio block (A_2)
112, 112’, 112"	second primary pilot package ($P_{2,1}$)
113, 113’, 113"	second secondary pilot package ($P_{2,2}$)
114	second audio frame
116	second primary time offset ($\Delta t_{2,1}$)
118	second secondary time offset ($\Delta t_{2,2}$)
121	third audio block (A_3)
122	third primary pilot package ($P_{3,1}$)
123	third secondary pilot package ($P_{3,2}$)
124	third audio frame
126	third primary time offset ($\Delta t_{3,1}$)
128	third secondary time offset ($\Delta t_{3,2}$)
212, 212’	reception of audio blocks
214, 214’	search and receive pilot packages
200, 200’, 200", 200’"	audio block
202	primary audio package
204	secondary audio package
206	first primary audio package
208	second primary audio package
210	first secondary audio package
213	second secondary audio package
215	first tertiary audio package
216	second tertiary audio package
400, 400’	a method for operating a hearing device
401	receiving audio stream from selected transmitter unit
402	evaluating first parameter
404	determining if search criterion is fulfilled
406	searching for pilot packages
408	evaluating pilot packages
410	determining if switch criterion is fulfilled
412	selecting new transmitter unit
414	determining and selecting optimum transmitter unit

Claims

1. Method (400, 400') for receiving wireless audio streams in a hearing device, the hearing device comprising a processing unit configured to compensate for hearing loss or disability of a hearing device user, the method comprising:

    - receiving (401), in the hearing device, audio packages of a primary audio stream from a primary transmitter unit having a primary transmitter unit address;
    - evaluating (402), with the processing unit, a first parameter of said received audio packages of the primary audio stream; and
    - if the first parameter fulfils a search criterion (404), wherein the search criterion (404) is whether or not the signal strength of the received audio packages from the first transmitter is satisfactory:

        - searching (406) for pilot packages from available transmitter units;
        - determining and selecting (414) an optimum transmitter unit based on one or more pilot package parameters of pilot packages from available transmitter units;
        - receiving audio packages of an audio stream from the optimum transmitter unit according to one or more pilot packages from the optimum transmitter unit; wherein

    determining and selecting (414) an optimum transmitter unit comprises:

        - evaluating (408) at least one pilot package parameter, including a first pilot package parameter, for one or more pilot packages from available transmitter units; and
        - if the at least one pilot package parameter fulfils a switch criterion (410):

            - selecting (412) a secondary transmitter unit from the available transmitter units as the optimum transmitter unit.

2. Method according to claim 1, the method comprising selecting the primary transmitter unit as the optimum transmitter unit if the at least one pilot package parameter does not fulfil the switch criterion.

3. Method according to any of claims 1-2, wherein the switch criterion is fulfilled if the first pilot package parameter of an available secondary transmitter unit is larger than the first pilot package parameter of the primary transmitter unit.

4. Method according to claim 1, wherein determining and selecting an optimum transmitter unit comprises

    - evaluating at least one pilot package parameter including a first pilot package parameter from each available transmitter unit; and
    - selecting the optimum transmitter unit based on the evaluation of at least one pilot package parameter.

5. Method according to any of the preceding claims, wherein each pilot package comprises a transmitter unit address of the transmitter unit, a time offset, and channel identifier of a following audio package, and wherein receiving audio packages of an audio stream from the optimum transmitter unit is based on the time offset of a pilot package.

6. Method according to any of the preceding claims, wherein each pilot package comprises an audio stream identifier, and wherein determining and selecting an optimum transmitter unit is based on the audio stream identifier.

7. Method according to any of the preceding claims, wherein the first parameter is a parameter indicative of signal strength of the primary audio stream.

8. Method according to any of the preceding claims, wherein a first pilot package parameter from each available transmitter unit is indicative of pilot package signal strength.

9. Method according to any of the preceding claims, wherein the search criterion is fulfilled if the first parameter is below or above a search threshold value.

10. Method according to any of the preceding claims, wherein searching for pilot packages is performed in time intervals of not receiving audio packages from the primary transmitter unit.

11. Method according to any of the preceding claims, wherein searching for pilot packages comprises receiving data on one or more dedicated pilot channels.

12. Method according to any of the preceding claims, wherein selecting the optimum transmitter unit from available transmitter units is based on best available signal strength.

13. Hearing device (2, 2') comprising

- an antenna (8);
- a receiver unit (10) coupled to the antenna and configured to wirelessly receive audio packages and pilot packages of audio streams;
- a processing unit (6) coupled to the wireless receiver unit for receiving data via the antenna;
- a receiver (4) coupled to an output of the processing unit for conversion of an output signal into an output audio signal;

wherein the processing unit (6) is configured to:

- receive audio packages of a primary audio stream from a primary transmitter unit with a primary transmitter unit address via the wireless receiver unit;
- evaluate a first parameter of said received audio packages of the primary audio stream; wherein, if the first parameter fulfills a search criterion, wherein the search criterion is whether or not the signal strength of the received audio packages from the first transmitter is satisfactory, the processing unit is configured to:

  - search for pilot packages from available transmitter units;
  - determine and select an optimum transmitter unit based on one or more pilot package parameters of pilot packages from available transmitter units; and
  - receive audio packages of an audio stream from the optimum transmitter unit according to one or more pilot packages from the optimum transmitter unit; wherein

determining and selecting an optimum transmitter unit comprises:

- evaluating at least one pilot package parameter, including a first pilot package parameter, for one or more pilot packages from available transmitter units; and
- if the at least one pilot package parameter fulfils a switch criterion:

  - selecting a secondary transmitter unit from the available transmitter units as the optimum transmitter unit.

14. Hearing device according to claim 13, comprising a microphone for conversion of an acoustic audio signal into an input audio signal.

15. Hearing device according to any of claims 13-14, wherein the processing unit is configured to compensate for hearing loss or hearing disability of the hearing device user.

