Claims

1. Apparatus for generating an output downmix representation from an input downmix representation, wherein ~~at least~~ a first portion of the input downmix representation is in accordance with a first downmixing scheme and a second portion of the input downmix representation is in accordance with a second downmixing scheme, the apparatus comprising:

an upmixer (200) for upmixing ~~at least~~ the first portion of the input downmix representation using an upmixing scheme corresponding to the first downmixing scheme to obtain ~~at least one~~a first upmixed portion, wherein the first portion of the input downmix representation is a first frequency band of a spectrum and the second portion of the input downmix representation is a second frequency band of the spectrum; and

a downmixer (300) for downmixing the ~~at least one~~first upmixed portion in accordance with a second downmixing scheme different from the first downmixing scheme to obtain a first downmixed portion ~~representing the output downmix representation for at least the portion of the input downmix representation~~; and

a combiner (400) for combining the first downmixed portion and the second portion of the input downmix representation to obtain the output downmix representation comprising a first output representation for the first portion of the input downmix representation and a second output representation for the second portion of the input downmix representation, wherein the first output representation for the first portion of the input downmix representation and the second output representation for the second portion of the input downmix representation represent the output downmix representation and are based on the second downmixing scheme.

~~2. Apparatus of claim 1, wherein only the portion of the input downmix representation is in accordance with the first downmixing scheme and a second portion of the input downmix representation is in accordance with the second downmixing scheme,~~

~~wherein the downmixer (300) is configured for downmixing the at least one upmixed portion in accordance with the second downmixing scheme to obtain the first downmixed portion; and~~

~~further comprising a combiner (400) for combining the first downmixed portion and the second portion of the input downmix representation or a downmixed portion derived from the second portion of the input downmix representation to obtain the output downmix representation comprising a first output representation for only the portion of the input downmix representation and a second output representation for the second portion of the input downmix representation, wherein the first output representation for only the portion of the input downmix representation and the second output representation for the second portion of the input downmix representation are based on the same downmixing scheme.~~

~~3~~2. Apparatus of claim 1 ~~or 2~~,

~~wherein the at least the portion of the input downmix representation or only the portion of the input downmix representation is a first frequency band~~, wherein the first downmixing scheme is a downmixing scheme relying on a residual signal, wherein the residual signal represents a side signal or a prediction residual signal, and

wherein the upmixer (200) is configured to perform, as the upmixing scheme, an upmix using the residual signal.

~~4~~3. Apparatus of claim 1, or 2~~, or 3~~, wherein the second downmixing scheme is a ~~fully~~ parametric scheme~~, and wherein the downmixer (300) is configured to apply the second downmixing scheme~~.

~~5. Apparatus of claim 2, 3, or 4, wherein the second portion of the input downmix representation is a second frequency band, and wherein the combiner (400) is configured to combine the first downmixed portion and the second portion of the input downmix representation to obtain the output downmix representation.~~

~~6~~4. Apparatus of any one of the preceding claims, further comprising an audio decoder (10) for generating a decoded core signal for ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~, and a decoded residual signal for ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~,

wherein the upmixer (200) is configured to use, in the upmixing scheme, the decoded core signal for ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~ and the decoded residual signal for ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~, wherein the decoded residual signal represents a side signal or a prediction residual signal,

wherein the downmixer (300) is configured for receiving the ~~at least one~~first upmixed portion comprising more channels than the input downmix representation.

~~7~~5. Apparatus of claim ~~6~~4, ~~wherein the second portion of the input downmix representation is in accordance with the second downmixing scheme,~~ wherein the audio decoder (10) is configured for generating a decoded core signal for the second portion of the input downmix representation ~~and a decoded residual signal for at least the portion of the input downmix representation or only the portion of the input downmix representation only~~, and wherein the combiner (400) is configured to combine the first downmixed portion and the decoded core signal for the second portion of the input downmix representation.

