

Claims

1. An apparatus for generating one or more audio output channels, wherein the apparatus comprises:

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a parameter processor ~~(110)~~ for calculating mixing information, and

a downmix processor ~~(120)~~ for generating the one or more audio output channels,

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wherein the downmix processor ~~(120)~~ is configured to receive a data stream comprising audio transport channels of an audio transport signal, wherein one or more audio channel signals are mixed within the audio transport signal, wherein one or more audio object signals are mixed within the audio transport signal, and wherein the number of the audio transport channels is smaller than the number of

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the one or more audio channel signals plus the number of the one or more audio object signals,

wherein the parameter processor ~~(110)~~ is configured to receive downmix information indicating information on how the one or more audio channel signals and the one or more audio object signals are mixed within the audio transport channels, and wherein the parameter processor ~~(110)~~ is configured to receive covariance information, and wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the downmix information and depending on the covariance information, and

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wherein the downmix processor ~~(120)~~ is configured to generate the one or more audio output channels from the audio transport signal depending on the mixing information,

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wherein the covariance information indicates a level difference information for at least one of the one or more audio channel signals and further indicates a level difference information for at least one of the one or more audio object signals, and wherein the covariance information does not indicate correlation information for any pair of one of the one or more audio channel signals and one of the one or

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more audio object signals,

wherein the one or more audio channel signals are mixed within a first group of one or more of the audio transport channels, wherein the one or more audio object

signals are mixed within a second group of one or more of the audio transport channels, wherein each audio transport channel of the first group is not comprised by the second group, and wherein each audio transport channel of the second group is not comprised by the first group, and

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wherein the downmix information comprises first downmix subinformation indicating information on how the one or more audio channel signals are mixed within the first group of the audio transport channels, and wherein the downmix information comprises second downmix subinformation indicating information on how the one or more audio object signals are mixed within the second group of the one or more audio transport channels,

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wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the first downmix subinformation, depending on the second downmix subinformation and depending on the covariance information,

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wherein the downmix processor ~~(120)~~ is configured to generate the one or more audio output signals from the first group of audio transport channels and from the second group of audio transport channels depending on the mixing information,

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wherein the downmix processor is configured to receive a first channel count number indicating the number of the audio transport channels of the first group of audio transport channels, and wherein the downmix processor is configured to receive a second channel count number indicating the number of the audio transport channels of the second group of audio transport channels, and

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wherein the downmix processor ~~(120)~~ is configured to identify whether an audio transport channel within the data stream belongs to the first group or to the second group depending on the first channel count number or depending on the second channel count number, or depending on the first channel count number and the second channel count number.

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2. An apparatus according to claim 1, wherein the covariance information indicates a level difference information for each of the one or more audio channel signals and further indicates a level difference information for each of the one or more audio object signals.

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3. An apparatus according to claim 1 or 2,

wherein two or more audio object signals are mixed within the audio transport signal, and wherein two or more audio channel signals are mixed within the audio transport signal,

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wherein the covariance information indicates correlation information for one or more pairs of a first one of the two or more audio channel signals and a second one of the two or more audio channel signals, or

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wherein the covariance information indicates correlation information for one or more pairs of a first one of the two or more audio object signals and a second one of the two or more audio object signals, or

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wherein the covariance information indicates correlation information for one or more pairs of a first one of the two or more audio channel signals and a second one of the two or more audio channel signals and indicates correlation information for one or more pairs of a first one of the two or more audio object signals and a second one of the two or more audio object signals.