Patentansprüche

1. Verfahren (400, 400') zum empfangen von drahtlosen Audioströmen in einem Hörgerät, wobei das Hörgerät eine Verarbeitungseinheit umfasst, die ausgelegt ist, um einen Hörverlust oder eine Hörschwäche eines Benutzers eines Hörgeräts zu kompensieren, wobei das Verfahren umfasst:

- Empfangen (401), in dem Hörgerät, von Audiopaketen eines primären Audiostroms von einer primären Sendeeinheit mit einer primären Sendeeinheitadresse;
- Auswerten (402), mit der Verarbeitungseinheit, eines ersten Parameters der empfangenen Audiopakete des primären Audiostroms; und
- wenn der erste Parameter ein Suchkriterium (404) erfüllt, wobei das Suchkriterium (404) ist, ob die Signalstärke der empfangenen Audiopakete von der ersten Sendeeinheit zufriedenstellend ist oder nicht;

- Suche (406) nach Pilotpaketen von verfügbaren Sendeeinheiten;
- Bestimmen und Auswählen (414) einer optimalen Sendeeinheit basierend auf einem oder mehreren Pilotpaketparameter(n) von Pilotpaketen von verfügbaren Sendeeinheiten;
- Empfangen von Audiopaketen eines Audiostroms von der optimalen Sendeeinheit entsprechend einem oder mehreren Pilotpaket(en) von der optimalen Sendeeinheit; wobei

das Bestimmen und Auswählen (414) einer optimalen Sendeeinheit Folgendes umfassen:

- Auswerten (408) von mindestens einem Pilotpaketparameter, umfassend einen ersten Pilotpaketparameter, für ein oder mehrere Pilotpaket(e) von verfügbaren Sendeeinheiten; und
- wenn der mindestens eine Pilotpaketparameter ein Schaltkriterium (410) erfüllt:

- Auswählen (412) einer sekundären Sendeeinheit aus den verfügbaren Sendeeinheiten als die optimale Sendeeinheit.

2. Verfahren nach Anspruch 1, wobei das Verfahren das Auswählen der primären Sendeeinheit als die optimale Sendeeinheit umfasst, wenn der mindestens eine Pilotpaketparameter das Schaltkriterium nicht erfüllt.

3. Verfahren nach einem der Ansprüche 1-2, wobei das Schaltkriterium erfüllt wird, wenn der erste Pilotpaketparameter einer verfügbaren Sendeeinheit größer ist als der erste Pilotpaketparameter der primären Sendeeinheit.

4. Verfahren nach Anspruch 1, wobei das Bestimmen und Auswählen einer optimalen Sendeeinheit Folgendes umfassen

- Auswerten von mindestens einem Pilotpaketparameter umfassend einen ersten Pilotpaketparameter von jeder verfügbaren Sendeeinheit; und
- Auswählen der optimalen Sendeeinheit basierend auf der Auswertung von mindestens einem Pilotpaketparameter.

5. Verfahren nach einem der vorgehenden Ansprüche, wobei jedes Pilotpaket eine Sendeeinheitadresse der Sendeeinheit, einen Zeitversatz, und einen Kanalidentifizierer eines nachfolgenden Audiopakets umfasst, und wobei das Empfangen von Audiopaketen eines Audiostroms von der optimalen Sendeeinheit auf dem Zeitversatz eines Pilotpakets basiert.

6. Verfahren nach einem der vorgehenden Ansprüche, wobei jedes Pilotpaket einen Audiostromidentifizierer umfasst, und wobei das Bestimmen und Auswählen einer optimalen Sendeeinheit auf dem Audiostromidentifizierer basieren.

7. Verfahren nach einem der vorgehenden Ansprüche, wobei der erste Parameter ein Parameter ist, der die Signalstärke des primären Audiostroms angibt.

8. Verfahren nach einem der vorgehenden Ansprüche, wobei ein erster Pilotpaketparameter von jeder verfügbaren Sendeeinheit eine Pilotpaketsignalstärke angibt.

9. Verfahren nach einem der vorgehenden Ansprüche, wobei das Suchkriterium erfüllt wird, wenn der erste Parameter unterhalb oder oberhalb eines Suchschwellenwerts liegt.

10. Verfahren nach einem der vorgehenden Ansprüche, wobei die Suche nach Pilotpaketen in Zeitintervallen durchgeführt wird, wo keine Audiopakete von der primären Sendeeinheit empfangen werden.

11. Verfahren nach einem der vorgehenden Ansprüche, wobei die Suche nach Pilotpaketen das Empfangen von Daten auf einem dedizierten Pilotkanal oder mehreren dedizierten Pilotkanälen umfasst.

12. Verfahren nach einem der vorgehenden Ansprüche, wobei das Auswählen der optimalen Sendeeinheit aus verfügbaren Sendeeinheiten auf der besten verfügbaren Signalstärke basiert.

13. Hörgerät (2, 2') umfassend

- eine Antenne (8);

- eine Empfangseinheit (10), die mit der Antenne verbunden ist und zum drahtlosen Empfangen von Audiopaketen und Pilotpaketen von Audioströmen ausgelegt ist;
- eine Verarbeitungseinheit (6), die zum Empfangen von Daten über die Antenne mit der drahtlosen Empfangseinheit verbunden ist;
- einen Empfänger (4), der mit einem Ausgang der Verarbeitungseinheit zum Umwandeln eines Ausgangssignals in ein Audioausgangssignal verbunden ist;

wobei die Verarbeitungseinheit (6) für Folgendes konfiguriert ist:

- Empfangen von Audiopaketen eines primären Audiostroms von einer primären Sendeeinheit mit einer primären Sendeeinheitadresse über die drahtlose Empfängereinheit;
- Auswerten eines ersten Parameters der empfangenen Audiopakete des primären Audiostroms;
wobei, wenn der erste Parameter ein Suchkriterium erfüllt, wobei das Suchkriterium ist, ob die Signalstärke der empfangenen Audiopakete von der ersten Sendeeinheit zufriedenstellend ist oder nicht, die Verarbeitungseinheit für Folgendes ausgelegt ist:

    - Suche nach Pilotpaketen von verfügbaren Sendeeinheiten;
    - Bestimmen und Auswählen einer optimalen Sendeeinheit basierend auf einem oder mehreren Pilotpaketparameter(n) von Pilotpaketen von verfügbaren Sendeeinheiten; und
    - Empfangen von Audiopaketen eines Audiostroms von der optimalen Sendeeinheit entsprechend einem oder mehreren Pilotpaket(en) von der optimalen Sendeeinheit; wobei

    das Bestimmen und Auswählen einer optimalen Sendeeinheit Folgendes umfassen:

    - Auswerten von mindestens einem Pilotpaketparameter, umfassend einen ersten Pilotpaketparameter, für ein oder mehrere Pilotpaket(e) von verfügbaren Sendeeinheiten; und
    - wenn der mindestens eine Pilotpaketparameter ein Schaltkriterium erfüllt:
    - Auswählen einer sekundären Sendeeinheit aus den verfügbaren Sendeeinheiten als die optimale Sendeeinheit.

