Claims

1. Downmixer for downmixing a multi-channel signal having at least two channels, wherein the multi-channel signal is a multi-channel audio signal, comprising:

a weighting value estimator for estimating band-wise weighting values for the at least two channels;

a spectral weighter for weighting spectral domain representations of the at least two channels using the band-wise weighting values, wherein each band of a first and a second channel of the plurality of at least two channels has a plurality of spectral values, and wherein the spectral weighter is configured to apply a same weight to each spectral value in the band of one of the at least two channels, and to apply another weight to each spectral value in the band of another channel of the at least two channels;

a converter for converting weighted spectral domain representations of the at least two channels into time representations of the at least two channels; and

a mixer for mixing the time representations of the at least two channels to obtain a downmix signal.

2. Downmixer of claim 1, wherein the weighting value estimator is configured to calculate a plurality of first band-wise weighting values for a plurality of bands of a first channel of the at least two channels and to calculate a second plurality of band-wise weighting values for the plurality of bands of a second channel of the at least two channels, or

wherein the multi-channel signal has more than two channels and wherein the weighting value estimator is configured to calculate a plurality of first band-wise weighting values for a plurality of bands of a first channel of the more than two channels, to calculate a second plurality of band-wise weighting values for the plurality of bands of a second channel of the more than two channels and to calculate a further plurality of band-wise weighting values for the plurality of bands of a further channel of the more than two channels.

3. Downmixer of claim 1 or 2,

wherein the spectral domain representations of the at least two channels each comprise a set of frequency bins, where spectral values are associated with the frequency bins,

wherein the weighting value estimator is configured to calculate the band-wise weighting values for bands, wherein each band comprises one, two or more frequency bins, or

wherein a number of frequency bins per band increases with bands having a higher center frequency.

4. Downmixer of one of the preceding claims,

wherein the weighting value estimator is configured to calculate the band-wise weighting values based on a target energy value per band, so that an energy in the band of the downmix signal is in a predetermined relation to energies in the same bands of the at least two channels.

5. Downmixer of one of the preceding claims, further comprising:

a core decoder for decoding an encoded signal, the encoded signal having encoded spectral domain representations of at least two original channels, wherein the core decoder is configured to generate the spectral domain representations from the encoded spectral domain representations.

6. Downmixer of the one the preceding claims,

wherein the spectral domain representations are either purely real or purely imaginary,

wherein the weighting value estimator is configured to estimate an imaginary spectral domain representation when the spectral domain representation is purely real, or to estimate a real spectral domain representation when the spectral domain representation is purely imaginary, and

wherein the weighting value estimator is configured to estimate the band-wise weighting values using the estimated imaginary spectral domain representation or the estimated real spectral domain representation.

7. Downmixer of one of the preceding claims, wherein the weighting value estimator is configured to calculate a first weighting value for a band of a first channel of the at least two channels,

wherein the weighting value estimator is configured to calculate a second weighting value for the band of a second channel of the at least two channels, and

wherein the weighting value estimator is configured to calculate the first weighting value and the second weighting value using an energy of the first channel in the band, an energy of the second channel in the band, and a mixed term depending on a product or a linear combination of spectral values from the at least two channels in the band.

8. Downmixer of ~~one of the preceding~~ claim~~s~~ 7,

wherein the weighting value estimator is configured to calculate, as the mixed term ~~representing~~ depending on the linear combination, a square root of an energy of spectral values added to each other in the band from the spectral domain representations of the at least two channels, wherein the band comprises a plurality of spectral values, or to calculate, as the mixed term ~~representing~~ depending on the product, an absolute value of a complex dot product between the spectral values in the band of ~~a~~ the first channel and the spectral values in the band of ~~a~~ the second channel of the at least two channels.

~~9. Downmixer of one of the preceding claims,~~

~~wherein each band of a first and a second channel of the plurality of at least two channels has a plurality of spectral values, wherein the spectral weighter is configured to apply the same weight to each spectral value in the band of one of the at least two channels, and to apply another weight to each spectral value in the band of another channel of the at least two channels.~~

~~10~~9. Downmixer of one of the preceding claims,

wherein the weighted spectral domain representations are MDCT (modified discrete cosine transform) spectra, and

wherein the converter is configured to perform, for each channel of the plurality of channels, an inverse MDCT transform using a synthesis windowing operation and an overlap-add operation.