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4. An apparatus according to one of the preceding claims,

wherein the covariance information comprises a plurality of covariance coefficients of a covariance matrix $\mathbf{E}_X$ of size $N \times N$, wherein N indicates the number of the one or more audio channel signals plus the number of the one or more audio object signals,

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wherein the covariance matrix $\mathbf{E}_X$ is defined according to the formula

$$\mathbf{E}_X = \begin{bmatrix} \mathbf{E}_X^{ch} & \mathbf{0} \\ \mathbf{0} & \mathbf{E}_X^{obj} \end{bmatrix},$$

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wherein $\mathbf{E}_X^{ch}$ indicates the coefficients of a first covariance submatrix of size $N_{Channels} \times N_{Channels}$, wherein $N_{Channels}$ indicates the number of the one or more audio channel signals,

wherein $\mathbf{E}_X^{obj}$ indicates the coefficients of a second covariance submatrix of size $N_{Objects} \times N_{Objects}$, wherein $N_{Objects}$ indicates the number of the one or more audio object signals,

5 wherein $\mathbf{0}$ indicates a zero matrix,

wherein the parameter processor (110) is configured to receive the plurality of covariance coefficients of the covariance matrix $\mathbf{E}_X$, and

10 wherein the parameter processor (110) is configured to set all coefficients of the covariance matrix $\mathbf{E}_X$ to 0, that are not received by the parameter processor (110).

5. An apparatus according to one of the preceding claims,

15 wherein the downmix information comprises a plurality of downmix coefficients of a downmix matrix $\mathbf{D}$ of size $N_{DmxCh} \times N$, wherein N_{DmxCh} indicates the number of the audio transport channels, and wherein N indicates the number of the one or more audio channel signals plus the number of the one or more audio object signals,

20 wherein the downmix matrix $\mathbf{D}$ is defined according to the formula

$$\mathbf{D} = \begin{bmatrix} \mathbf{D}_{ch} & \mathbf{0} \\ \mathbf{0} & \mathbf{D}_{obj} \end{bmatrix},$$

25 wherein $\mathbf{D}_{ch}$ indicates the coefficients of a first downmix submatrix of size $N_{DmxCh}^{ch} \times N_{Channels}$, wherein indicates N_{DmxCh}^{ch} the number of the audio transport channels of the first group of the audio transport channels, and wherein $N_{Channels}$ indicates the number of the one or more audio channel signals,

30 wherein $\mathbf{D}_{obj}$ indicates the coefficients of a second downmix submatrix of size $N_{DmxCh}^{obj} \times N_{Objects}$, wherein indicates N_{DmxCh}^{obj} the number of the audio transport channels of the second group of the audio transport channels, and wherein $N_{Objects}$ indicates the number of the one or more audio channel signals,

35 wherein $\mathbf{0}$ indicates a zero matrix,

wherein the parameter processor ~~(110)~~ is configured to receive the plurality of downmix coefficients of the downmix matrix **D**, and

wherein the parameter processor ~~(110)~~ is configured to set all coefficients of the downmix matrix **D** to 0, that are not received by the parameter processor ~~(110)~~.

6. An apparatus according to one of the preceding claims,

wherein the parameter processor ~~(110)~~ is configured to receive rendering information indicating information on how the one or more audio channel signals and the one or more audio object signals are mixed within the one or more audio output channels,

wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the downmix information, depending on the covariance information and depending on rendering information.

7. An apparatus according to claim 6,

wherein the parameter processor ~~(110)~~ is configured to receive a plurality of coefficients of a rendering matrix **R** as the rendering information, and

wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the downmix information, depending on the covariance information and depending on the rendering matrix **R**.

8. An apparatus according to claim 6,

wherein the parameter processor ~~(110)~~ is configured to receive metadata information as the rendering information, wherein the metadata information comprises position information,

wherein the position information indicates a position for each of the one or more audio object signals,

wherein the position information does not indicate a position for any of the one or more audio channel signals,

wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the downmix information, depending on the covariance information, and depending on the position information.

5 9. An apparatus according to claim 8,

wherein the metadata information further comprises gain information,

10 wherein the gain information indicates a gain value for each of the one or more audio object signals,

wherein the gain information does not indicate a gain value for any of the one or more audio channel signals,

15 wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the downmix information, depending on the covariance information, depending on the position information, and depending on the gain information.