14. Hörgerät nach Anspruch 13, umfassend ein Mikrofon zum Umwandeln eines akustischen Audiosignals in ein Audioeingangssignal.

15. Hörgerät nach einem der Ansprüche 13-14, wobei die Verarbeitungseinheit ausgelegt ist, um einen Hörverlust oder eine Hörschwäche des Benutzers des Hörgeräts zu kompensieren.

Revendications

1. Procédé (400, 400') pour recevoir des flux audio sans fil dans une prothèse auditive, la prothèse auditive comprenant une unité de traitement configurée pour compenser la perte auditive ou l'incapacité auditive de l'utilisateur de la prothèse auditive, le procédé comprenant :

- la réception (401), dans la prothèse auditive, de paquets audio d'un flux audio primaire provenant d'une unité émettrice primaire ayant une adresse d'unité d'émetteur primaire ;
- l'évaluation (402), avec l'unité de traitement, d'un premier paramètre des paquets audio reçus du flux audio primaire ; et
- si le premier paramètre répond à un critère de recherche (404), ledit critère de recherche (404) étant la satisfaction ou l'insatisfaction de l'intensité du signal des paquets audio reçus du premier émetteur :

    - la recherche (406) de paquets pilotes à partir d'unités émettrices disponibles ;
    - la détermination et la sélection (414) d'une unité émettrice optimale sur la base d'un ou plusieurs paramètres de paquets pilotes de paquets pilotes provenant d'unités émettrices disponibles ;
    - la réception de paquets audio d'un flux audio provenant de l'unité d'émission optimale en fonction d'un ou de plusieurs paquets pilotes provenant de l'unité émettrice optimale ; dans lequel

    la détermination et la sélection (414) d'une unité émettrice optimale comprenant :

- l'évaluation (408) d'au moins un paramètre de paquet pilote, comprenant un premier paramètre de paquet pilote, pour un ou plusieurs paquets pilotes à partir d'unités émettrices disponibles ; et
- si l'au moins un paramètre de paquet pilote remplit un critère de commutation (410) :

    - la sélection (412) d'une unité de transmission secondaire parmi les unités émettrices disponibles en tant qu'unité émettrice optimale.

2. Procédé selon la revendication 1, le procédé comprenant la sélection de l'unité émettrice primaire en tant qu'unité émettrice optimale si l'au moins un paramètre de paquet pilote ne satisfait pas au critère de commutation.

3. Procédé selon l'une quelconque des revendications 1 à 2, dans lequel le critère de commutation est rempli si le premier paramètre de paquet pilote d'une unité émettrice secondaire disponible est supérieur au premier paramètre de paquet pilote de l'unité émettrice primaire.

4. Procédé selon la revendication 1, dans lequel la détermination et la sélection d'une unité émettrice optimale comprennent

- l'évaluation d'au moins un paramètre de paquet pilote comprenant un premier paramètre de paquet pilote à partir de chaque unité émettrice disponible ; et
- la sélection de l'unité émettrice optimale sur la base de l'évaluation d'au moins un paramètre de paquet pilote.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel chaque paquet pilote comprend une adresse d'unité émettrice de l'unité émettrice, un décalage temporel et un identificateur de canal d'un paquet audio suivant, et dans lequel la réception de paquets audio d'un flux audio provenant de l'unité émettrice optimale est basée sur le décalage temporel d'un paquet pilote.

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel chaque paquet pilote comprend un identifiant de flux audio, et dans lequel la détermination et la sélection d'une unité émettrice optimale sont basées sur l'identifiant de flux audio.

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel le premier paramètre est un paramètre indicatif de l'intensité du signal du flux audio primaire.

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel un premier paramètre de paquet pilote provenant de chaque unité émettrice disponible est indicatif de l'intensité du signal du paquet pilote.

9. Procédé selon l'une quelconque des revendications précédentes, dans lequel le critère de recherche est rempli si le premier paramètre est inférieur ou supérieur à une valeur de seuil de recherche.

10. Procédé selon l'une quelconque des revendications précédentes, dans lequel la recherche de paquets pilotes est effectuée dans des intervalles de temps de non réception de paquets audio provenant de l'unité émettrice primaire.

11. Procédé selon l'une quelconque des revendications précédentes, dans lequel la recherche de paquets pilotes comprend la réception de données sur un ou plusieurs canaux pilotes dédiés.

12. Procédé selon l'une quelconque des revendications précédentes, dans lequel la sélection de l'unité émettrice optimale parmi les unités émettrices disponibles est basée sur la meilleure intensité du signal disponible.

13. Prothèse auditive (2, 2') comprenant

- une antenne (8) ;
- une unité de réception (10) couplée à l'antenne et configurée pour recevoir sans fil des paquets audio et des paquets pilotes de flux audio ;
- une unité de traitement (6) couplée à l'unité de réception sans fil pour recevoir des données via l'antenne ;
- un récepteur (4) couplé à une sortie de l'unité de traitement pour la conversion d'un signal de sortie en un signal audio de sortie ;

l'unité de traitement (6) étant configurée pour :

- recevoir des paquets audio d'un flux audio primaire provenant d'une unité émettrice primaire ayant une adresse d'unité d'émetteur primaire via l'unité de récepteur sans fil ;
- évaluer un premier paramètre desdits paquets audio reçus du flux audio primaire ;
dans laquelle si le premier paramètre répond à un critère de recherche, ledit critère de recherche étant la satisfaction ou l'insatisfaction de l'intensité du signal des paquets audio reçus du premier émetteur, l'unité de traitement est configurée pour :