~~11~~10. Downmixer of one of the preceding claims,

wherein the mixer is configured to apply a sample-by-sample addition of the time representations of the at least two channels, or

wherein the mixer is configured to apply a sample-by-sample addition of the time representations of the at least two channels and a scaling operation applied to a result of the sample-by-sample addition or applied to inputs into the sample-by-sample addition.

~~12~~11. Downmixer of one of the preceding claims,

wherein the converter is configured to generate raw time representations using a spectrum-time algorithm, and

to post process the raw time representations individually, in signal processing direction before the mixing by the mixer, using separate control information for the channels to obtain the time representations.

~~13~~12. Downmixer of claim ~~12~~11,

wherein the converter is configured to perform, as the post processing, a bass post-filtering, a TCX-LTP (Transform Coded Excitation Long Term Prediction) processing or an LPC (Linear Prediction Coding) synthesis individually for each time representation.

~~14~~13. Downmixer of one of the preceding claims,

wherein a first spectral domain representation of a first channel of the at least two channels has a first time or frequency resolution,

wherein a second spectral domain representation of a second channel of the at least two channels has a second time or frequency resolution, wherein the second time or frequency resolution is different from the first time or frequency resolution, and

wherein the weighting value estimator is configured to calculate the band-wise weighting values so that a frequency resolution of the bands associated with the band-wise weighting values is lower than the first frequency resolution and the second frequency resolution or is equal to the lower one of the first and the second frequency resolution.

~~15~~14. Downmixer of one of the preceding claims,

wherein the first spectral domain representation has a first plurality of spectral values in a band,

wherein the second spectral domain representation has a second plurality of spectral values in the band, the second plurality being higher than the first plurality, and

wherein the weighting value estimator is configured

to combine two or more spectral values of the second plurality of spectral values or to select, from the second plurality of spectral values, a subset of spectral values,

to calculate a mixed term depending on products or linear combinations of spectral values from the at least two channels in the band using a result of combining the two or more spectral values or using the subset of spectral values, and

to calculate the band-wise weighting values using the mixed term.

~~16~~15. Downmixer in accordance with one of the preceding claims,

wherein a first spectral domain representation comprises a plurality of first spectral values representing a first time bin size and a first frequency bin size,

wherein the second spectral domain representation comprises a plurality of spectral values representing a second time bin size and a second frequency bin size,

wherein the first time bin size is greater than the second time bin size, or wherein the first frequency bin size is lower than the second frequency bin size,

wherein the weighting value estimator is configured to combine a plurality of spectral values from the first spectral domain representation to obtain a first combined spectral domain representation in which a combined frequency bin size is equal to the second frequency bin size, or to combine a plurality of spectral values from the second spectral domain representation to obtain a first combined spectral domain representation in which a combined time bin size is equal to the first time bin size.

~~17~~16. Downmixer of claim ~~16~~15,

wherein the weighting value estimator is configured to use the first combined spectral domain representation or the second combined spectral domain representation for the ~~calculation of~~estimating the band-wise weighting values for a first channel of the at least two channels and a second channel of the at least two channels, the ~~calculation~~ estimating comprising a calculation of a mixed term in bands and a calculation of energies in the bands, and

wherein the spectral weighter is configured to apply the band-wise weighting values for the first channel of the at least two channels to spectral values of the first spectral domain representation in corresponding bands and to apply the band-wise weighting values for the second channel of the at least two channels to spectral values of the second spectral domain representation in the corresponding bands.

~~18~~17. Downmixer in accordance with one of the claims 1 to ~~15~~14,

wherein a first spectral domain representation of a first channel comprises a plurality of first spectral values representing a first time bin size and a first frequency bin size,

wherein a second spectral domain representation of a second channel comprises at least two subframes, wherein each subframe comprises a plurality of spectral values representing a second time bin size and a second frequency bin size,

wherein the first time bin size is greater than the second time bin size, or wherein the first frequency bin size is lower than the second frequency bin size,

wherein the weighting value estimator is configured

to combine spectral values belonging to the same frequency bin from each subframe of the second spectral domain representation in a first manner to obtain a first group of combined spectral values, and

to combine spectral values belonging to the same frequency bin from each subframe of the second spectral domain representation in a second manner to obtain a second group of combined spectral values, the second manner being different from the first manner,

wherein the first group of combined spectral values and the second group of combined spectral values represent a combined spectral domain representation having the first time bin size and the first frequency bin size, and

to use the spectral values of the combined spectral domain representation and the first spectral domain representation for the ~~calculation of~~estimating the band-wise weighting values.