~~8~~6. Apparatus of one of the preceding claims, further comprising:

a time-to-spectrum converter (100) for converting a time domain input downmix representation of ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~ into a spectral domain; and, as the combiner (400), a spectrum-to-time converter (400) for converting the first downmixed portion and the second portion of the input downmix representation ~~an output signal~~ into a time domain to obtain the output downmix representation, wherein the time-to-spectrum converter (100) or the spectrum-to-time converter (400) is configured to perform an overlap and add processing or to perform a crossover processing from an earlier time block to a later time block, or

~~further comprising an output interface (500) for outputting the output downmix representation to a rendering device or further comprising a rendering device for rendering the output downmix representation as a mono replay signal, or~~

wherein the downmixer (300) is configured to apply, as the second downmixing scheme, an active downmixing scheme, an energy conserving downmixing scheme, or a downmixing scheme, in which a target energy of the downmix signal is in a predetermined ratio to an energy of a mid-channel derived from a first channel and a second channel, wherein at least one of the first channel and the second channel is phase rotated before being added together to form the input downmix representation, wherein the active downmixing scheme comprises performing energy-scaling in an effort to preserve the overall energy of the signal, conducting a phase alignment to avoid cancellation effects, performing a procedure to prevent comb-filter effects by coherence suppression, performing an energy-correction in a frequency-dependent manner by calculating separate weighting factors for multiple spectral bands, performing the downmix on a hybrid QMF subband representation of the signals with additional prior phase alignment of the channels, using a band-wise downmix including both phase and temporal alignment, or generating a downmix or a mono signal that is energy-compensated, and does not suffer from energy fluctuations.

7. Apparatus of one of the preceding claims, further comprising an output interface (500) for outputting the output downmix representation to a rendering device or further comprising a rendering device for rendering the output downmix representation as a mono replay signal.

~~9~~8. Apparatus of claim ~~8~~1, comprising:

a time-to-spectrum converter (100) for converting a time domain input downmix representation of the first portion of the input downmix representation into a spectral domain; and

as the combiner (400), a spectrum-to-time converter (400) for converting the first downmixed portion and the second portion of the input downmix representation into a time domain to obtain the output downmix representation, wherein the time-to-spectrum converter (100) or the spectrum-to-time converter (400) is configured to perform an overlap and add processing or to perform a crossover processing from an earlier time block to a later time block,

wherein the second portion of the input downmix representation is in accordance with the second downmixing scheme, wherein the time-to-spectrum converter (100) is configured for converting a time domain input downmix representation of the second portion of the input downmix representation into the spectral domain, or

wherein the downmixer (300) is configured to apply, as the second downmixing scheme, a downmixing scheme, in which a target energy of the downmix signal is in a predetermined ratio to an energy of a mid-channel derived from a first channel and a second channel, wherein at least one of the first channel and the second channel is phase rotated before being added together to form the input downmix representation, and wherein the predetermined ratio indicates an equality or a deviation range being 3 dB related to a higher energy of energies of thea first ~~original~~ channel and thea second ~~original~~ channel.

~~10~~9. Apparatus of one of the preceding claims, wherein ~~at least~~ the first portion of the input downmix representation is in accordance with the first downmixing scheme relying on a residual signal or on a residual signal and parametric information, wherein the residual signal represents a side signal or a prediction residual signal,

wherein the upmixer (200) is configured for upmixing the input downmix representation of ~~at least~~ the first portion of the input downmix representation using the upmixing scheme corresponding to the first downmixing scheme and using the residual signal or the residual signal and the parametric information, respectively to obtain the ~~at least one~~first upmixed portion; and

~~wherein the downmixer (300) is configured for downmixing the at least one upmixed portion in accordance with the second downmixing scheme different from the first downmixing scheme,~~ wherein the second downmixing scheme is an active downmixing scheme or a ~~fully~~ parametric downmixing scheme to obtain the output downmix representation~~ comprising at least one downmixed portion~~, wherein the active downmixing scheme comprises performing energy-scaling in an effort to preserve the overall energy of the signal, conducting a phase alignment to avoid cancellation effects, performing a procedure to prevent comb-filter effects by coherence suppression, performing an energy-correction in a frequency-dependent manner by calculating separate weighting factors for multiple spectral bands, performing the downmix on a hybrid QMF subband representation of the signals with

additional prior phase alignment of the channels, using a band-wise downmix including both phase and temporal alignment, or generating a downmix or a mono signal that is energy-compensated, and does not suffer from energy fluctuations.

101. Apparatus of claim 109, further comprising an output interface (500) for outputting the output downmix representation to a rendering device or further comprising a rendering device for rendering the output downmix representation as a mono replay signal.