- la recherche de paquets pilotes à partir d'unités émettrices disponibles ;
- la détermination et la sélection d'une unité émettrice optimale sur la base d'un ou plusieurs paramètres de paquets pilotes de paquets pilotes provenant d'unités émettrices disponibles ; et
- la réception de paquets audio d'un flux audio provenant de l'unité d'émission optimale en fonction d'un ou de plusieurs paquets pilotes provenant de l'unité émettrice optimale ; dans laquelle

la détermination et la sélection d'une unité émettrice optimale comprenant :

- l'évaluation d'au moins un paramètre de paquet pilote, comprenant un premier paramètre de paquet pilote, pour un ou plusieurs paquets pilotes à partir d'unités émettrices disponibles ; et
- si l'au moins un paramètre de paquet pilote remplit un critère de commutation :

- la sélection d'une unité de transmission secondaire parmi les unités émettrices disponibles en tant qu'unité émettrice optimale.

14. Prothèse auditive selon la revendication 13, comprenant un microphone pour la conversion d'un signal audio acoustique en un signal audio d'entrée.

15. Prothèse auditive selon l'une quelconque des revendications 13 à 14, dans lequel l'unité de traitement est configurée pour compenser la perte auditive ou l'incapacité auditive de l'utilisateur de la prothèse auditive.