~~19~~18. Downmixer in accordance with claim ~~18~~17,

wherein the weighting value estimator is configured to perform one of an addition and a subtraction in the first manner and the other of the addition and the subtraction in the second manner.

~~20~~19. Downmixer in accordance with claim ~~18 17~~ or ~~19~~18, wherein the weighting value estimator is configured to perform an average function in the first manner and in the second manner.

~~21~~20. Downmixer in accordance with one of claims ~~18 17~~ to ~~20~~19, wherein the weighting value estimator is configured to apply either the first manner or the second manner comprising a weighting using a weighting sign, wherein the weighting value estimator is configured to set the weighting sign in accordance with a frequency bin number of the same frequency bin.

21. Downmixer in accordance with one of claims ~~18 17~~ to ~~21~~20, wherein the weighting value estimator is configured to apply, as the first manner, one of a high pass filtering and a low pass filtering, and as the second manner, the other one of a high pass filtering and a low pass filtering.

22. Downmixer in accordance with one of claims ~~18 17~~ to ~~22~~21, wherein the weighting value estimator is configured to transform a lower resolution bin into two higher resolution bins, wherein the first manner is used for an even bin number of a first higher resolution bin of the two higher resolution bins and the second manner is used for an odd bin number of a second higher resolution bin of the two higher resolution bins.

23. Downmixer in accordance with one of claims ~~18 17~~ to 22,

wherein the first spectral domain representation of the first channel comprises a TCX20 frame, wherein the second spectral domain representation of the second channel comprises two TCX10

subframes, wherein the weighting value estimator is configured to calculate a combined TCX20 spectral domain representation from the two TCX10 subframes, or

wherein the first spectral domain representation of the first channel comprises a TCX20 frame, wherein the second spectral domain representation of the second channel comprises a TCX10 subframe and two TCX5 subframes, wherein the weighting value estimator is configured to calculate a first combined TCX10 spectral domain representation from the two TCX5 subframes and to calculate a second combined TCX20 subframe from the first combined TCX10 spectral domain representation and the TCX10 subframe, or

wherein the first spectral domain representation of the first channel comprises a TCX10 subframe, wherein the second spectral domain representation of the second channel comprises two TCX5 subframes, and wherein the weighting value estimator is configured to calculate a combined TCX10 spectral domain representation from the two TCX5 subframes,

wherein the expression TCX20 indicates a first portion with a first time length, wherein the expression TCX10 indicates a second portion with a second time length, and wherein the expression TCX5 indicates a third portion with a third time length, wherein the first time length is longer than the second time length or the third time length, or wherein the second time length is shorter than the first time length or longer than the second time length, and wherein the third time length is shorter than the first time length or shorter than the second time length.

24. Downmixer in accordance with one of claims ~~18~~ 17 to 23, wherein the weighting value estimator is configured to apply the first manner based on the following equation:

$MDCT_{2i,k0} = \frac{1}{2}\left(MDCT_{i,k1} + (-1)^i MDCT_{i,k0}\right)$, or

wherein the weighting value estimator is configured to apply the second manner based on the following equation:

$MDCT_{2i+1,k0} = \frac{1}{2}\left(MDCT_{i,k1} - (-1)^i MDCT_{i,k0}\right)$,

wherein i specifies a spectral bin number and $k0$ and $k1$ specify subframes of the second spectral domain representation of the second channel, and

wherein $MDCT_{2i,k0}$ and $MDCT_{2i+1,k0}$ indicate spectral values of the combined spectral domain representation and $MDCT_{i,k1}$ and $MDCT_{i,k0}$ indicate spectral values from a second subframe k_1 and a first subframe k_0, respectively.

25. Downmixer in accordance with claim 1,

wherein a first spectral domain representation of a first channel of the at least two channels has a first time resolution or a first frequency resolution, wherein a second spectral domain representation of a second channel of the at least two channels has a second time resolution or a second frequency resolution, wherein the second time resolution is different from the first time resolution or wherein the second frequency resolution is different from the first frequency resolution, and

wherein the weighting value estimator is configured to convert the first spectral domain representation into a combined spectral domain representation having the second time resolution or the second frequency resolution, and to calculate the band-wise weighting values using the combined spectral domain representation and the second spectral domain representation, or to convert the second spectral domain representation into a combined spectral domain representation having the first time resolution or the first frequency resolution, and to calculate the band-wise weighting values using the combined spectral domain representation and the first spectral domain representation, or