1211. Apparatus of claim 10 9 or 101, wherein the downmixer (300) is configured to apply, as the active downmixing scheme, an energy conserving downmixing scheme, or a downmixing scheme, in which a target energy of the downmix signal is in a predetermined ratio to an energy of a mid-channel derived from a first channel and a second channel, wherein at least one of the first channel and the second channel is phase rotated before being added together.

13. Apparatus of claim 10, 11, or 12, wherein at least the portion of the input downmix representation comprises the full bandwidth of the input downmix representation.

124. Apparatus of one of the preceding claims,

wherein the downmixer (300) is configured to perform the second downmixing scheme, the second downmixing scheme comprising:

calculating (800) a first weight for a first channel and a second weight for a second channel for a spectral band of the at least onefirst upmixed portion, the spectral band comprising a plurality of spectral lines, and

applying (820) the first weight to spectral lines of the spectral band of the first channel and applying the second weight to spectral lines of the spectral band of the second channel, and adding first weighted lines and second weighted lines to obtain downmixed spectral lines in the spectral band, and

wherein the apparatus combiner (400) is configured to convert (840) the downmixed spectral lines to a time domain to obtain time domain samples of the output downmix representation.

135. Apparatus of claim 1412, wherein the calculation of the first weight and the second weight is performed band wise using energies of the first channel and the second channel and a target energy.

1614. Apparatus of claim 1513, wherein the target energy is equal to an energy of a phase-rotated mid-channel or is derived from the energies of the first channel, the second channel and from a correlation value between the first channel and the second channel.

1715. Apparatus of one of claims 14 12 to 1614, wherein calculating the first weight and the second weight comprises, for a spectral band:

calculating (802) an amplitude-related measure for the first channel in the spectral band;

calculating (804) an amplitude-related measure for the second channel in the spectral band:

calculating (806) an amplitude-related measure for a linear combination of the first channel and the second channel in the spectral band;

calculating (808) a cross-correlation measure between the first channel and the second channel in the spectral band; and

calculating (810) the first weight and the second weight using the amplitude-related measure for the first channel, the amplitude-related measure for the second channel, the amplitude-related measure for the linear combination and the cross-correlation measure.

1816. Apparatus of one of the preceding claims, wherein the upmixer (200) is configured to perform the upmixing scheme, the upmixing scheme comprising:

calculating first channel spectral lines for a spectral band of at least the first portion of the input downmix representation or only the portion of the input downmix representation from spectral lines of the spectral band of at least the first portion of

the input downmix representation ~~or only the portion of the input downmix representation~~ using a prediction parameter for the spectral band and residual signal spectral lines for the spectral band and a first calculation rule, wherein the residual signal represents a side signal or a prediction residual signal, and

calculating second channel spectral lines for the spectral band of ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~ from the spectral lines of the spectral band of ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~ using the prediction parameter for the spectral band and the residual signal spectral lines for the spectral band and a second calculation rule,

wherein the first calculation rule is different from the second calculation rule.

17~~9~~. Apparatus of claim 16~~8~~, wherein the first calculation rule comprises one of an addition and a subtraction and the second calculation rule comprises the other one of the addition and the subtraction.

20~~18~~. Multichannel decoder, comprising:

an input interface (100, 120) for providing the~~an~~ input downmix representation and parametric data at least for a second portion of the input downmix representation; and

the apparatus of one of the preceding claims,

wherein the multichannel decoder is configured to upmix, with the upmixer (200), the input downmix representation for ~~at least~~ the first portion of the input downmix representation ~~or only the portion of the input downmix representation~~ in accordance with the upmixing scheme corresponding to the first downmixing scheme to obtain the ~~at least one~~first upmixed portion, and~~/or~~ to upmix (220) the input downmix representation for the second portion and the parametric data using a second upmixing scheme corresponding to the second downmixing scheme to obtain an upmixed second portion, and

wherein thea combiner (400, 420) is configured to combine the at least onefirst upmixed portion and the upmixed second portion to obtain a multichannel output signal.