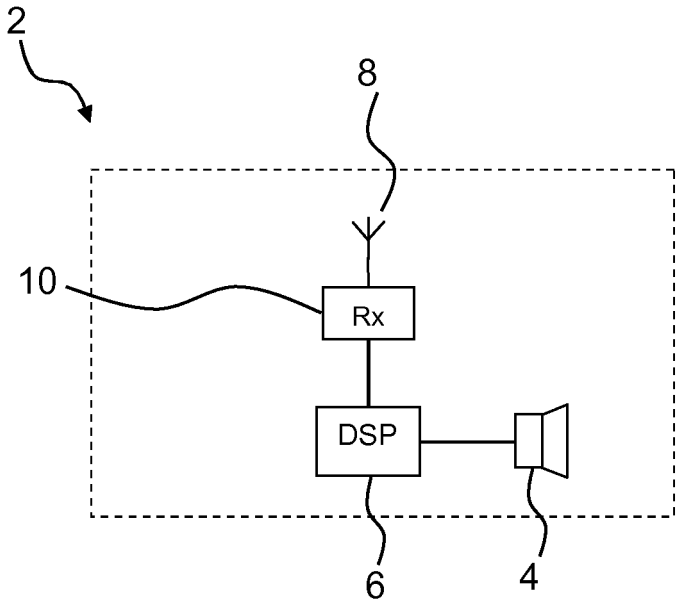

Fig. 1

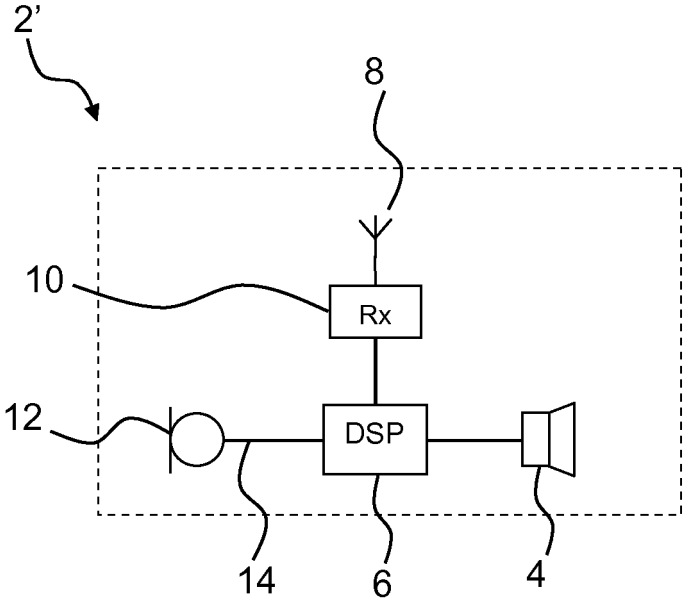

Fig. 2

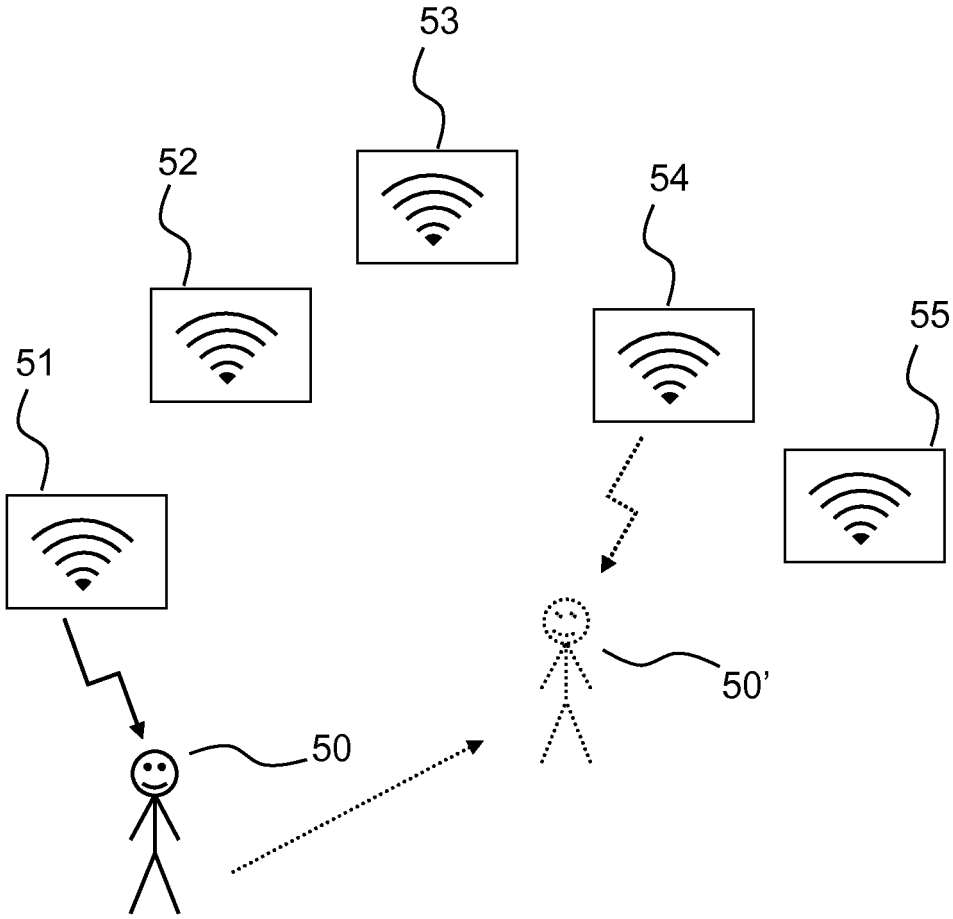

Fig. 3

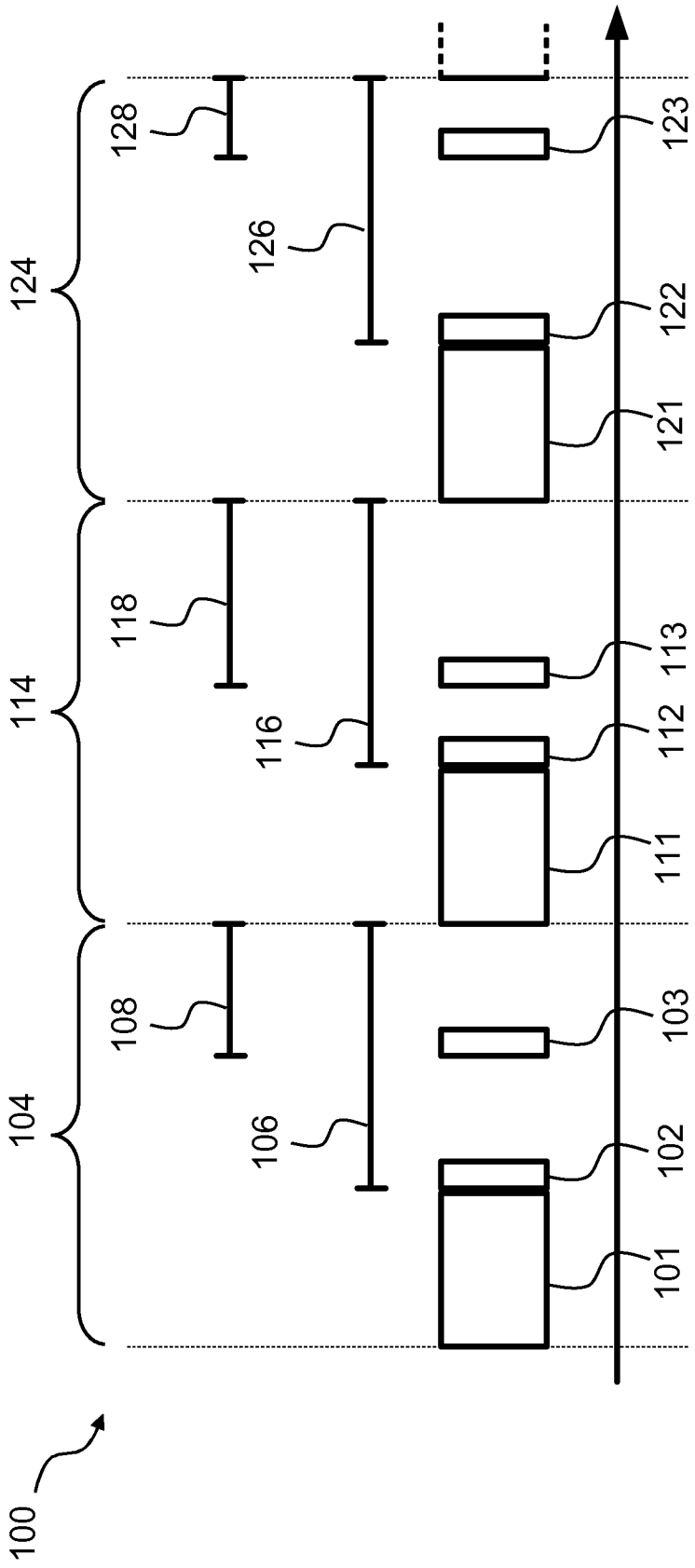
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