wherein a first spectral domain representation of a first channel of the at least two channels has a first time resolution or a first frequency resolution, wherein a second spectral domain representation of a second channel of the at least two channels has a second time resolution or a second frequency resolution, wherein the second time resolution is different from the first time resolution or wherein the second frequency resolution is different from the first frequency resolution and

wherein the weighting value estimator is configured

to convert the first spectral domain representation into a first combined spectral domain representation having a third time resolution or a third frequency resolution,

wherein the third time resolution is different from the first time resolution or the second time resolution and wherein the third frequency resolution is different from the first frequency resolution or the second frequency resolution,

to convert the second spectral domain representation into a second combined spectral domain representation having the third time resolution or the third frequency resolution, and

to calculate the band-wise weighting values using the first combined spectral domain representation and the second combined spectral domain representation.

26. Downmixer in accordance with claim 25,

wherein the second channel comprises, for a specific time portion (TCX20), the second spectral domain representation,

wherein the first channel comprises, for the specific time portion (2xTCX10), two or more of the first spectral domain representations,

wherein the weighting value estimator is configured to convert the two or more first spectral domain representations into the combined spectral domain representation having the same time and frequency resolution as the second spectral domain representation, and to calculate the band-wise weighting values using the combined spectral domain representation and the second spectral domain representation, and

wherein the spectral weighter is configured to weight the second spectral domain representation using the band-wise weighting values, and to weight each first spectral domain representation of the two or more first spectral domain representations using the same band-wise weighting values.

27. Downmixer in accordance with claim 26,

wherein the weighting value estimator is configured, for adding spectral values for a same frequency of the two or more first spectral domain representations to obtain a first spectral value of the combined spectral domain representation, and for subtracting spectral values for a same frequency of the two or more first spectral domain representations to obtain a second spectral value of the combined spectral domain representation being higher and adjacent in frequency to the first spectral value of the combined spectral domain representation, and

wherein the spectral weighter is configured to weight a band having same frequencies in each first spectral domain representation of the two or more first spectral domain representations using the same band-wise weighting value.

28. Downmixer in accordance with claim 25,

wherein the second channel comprises, for a specific time portion (TCX20), the second spectral domain representation,

wherein the first channel comprises, for the specific time portion (2xTCX10), two or more first spectral domain representations,

wherein the weighting value estimator is configured

to convert the second spectral domain representation into two or more combined spectral domain representations having the same time and frequency resolution as the two or more first spectral domain representations,

to calculate first band-wise weighting values using a first combined spectral domain representation of the two or more combined spectral domain representations and a first first spectral domain representation of the two or more first spectral domain representations,

to calculate second band-wise weighting values using a second combined spectral domain representation of the two or more combined spectral domain representations and a second first spectral domain representation of the two or more first spectral domain representations, and

wherein the spectral weighter is configured

to weight the second spectral domain representation using derived band-wise weighting values derived from the first and second band-wise weighting values,

to weight the first first spectral domain representation of the two or more first spectral domain representations using the first band-wise weighting values and

to weight the second first spectral domain representation of the two or more first spectral domain representations using the second band-wise weighting values.

29. Downmixer in accordance with claim 28,

wherein the weighting value estimator is configured, for adding spectral values for pairs of frequencies of the second spectral domain representation to obtain an added spectral value and for copying to added spectral value to obtain a combined spectral value for each of the two or more combined spectral domain representations, and

wherein the spectral weighter is configured to combine a weighting value for a specific band of the first band-wise weighting values with a weighting value for the specific band of the second band-wise weighting values to obtain a derived weighting value for the specific band of the derived band-wise weighting values.

30. Downmixer in accordance with claim 25,

wherein the second channel comprises, for a specific time portion (TCX20), the second spectral domain representation,

wherein the first channel comprises, for the specific time portion (2xTCX10), two or more first spectral domain representations,

wherein the weighting value estimator is configured

to convert the second spectral domain representation into two or more combined spectral domain representations having the same time resolution as the two or more first spectral domain representations, and having the same frequency resolution as the second spectral domain representation,

to calculate first band-wise weighting values using a first combined spectral domain representation of the two or more combined spectral domain representations and a first first spectral domain representation of the two or more first spectral domain representations,

to calculate second band-wise weighting values using a second combined spectral domain representation of the two or more combined spectral domain representations and

a second first spectral domain representation of the two or more first spectral domain representations, and

wherein the spectral weighter is configured

to weight the second spectral domain representation using band-wise weighting values derived from the first and second band-wise weighting values,

to weight the first first spectral domain representation of the two or more first spectral domain representations using the first band-wise weighting values, and

to weight the second first spectral domain representation of the two or more first spectral domain representations using the second band-wise weighting values.