20 10. An apparatus according to claim 8 or 9,

wherein the parameter processor ~~(110)~~ is configured to calculate a mixing matrix S as the mixing information, wherein the mixing matrix S is defined according to the formula

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$$S = RG,$$

wherein G is a decoding matrix depending on the downmix information and depending on the covariance information,

30 wherein R is a rendering matrix depending on the metadata information,

wherein the downmix processor ~~(120)~~ is configured to generate the one or more audio output channels of the audio output signal by applying the formula

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$$Z = SY,$$

wherein Z is the audio output signal, and wherein Y is the audio transport signal.

11. An apparatus according to one of the preceding claims,

wherein two or more audio object signals are mixed within the audio transport signal, and wherein two or more audio channel signals are mixed within the audio transport signal,

wherein the covariance information indicates correlation information for one or more pairs of a first one of the two or more audio channel signals and a second one of the two or more audio channel signals,

wherein the covariance information does not indicate correlation information for any pair of a first one of the one or more audio object signals and a second one of the one or more audio object signals, and

wherein the parameter processor ~~(110)~~ is configured to calculate the mixing information depending on the downmix information, depending on a the level difference information of each of the one or more audio channel signals, depending on the second level difference information of each of the one or more audio object signals, and depending on the correlation information of the one or more pairs of a first one of the two or more audio channel signals and a second one of the two or more audio channel signals.

12. An apparatus for generating an audio transport signal comprising audio transport channels, wherein the apparatus comprises:

a channel/object mixer ~~(210)~~ for generating the audio transport channels of the audio transport signal, and

an output interface ~~(220)~~,

wherein the channel/object mixer ~~(210)~~ is configured to generate the audio transport signal comprising the audio transport channels by mixing one or more audio channel signals and one or more audio object signals within the audio transport signal depending on downmix information indicating information on how the one or more audio channel signals and the one or more audio object signals have to be mixed within the audio transport channels, wherein the number of the

audio transport channels is smaller than the number of the one or more audio channel signals plus the number of the one or more audio object signals,

wherein the output interface ~~(220)~~ is configured to output the audio transport signal, the downmix information and covariance information,

wherein the covariance information indicates a level difference information for at least one of the one or more audio channel signals and further indicates a level difference information for at least one of the one or more audio object signals, and wherein the covariance information does not indicate correlation information for any pair of one of the one or more audio channel signals and one of the one or more audio object signals,

wherein the apparatus is configured to mix the one or more audio channel signals within a first group of one or more of the audio transport channels, wherein the apparatus is configured to mix the one or more audio object signals within a second group of one or more of the audio transport channels, wherein each audio transport channel of the first group is not comprised by the second group, and wherein each audio transport channel of the second group is not comprised by the first group, and

wherein the downmix information comprises first downmix subinformation indicating information on how the one or more audio channel signals are mixed within the first group of the audio transport channels, and wherein the downmix information comprises second downmix subinformation indicating information on how the one or more audio object signals are mixed within the second group of the audio transport channels,

wherein the apparatus is configured to output a first channel count number indicating the number of the audio transport channels of the first group of audio transport channels, and wherein the apparatus is configured to output a second channel count number indicating the number of the audio transport channels of the second group of audio transport channels.

13. An apparatus according to claim 12, wherein channel/object mixer ~~(210)~~ is configured to generate the audio transport signal so that the number of the audio transport channels of the audio transport signal depends on how much bitrate is available for transmitting the audio transport signal.

14. A system, comprising:

an apparatus ~~(310)~~ according to claim 12 or 13 for generating an audio transport signal, and

an apparatus ~~(320)~~ according to one of claims 1 to 11 for generating one or more audio output channels,

wherein the apparatus ~~(320)~~ according to one of claims 1 to 11 is configured to receive the audio transport signal, downmix information and covariance information from the apparatus ~~(310)~~ according to claim 12 or 13, and

wherein the apparatus ~~(320)~~ according to one of claims 1 to 11 is configured to generate the one or more audio output channels from the audio transport signal depending on the downmix information and depending on the covariance information.