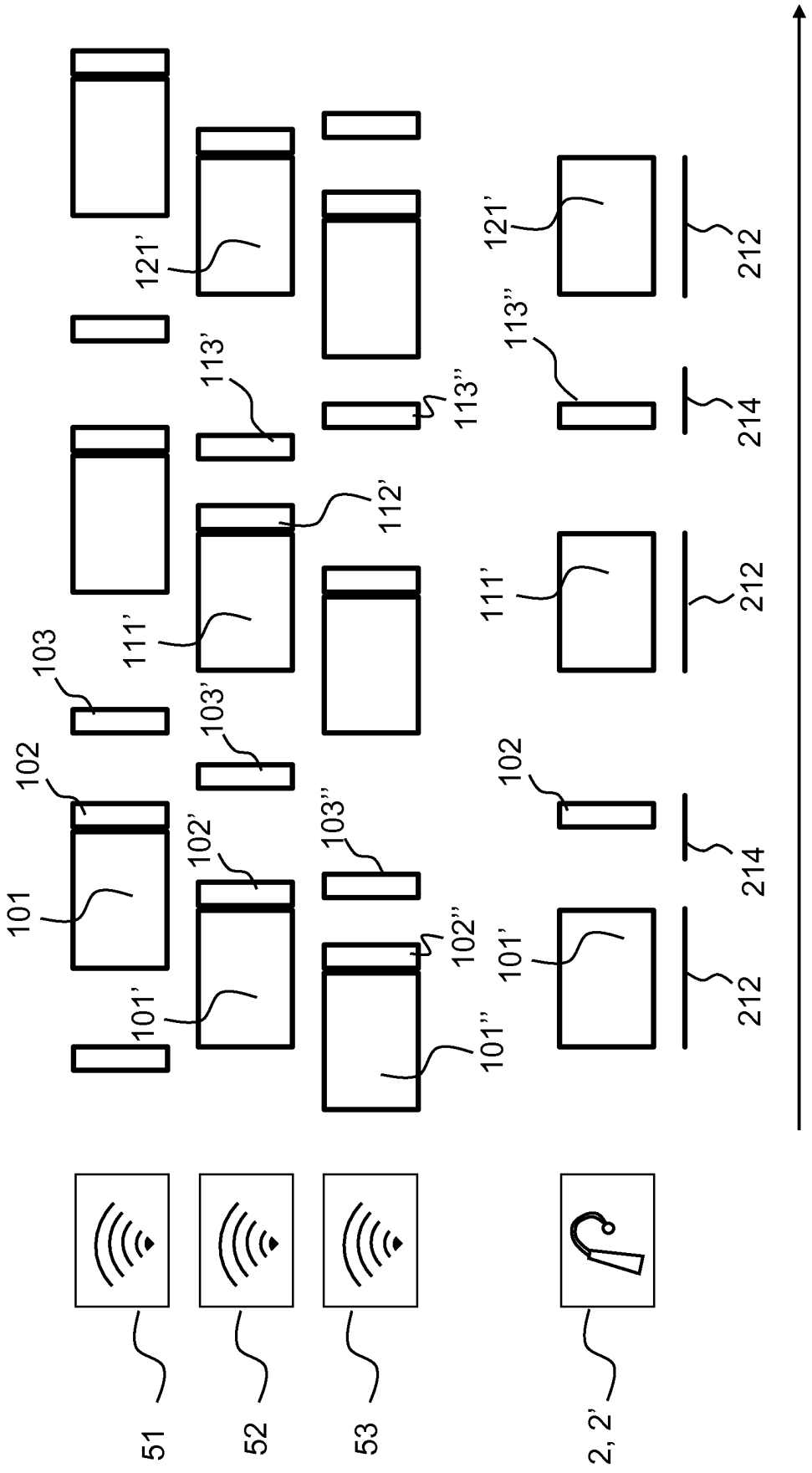
Fig. 4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102
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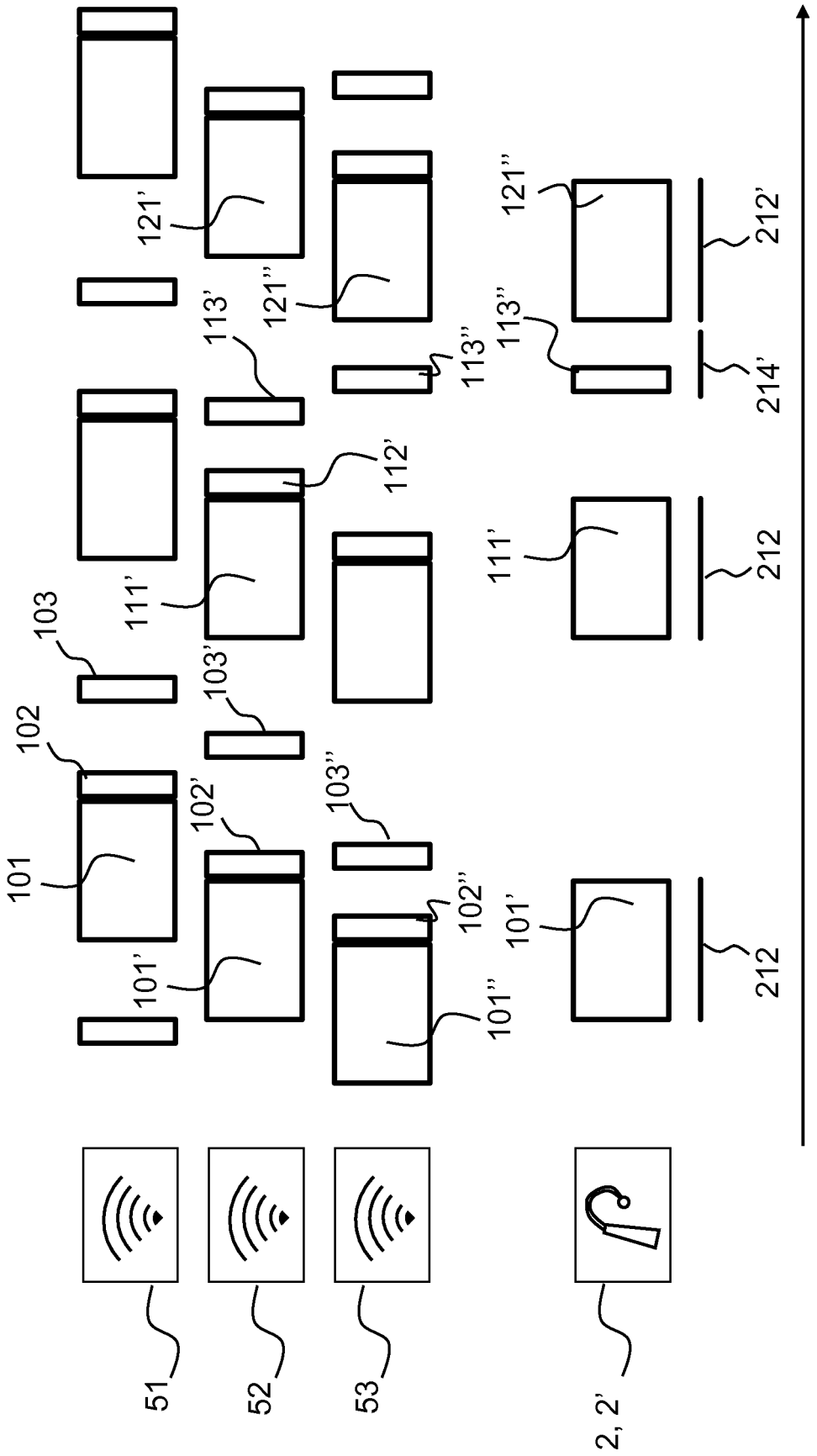
214
113''
121'
212