31. Downmixer in accordance with claim 30,

wherein the weighting value estimator is configured for upsampling one or more spectral values to obtain a upsampled spectral values for adjacent frequencies of the second spectral domain representation and for copying to upsampled spectral values to obtain combined spectral values for each of the two or more combined spectral domain representations, and

wherein the spectral weighter is configured to combine a weighting value for a specific band of the first band-wise weighting values with a weighting value for the specific band of the second band-wise weighting values to obtain a derived weighting value for the specific band of the derived band-wise weighting values.

32. Downmixer in accordance with claim 25,

wherein the second channel comprises, for a specific time portion (TCX20), the second spectral domain representation,

wherein the first channel comprises, for the specific time portion (2xTCX10), two or more of the first spectral domain representations,

wherein the weighting value estimator is configured

to convert the two or more first spectral domain representations into the first combined spectral domain representation having the same time resolution as the second spectral domain representation,

to convert the second spectral domain representations into the second combined spectral domain representation having the same frequency resolution as the two or more first spectral domain representation, and

to calculate the band-wise weighting values using the first combined spectral domain representation and the second combined spectral domain representation, and

wherein the spectral weighter is configured to weight the second spectral domain representation using the band-wise weighting values, and to weight each first spectral domain representation of the two or more first spectral domain representations using the same band-wise weighting values.

33. Downmixer in accordance with claim 32,

wherein the weighting value estimator is configured for adding spectral values for pairs of frequencies of the second spectral domain representation to obtain the second combined spectral domain representation, and for adding spectral values of the same frequency of the two or more of the first spectral domain representations to obtain the first combined spectral domain representation, and

wherein the spectral weighter is configured to weight a band having same frequencies in each first spectral domain representation of the two or more first spectral domain representations using the same band-wise weighting value.

34. Downmixer in accordance with one of the preceding claims,

wherein the weighting value estimator is configured to calculate a plurality of first band-wise weighting values for a plurality of bands of a first channel of the at least two channels using a first calculation rule depending on at least two of spectral values of a first spectral domain representation of the first channel, spectral values of a second spectral domain representation of the second channel, spectral values of a single combined spectral domain representation derived from the spectral values of the first spectral domain representation or the second spectral domain representation, spectral values of a first combined spectral domain representation derived from the

spectral values of the first spectral domain representation, and spectral values of a second combined spectral domain representation derived from the spectral values of the second spectral domain representation, and

wherein the weighting value estimator is configured to calculate a plurality of second band-wise weighting values for a plurality of bands of the first channel of the at least two channels using a second calculation rule depending on at least two of the plurality of first band-wise weighting values, the spectral values of the first spectral domain representation of the first channel, the spectral values of the second spectral domain representation of the second channel, the spectral values of the single combined spectral domain representation derived from the spectral values of the first spectral domain representation or the second spectral domain representation, the spectral values of a first combined spectral domain representation derived from the spectral values of the first spectral domain representation, and the spectral values of a second combined spectral domain representation derived from the spectral values of the second spectral domain representation, wherein the second calculation rule is different from the first calculation rule.

35. Downmixer for downmixing a multi-channel signal having at least two channels, wherein the multi-channel signal is an audio signal, comprising:

a weighting value estimator for estimating band-wise weighting values for the at least two channels, wherein the weighting value estimator is configured to calculate the band-wise weighting values based on a target energy value per band, so that an energy in the band of a downmix signal is in a predetermined relation to energies in the same bands of the at least two channels;

a spectral weighter for weighting spectral domain representations of the at least two channels using the band-wise weighting values to obtain weighted spectral domain representations, wherein each band of a first and a second channel of the at least two channels has a plurality of spectral values, wherein the spectral weighter is configured to apply the same weight to each spectral value in the band of one of the at least two channels, and to apply another weight to each spectral value in the band of another channel of the at least two channels; and

a mixer for calculating the downmix signal using the weighted spectral domain representations of the at least two channels.