2119. Multichannel decoder of claim 2018, wherein the input interface (100, 120) comprises:

a the first time-to-spectrum converter (100) for converting generating a first spectral representation of the at least thefirst portion of the input downmix representation or only the portion of the input downmix representation and a second spectral representation of thea second portion of the input downmix representation, the second portion of the input downmix representation comprising spectral values for higher frequencies than at least the first portion of the input downmix representation or only the portion of the input downmix representation of the first spectral representation;

a second time-to-spectrum-converter (120) for generating a spectral representation of a residual signal for the at least thefirst portion of the input downmix representation or only the portion of the input downmix representation, wherein the residual signal represents a side signal or a prediction residual signal,

wherein the upmixer (200) is configured to upmix the first spectral representation using the spectral representation of the residual signal to obtain the at least onefirst upmixed portion in the spectral domain,

wherein the downmixer (300) is configured to downmix the at least onefirst upmixed portion to obtain the first downmixed portion in the spectral domain, and

wherein the combiner (400) comprises thea spectrum-to-time converter for combining the first downmixed portion and the spectral representation of the second portion of the input downmix representation and for converting into the time domain to obtain the output downmix representation.

202. Multichannel decoder of claim 20 18 or 21 19, further comprising:

a second upmixer (220) for upmixing the second portion of the input downmix representation to obtain the upmixed second portion,

wherein, in a multichannel output mode, the combiner (400) is configured to combine a first channel of the ~~at least one~~first upmixed portion and ~~the~~ a first channel of the upmixed second portion and to convert into a time domain to obtain a first channel of a multichannel output,

wherein the multichannel decoder further comprises a second combiner (420) configured to combine, in the multichannel output mode, a second channel of the ~~at least one~~first upmixed portion and a second channel of the upmixed second portion and to convert into the time domain to obtain a second channel of the multichannel output.

~~23~~21. Multichannel decoder of claim ~~21~~19, further comprising:

a second upmixer (220) for upmixing the second portion of the input downmix representation to obtain the upmixed second portion,

wherein, in a multichannel output mode, the combiner (400) is configured to combine a first channel of the ~~at least one~~first upmixed portion and ~~the~~ a first channel of the upmixed second portion and to convert into a time domain to obtain a first channel of a multichannel output,

wherein the multichannel decoder further comprises a second combiner (420) configured to combine, in the multichannel output mode, a second channel of the ~~at least one~~ first upmixed portion and a second channel of the upmixed second portion and to convert into the time domain to obtain a second channel of the multichannel output,

a switch (710) connected between the first time-to-spectrum-converter (100) and the second upmixer (220), and

a controller (700), wherein the controller (700) is configured to control, in a mono-output mode, the switch (710) to connect an output of the first time-to-spectrum-converter (100) to the combiner (400) or to bypass the second upmixer (220) and to

connect an output of the upmixer (200) to an input of the downmixer (300), or to control, in the multichannel output mode, the switch (710) to connect an output of the first time-to-spectrum-converter (100) to an input of the second upmixer (220).

224. Multichannel decoder of one of claims 2220 and , 2321, further comprising a second switch (720) connected between the upmixer (200) and the downmixer (300); and

a controller (700), wherein the controller (700) is configured to control, in the mono-output mode, the second switch (720) to connect an output of the upmixer (200) to an input of the downmixer (300) and to control, in the multichannel output mode, the second switch (720) to connect an output of the upmixer (200) to an input of the second combiner (420) or to bypass the downmixer (300).

235. Method for generating an output downmix representation from an input downmix representation, wherein at least a first portion of the input downmix representation is in accordance with a first downmixing scheme, and wherein a second portion of the input downmix representation is in accordance with a second downmixing scheme, the method comprising:

upmixing the input downmix representation of at least the first portion of the input downmix representation using an upmixing scheme corresponding to the first downmixing scheme to obtain an at least onefirst upmixed portion, wherein the first portion of the input downmix representation is a first frequency band of a spectrum and the second portion of the input downmix representation is a second frequency band of the spectrum; and

downmixing the at least onefirst upmixed portion in accordance with a second downmixing scheme different from the first downmixing scheme to obtain a first downmixed portion representing the output downmix representation for at least the portion of the input downmix representation; and

combining the first downmixed portion and the second portion of the input downmix representation to obtain the output downmix representation comprising a first output representation for the first portion of the input downmix representation and a second output representation for the second portion of the input downmix representation, wherein the first output representation for the first portion of the input downmix

representation and the second output representation for the second portion of the input downmix representation represent the output downmix representation and are based on the second downmixing scheme.