Fig. 5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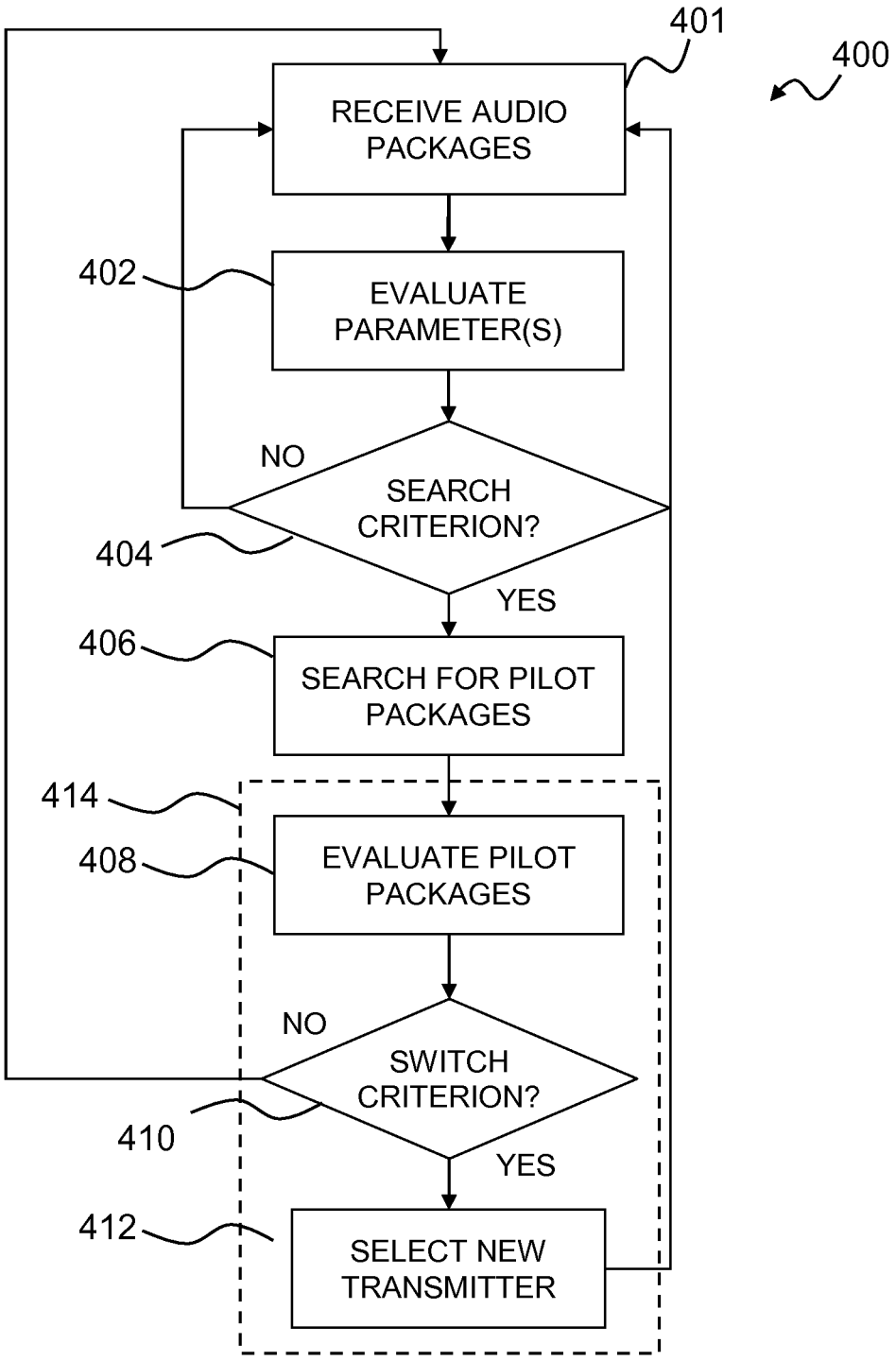
121'
121''
111'
113''
121''
212
212
212'
214'

Fig. 6


401
400
RECEIVE AUDIO PACKAGES
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EVALUATE PARAMETER(S)
NO
SEARCH CRITERION?
404
YES
406
SEARCH FOR PILOT PACKAGES
414
408
EVALUATE PILOT PACKAGES
NO
SWITCH CRITERION?
410
YES
412
SELECT NEW TRANSMITTER

Fig. 7

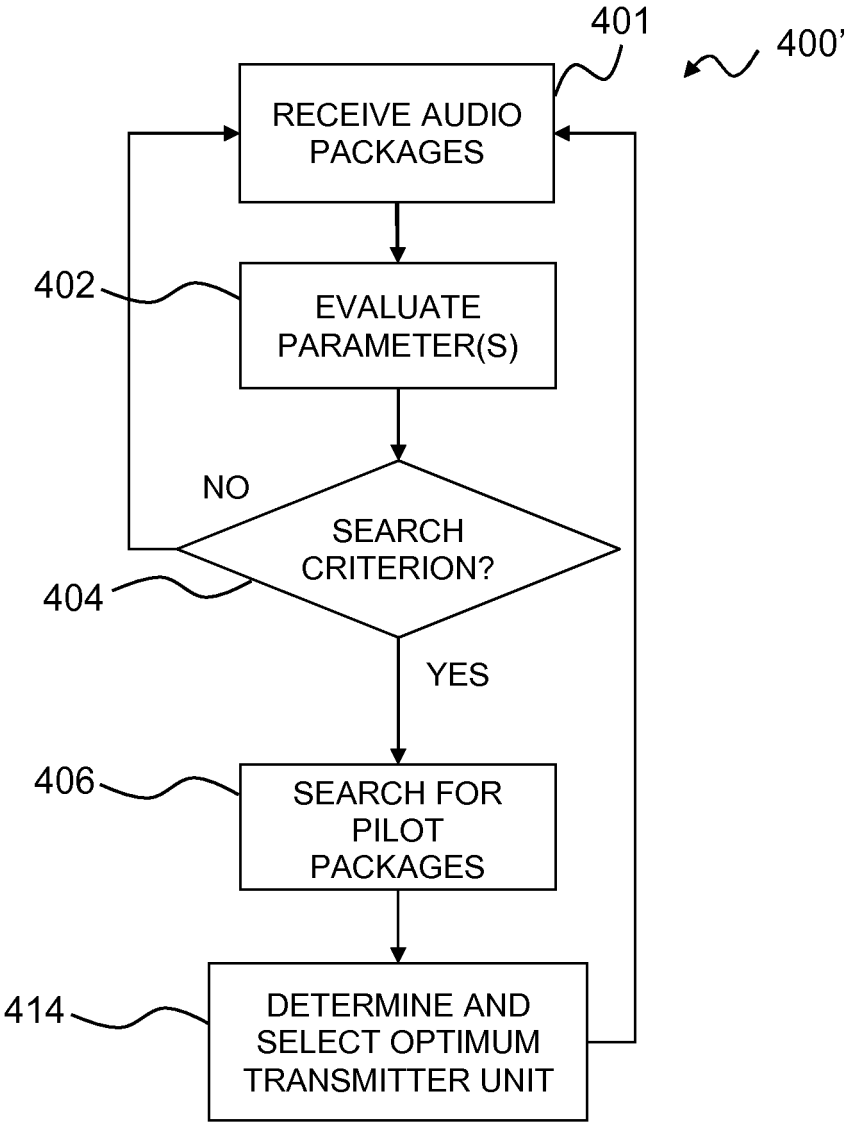
401
400'
RECEIVE AUDIO PACKAGES
402
EVALUATE PARAMETER(S)
NO
SEARCH CRITERION?
404
YES
406
SEARCH FOR PILOT PACKAGES
414
DETERMINE AND SELECT OPTIMUM TRANSMITTER UNIT