36. Downmixer of the claim 35,

wherein the spectral domain representations are either purely real or purely imaginary,

wherein the weighting value estimator is configured to estimate an imaginary spectral domain representation when the spectral domain representation is purely real, or to estimate a real spectral domain representation when the spectral domain representation is purely imaginary, and

wherein the weighting value estimator is configured to estimate the band-wise weighting values using the estimated imaginary spectral domain representation or the estimated real spectral domain representation.

37. Downmixer of one of the claims 35 or 36, wherein the weighting value estimator is configured to calculate a first weighting value for a band of a first channel of the at least two channels, to calculate a second weighting value for the band of a second channel of the at least two channels, and to calculate the first weighting value and the second weighting value using an energy of the first channel in the band, an energy of the second channel in the band, and a mixed term depending on a product or a linear combination of spectral values from the at least two channels in the band.

38. Downmixer of one of the claims 35 to 37,

wherein the weighting value estimator is configured to calculate, as the mixed term representing the linear combination, a square root of an energy of spectral values added to each other in the band from the spectral domain representations of the at least two channels, wherein the band comprises a plurality of spectral values, or to calculate, as the mixed term representing the product, an absolute value of a complex dot product between the spectral values in the band of a first channel and the spectral values in the band of a second channel of the at least two channels.

~~39. Downmixer of one of the claims 35 to 38,~~

~~wherein each band of a first and a second channel of the at least two channels has a plurality of spectral values, wherein the spectral weighter is configured to apply the same weight to each spectral value in the band of one of the at least two channels, and to apply another weight to each spectral value in the band of another channel of the at least two channels.~~

~~40~~39. Downmixer of one of the claims 35 to ~~39~~38, wherein the weighting value estimator is configured to calculate the band-wise weighting values for a first channel of the at least two channels based on the following equation:

$$w_R = \frac{1}{2\sqrt{2}} \frac{\sqrt{|L|^2 + |R|^2 + 2|\langle L, R\rangle|}}{|L| + |R|}$$

wherein w_R is a weighting factor for the first channel for a band, wherein $|L|^2$ is an estimated power for the second channel, wherein $|R|^2$ is an estimated power for the first channel in the band, wherein $2|\langle L, R\rangle|$ is an estimated dot product between the channels in the band, wherein $|L|$ is an estimated amplitude for the second channel in the band, wherein $|R|$ is an estimated amplitude for the first channel in the band.

~~41~~40. Downmixer of claim ~~40~~39, wherein the weighting value estimator is configured to calculate the band-wise weighting values for a second channel of the at least two channels based on the following equation:

$$w_L = w_R + 1 - \frac{|L + R|}{|L| + |R|},$$

wherein w_L is a weighting factor for the second channel for the band, and wherein $|L + R|$ is an estimated linear combination of the estimated amplitudes for the first channel and the second channel in the band.

~~42~~41. Downmixer of one of claims ~~39~~ 35 to ~~41~~40, wherein the weighting value estimator is configured to calculate the estimated amplitude for the second channel in the band, and to calculate the estimated amplitude for the first channel in the band based on the following equations:

$|L| = \sqrt{\sum_{i\ in\ b}(MDCT_{i,l}{}^2 + MDST_{i,l}{}^2)}$, $|R| = \sqrt{\sum_{i\ in\ b}(MDCT_{i,r}{}^2 + MDST_{i,r}{}^2)}$, or

wherein the weighting value estimator is configured to calculate the estimated linear combination of the estimated amplitudes for the first channel and the second channel in the band based on the following equation:

$$|L+R| = \sqrt{|L|^2 + |R|^2 + 2\left(\sum_{i\ in\ b}(MDCT_{i,l}MDCT_{i,r} + MDST_{i,l}MDST_{i,r})\right)^2}, \text{ or}$$

wherein the weighting value estimator is configured to calculate the estimated dot product between the channels in the band based on the following equation:

$$|\langle L,R\rangle| = \sqrt{\left(\sum_{i\ in\ b}(MDCT_{i,l}MDCT_{i,r} + MDST_{i,l}MDST_{i,r})\right)^2 + \left(\sum_{i\ in\ b}(MDST_{i,l}MDCT_{i,r} - MDCT_{i,l}MDST_{i,r})\right)^2}, \text{ or}$$

wherein the weighting value estimator is configured to calculate the estimated power for the second channel in the band or the estimated power for the first channel in the band based on the following equation:

$$|L|^2 = \sum_{i\ in\ b}({MDCT_{i,l}}^2 + {MDST_{i,l}}^2), \qquad |R|^2 = \sum_{i\ in\ b}({MDCT_{i,r}}^2 + {MDST_{i,r}}^2)$$

wherein i specifies the bin number inside spectral band b, and wherein $MDST_i$ represents an estimated imaginary part of an MDCT bin i, wherein $MDCT_i$ represents the real part of the MDCT bin i included in the spectral domain representation of the first or the second channel, wherein r represents the first channel, and wherein l represents the second channel.