~~26. Method of claim 25, wherein a second portion of the input downmix representation is in accordance with a second downmixing scheme,~~

~~wherein the downmixing comprises downmixing the at least one upmixed portion in accordance with the second downmixing scheme to obtain the first downmixed portion; and~~

~~wherein the method further comprises combining the first downmixed portion and the second portion or a downmixed portion derived from the second portion to obtain the output downmix representation, wherein the output downmix representation for at least the portion of the input downmix representation and the output representation for the second portion are based on the same downmixing scheme.~~

~~27. Method of claim 25 or 26, wherein at least the portion of the input downmix representation is in accordance with the first downmixing scheme relying on a residual signal or on a residual signal and parametric information,~~

~~wherein the upmixing comprises upmixing the input downmix representation of at least the portion of the input downmix representation using an upmixing scheme corresponding to the first downmixing scheme and using the residual signal or the residual signal and the parametric information, respectively to obtain the at least one upmixed portion; and~~

~~wherein the downmixing comprises downmixing the at least one upmixed portion in accordance with the second downmixing scheme different from the first downmixing scheme, wherein the second downmixing scheme is an active downmixing scheme or a fully parametric downmixing scheme to obtain the output downmix representation for at least the portion of the input downmix representation.~~

~~28~~24. Method of multichannel decoding, comprising:

providing the~~an~~ input downmix representation and parametric data at least for a second portion of the input downmix representation;

the method of ~~any one of~~ claim~~s 25 to 27~~23,

wherein the method comprises the upmixing ~~the input downmix representation for at least the portion of the input downmix representation or only~~ the first portion of the input downmix representation in accordance with the upmixing scheme corresponding to the first downmixing scheme to obtain the ~~at least one~~first upmixed portion, and~~/or~~ upmixing the second portion of the input downmix representation and the parametric data using a second upmixing scheme corresponding to the second downmixing scheme to obtain an upmixed second portion, and

combining the ~~at least one~~first upmixed portion and the upmixed second portion to obtain a multichannel output signal.

~~29. Computer program for performing, when running on a computer or a processor, the method of any one of claims 25 to 28.~~

~~30~~25. Apparatus for generating an output downmix representation from an input downmix representation, wherein a first portion of the input downmix representation is in accordance with a first downmixing scheme and a second portion of the input downmix representation is in accordance with ~~the~~ a second downmixing scheme, the apparatus comprising:

an upmixer (200) for upmixing the first portion of the input downmix representation using a first upmixing scheme corresponding to the first downmixing scheme to obtain a first upmixed portion and for upmixing the second portion of the input downmix representation using a second upmixing scheme corresponding to the second downmixing scheme to obtain a second upmixed portion, wherein the first portion of the input downmix representation is a first frequency band of a spectrum and the second portion of the input downmix representation is a second frequency band of the spectrum; and

a downmixer (300) for downmixing the first upmixed portion and the second upmixed portion in accordance with a third downmixing scheme different from the first

downmixing scheme and the second downmixing scheme to obtain the output downmix representation, wherein the output downmix representation for the first portion of the input downmix representation and the output downmix representation for the second portion of the input downmix representation are based on the ~~same~~ third downmixing scheme ~~of the input downmix representation~~.

26. Method for generating an output downmix representation from an input downmix representation, wherein a first portion of the input downmix representation is in accordance with a first downmixing scheme and a second portion of the input downmix representation is in accordance with a second downmixing scheme, the method comprising:

upmixing the first portion of the input downmix representation using a first upmixing scheme corresponding to the first downmixing scheme to obtain a first upmixed portion and upmixing the second portion of the input downmix representation using a second upmixing scheme corresponding to the second downmixing scheme to obtain a second upmixed portion, wherein the first portion of the input downmix representation is a first frequency band of a spectrum and the second portion of the input downmix representation is a second frequency band of the spectrum; and

downmixing the first upmixed portion and the second upmixed portion in accordance with a third downmixing scheme different from the first downmixing scheme and the second downmixing scheme to obtain the output downmix representation, wherein the output downmix representation for the first portion of the input downmix representation and the output downmix representation for the second portion of the input downmix representation are based on the third downmixing scheme.

27. Computer program for performing, when running on a computer or a processor, the method of claim 23, 24, or 26.