Fig. 8

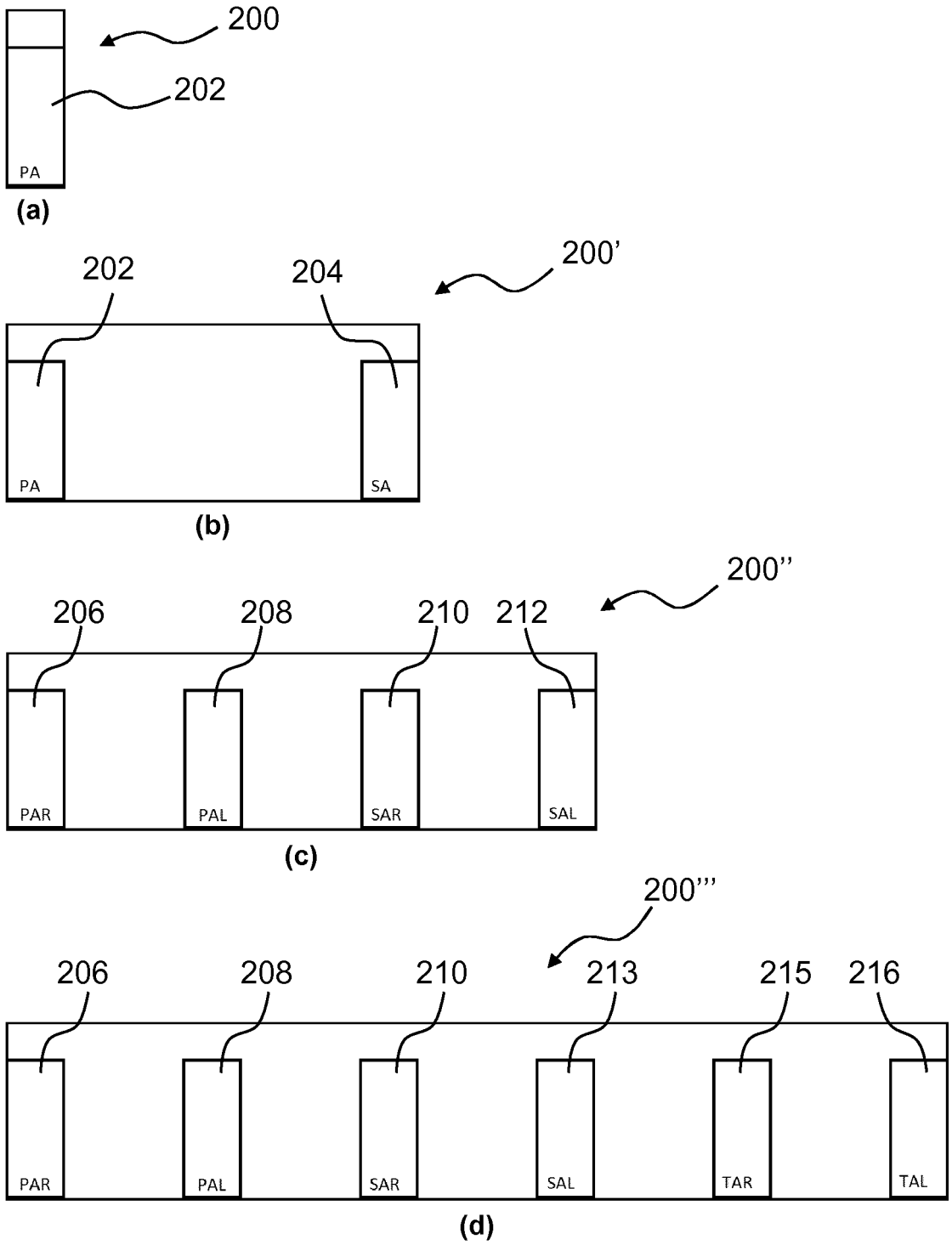
200
202
PA
(a)
202
204
200'
PA
SA
(b)
200''
206
208
210
212
PAR
PAL
SAR
SAL
(c)
200'''
206
208
210
213
215
216
PAR
PAL
SAR
SAL
TAR
TAL
(d)

Fig. 9

TRANSMITTER UNIT ADDRESS
AUDIO STREAM IDENTIFIER
AUDIO STREAM DATA

(a)

TRANSMITTER UNIT ADDRESS
CHANNEL IDENTIFIER
TIME OFFSET
AUDIO STREAM IDENTIFIER
NETWORK IDENTIFIER

(b)

Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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