4342. Downmixer of one of the claims 35 to 4241,

wherein a first spectral domain representation of a first channel of the at least two channels has a first time resolution or a first frequency resolution, wherein a second spectral domain representation of a second channel of the at least two channels has a second time resolution or a second frequency resolution, wherein the second time resolution is different from the first time resolution and wherein the second frequency resolution is different from the first frequency resolution, and

wherein the weighting value estimator is configured to convert the first spectral domain representation into a combined spectral domain representation having the second time resolution or the second frequency resolution, and to calculate the band-wise weighting values using the combined

spectral domain representation and the second spectral domain representation, or to convert the second spectral domain representation into a combined spectral domain representation having the first time resolution or the first frequency resolution, and to calculate the band-wise weighting values using the combined spectral domain representation and the first spectral domain representation, or

wherein a first spectral domain representation of a first channel of the at least two channels has a first time resolution or a first frequency resolution, wherein a second spectral domain representation of a second channel of the at least two channels has a second time resolution or a second frequency resolution, wherein the second time resolution is different from the first time resolution and wherein the second frequency resolution is different from the first frequency resolution, and

wherein the weighting value estimator is configured

to convert the first spectral domain representation into a first combined spectral domain representation having a third time resolution or a third frequency resolution,

wherein the third time resolution is different from the first time resolution or the second time resolution and wherein the third frequency resolution is different from the first frequency resolution or the second frequency resolution,

to convert the second spectral domain representation into a second combined spectral domain representation having the third time resolution or the third frequency resolution, and

to calculate the band-wise weighting values using the first combined spectral domain representation and the second combined spectral domain representation.

4443. Downmixer of claim 4342, wherein the spectral weighter is configured for weighting, as the spectral domain representations of the at least two channels, one of the combined spectral domain representation and the second spectral domain representation, the combined spectral domain representation and the first spectral domain representation, and the first combined spectral domain representation and the second combined spectral domain representation to obtain a first weighted spectral domain representation and a second weighted spectral domain representation.

4544. Downmixer of claim 4443, wherein the mixer is configured for adding the first and second weighted spectral domain representations to obtain a spectral domain downmix representation and for converting the spectral domain downmix representation in the time domain to obtain the downmix signal or for converting the first and second weighted spectral domain representations into the time domain to obtain time representations of the at least two channels and for adding the time representations of the at least two channels to obtain the downmix signal.

4645. Method for downmixing a multi-channel signal having at least two channels, wherein the multi-channel signal is an audio signal, comprising:

estimating band-wise weighting values for the at least two channels;

weighting spectral domain representations of the at least two channels using the band-wise weighting values, wherein each band of a first and a second channel of the plurality of at least two channels has a plurality of spectral values, and wherein the weighting comprises applying the same weight to each spectral value in the band of one of the at least two channels, and applying another weight to each spectral value in the band of another channel of the at least two channels;

converting weighted spectral domain representations of the at least two channels into time representations of the at least two channels; and

mixing the time representations of the at least two channels to obtain a downmix signal.

4746. Method of downmixing a multi-channel signal having at least two channels, wherein the multi-channel signal is an audio signal, comprising:

estimating band-wise weighting values for the at least two channels, comprising calculating the band-wise weighting values based on a target energy value per band, so that an energy in the band of a downmix signal is in a predetermined relation to energies in the same bands of the at least two channels, wherein each band of a first and a second channel of the plurality of at least two channels has a plurality of spectral values, and wherein the weighting comprises applying the same weight to each spectral value in the band of one of the at least two channels, and applying another weight to each spectral value in the band of another channel of the at least two channels;

weighting spectral domain representations of the at least two channels using the band-wise weighting values to obtain weighted spectral domain representations; and

calculating the downmix signal using the weighted spectral domain representations of the at least two channels.

~~48~~47. Computer program for performing, when running a computer or processor, the method of claim ~~46~~ 45 or ~~47~~46.