15. A method for generating one or more audio output channels, wherein the method comprises:

receiving a data stream comprising audio transport channels of an audio transport signal, wherein one or more audio channel signals are mixed within the audio transport signal, wherein one or more audio object signals are mixed within the audio transport signal, and wherein the number of the audio transport channels is smaller than the number of the one or more audio channel signals plus the number of the one or more audio object signals,

receiving downmix information indicating information on how the one or more audio channel signals and the one or more audio object signals are mixed within the audio transport channels,

receiving covariance information,

calculating mixing information depending on the downmix information and depending on the covariance information, and

generating the one or more audio output channels,

generating the one or more audio output channels from the audio transport signal depending on the mixing information,

5 wherein the covariance information indicates a level difference information for at least one of the one or more audio channel signals and further indicates a level difference information for at least one of the one or more audio object signals, and wherein the covariance information does not indicate correlation information for any pair of one of the one or more audio channel signals and one of the one or
10 more audio object signals,

wherein the one or more audio channel signals are mixed within a first group of one or more of the audio transport channels, wherein the one or more audio object signals are mixed within a second group of one or more of the audio transport
15 channels, wherein each audio transport channel of the first group is not comprised by the second group, and wherein each audio transport channel of the second group is not comprised by the first group, and

wherein the downmix information comprises first downmix subinformation indicating information on how the one or more audio channel signals are mixed within the first group of the audio transport channels, and wherein the downmix
20 information comprises second downmix subinformation indicating information on how the one or more audio object signals are mixed within the second group of the audio transport channels,

25 wherein the mixing information is calculated depending on the first downmix subinformation, depending on the second downmix subinformation and depending on the covariance information,

30 wherein the one or more audio output signals are generated from the first group of audio transport channels and from the second group of audio transport channels depending on the mixing information,

wherein the method further comprises the step of receiving a first channel count
35 number indicating the number of the audio transport channels of the first group of audio transport channels, and wherein the method further comprises the step of receiving a second channel count number indicating the number of the audio transport channels of the second group of audio transport channels, and

wherein the method further comprises the step of identifying whether an audio transport channel within the data stream belongs to the first group or to the second group depending on the first channel count number or depending on the second channel count number, or depending on the first channel count number and the second channel count number.

16. A method for generating an audio transport signal comprising audio transport channels, wherein the method comprises:

generating the audio transport signal comprising the audio transport channels by mixing one or more audio channel signals and one or more audio object signals within the audio transport signal depending on downmix information indicating information on how the one or more audio channel signals and the one or more audio object signals have to be mixed within the audio transport channels, wherein the number of the audio transport channels is smaller than the number of the one or more audio channel signals plus the number of the one or more audio object signals, and

outputting the audio transport signal, the downmix information and covariance information,

wherein the covariance information indicates a level difference information for at least one of the one or more audio channel signals and further indicates a level difference information for at least one of the one or more audio object signals, and

wherein the covariance information does not indicate correlation information for any pair of one of the one or more audio channel signals and one of the one or more audio object signals,

wherein the one or more audio channel signals are mixed within a first group of one or more of the audio transport channels, wherein the one or more audio object signals are mixed within a second group of one or more of the audio transport channels, wherein each audio transport channel of the first group is not comprised by the second group, and wherein each audio transport channel of the second group is not comprised by the first group, and

wherein the downmix information comprises first downmix subinformation indicating information on how the one or more audio channel signals are mixed within the first group of the audio transport channels, and wherein the downmix information comprises second downmix subinformation indicating information on how the one or more audio object signals are mixed within the second group of the audio transport channels, and

wherein the method further comprises outputting a first channel count number indicating the number of the audio transport channels of the first group of audio transport channels, and wherein the method further comprises outputting a second channel count number indicating the number of the audio transport channels of the second group of audio transport channels.

17. A computer program for implementing the method of claim 15 or 16 when being executed on a computer or signal processor.