Claims

1. An apparatus for encoding a first channel and a second channel of an audio input signal comprising two or more channels to obtain an encoded audio signal, wherein the apparatus comprises:

a normalizer configured to determine a normalization value for the audio input signal depending on the first channel of the audio input signal and depending on the second channel of the audio input signal, wherein the normalizer is configured to determine a first channel and a second channel of a normalized audio signal by normalizing, depending on the normalization value, at least one of the first channel and the second channel of the audio input signal,

an encoding unit being configured to generate a processed audio signal having a first channel and a second channel, such that one or more spectral bands of the first channel of the processed audio signal are one or more spectral bands of the first channel of the normalized audio signal, such that one or more spectral bands of the second channel of the processed audio signal are one or more spectral bands of the second channel of the normalized audio signal, such that at least one spectral band of the first channel of the processed audio signal is a spectral band of a mid signal depending on a spectral band of the first channel of the normalized audio signal and depending on a spectral band of the second channel of the normalized audio signal, and such that at least one spectral band of the second channel of the processed audio signal is a spectral band of a side signal depending on a spectral band of the first channel of the normalized audio signal and depending on a spectral band of the second channel of the normalized audio signal, wherein the encoding unit is configured to encode the processed audio signal to obtain the encoded audio signal.

2. An apparatus according to claim 1,

wherein the encoding unit is configured to choose between a full-mid-side encoding mode and a full-dual-mono encoding mode and a band-wise encoding mode depending on a plurality of spectral bands of a first channel of the normalized audio signal and depending on a plurality of spectral bands of a second channel of the normalized audio signal,

wherein the encoding unit is configured, if the full-mid-side encoding mode is chosen, to generate a mid signal from the first channel and from the second channel of the normalized audio signal as a first channel of a mid-side signal, to generate a side signal from the first channel and from the second channel of the normalized audio signal as a second channel of the mid-side signal, and to encode the mid-side signal to obtain the encoded audio signal,

wherein the encoding unit is configured, if the full-dual-mono encoding mode is chosen, to encode the normalized audio signal to obtain the encoded audio signal, and

wherein the encoding unit is configured, if the band-wise encoding mode is chosen, to generate the processed audio signal, such that one or more spectral bands of the first channel of the processed audio signal are one or more spectral bands of the first channel of the normalized audio signal, such that one or more spectral bands of the second channel of the processed audio signal are one or more spectral bands of the second channel of the normalized audio signal, such that at least one spectral band of the first channel of the processed audio signal is a spectral band of a mid signal depending on a spectral band of the first channel of the normalized audio signal and depending on a spectral band of the second channel of the normalized audio signal, and such that at least one spectral band of the second channel of the processed audio signal is a spectral band of a side signal depending on a spectral band of the first channel of the normalized audio signal and depending on a spectral band of the second channel of the normalized audio signal, wherein the encoding unit is configured to encode the processed audio signal to obtain the encoded audio signal.

3. An apparatus according to claim 2,

wherein the encoding unit is configured, if the band-wise encoding mode is chosen, to decide for each spectral band of a plurality of spectral bands of the processed audio signal, whether mid-side encoding is employed or whether dual-mono encoding is employed,

wherein, if the mid-side encoding is employed for said spectral band, the encoding unit is configured to generate said spectral band of the first channel of the processed audio signal as a spectral band of a mid signal based on said spectral band of the first channel of the normalized audio signal and based on said spectral

band of the second channel of the normalized audio signal, and the encoding unit is configured to generate said spectral band of the second channel of the processed audio signal as a spectral band of a side signal based on said spectral band of the first channel of the normalized audio signal and based on said spectral band of the second channel of the normalized audio signal, and

wherein, if the dual-mono encoding is employed for said spectral band,

the encoding unit is configured to use said spectral band of the first channel of the normalized audio signal as said spectral band of the first channel of the processed audio signal, and is configured to use said spectral band of the second channel of the normalized audio signal as said spectral band of the second channel of the processed audio signal, or

the encoding unit is configured to use said spectral band of the second channel of the normalized audio signal as said spectral band of the first channel of the processed audio signal, and is configured to use said spectral band of the first channel of the normalized audio signal as said spectral band of the second channel of the processed audio signal.

4. An apparatus according to claim 2 or 3, wherein the encoding unit is configured to choose between the full-mid-side encoding mode and the full-dual-mono encoding mode and the band-wise encoding mode by determining a first estimation estimating a first number of bits that are needed for encoding when the full-mid-side encoding mode is employed, by determining a second estimation estimating a second number of bits that are needed for encoding when the full-dual-mono encoding mode is employed, by determining a third estimation estimating a third number of bits that are needed for encoding when the band-wise encoding mode is employed, and by choosing that encoding mode among the full-mid-side encoding mode and the full-dual-mono encoding mode and the band-wise encoding mode that has a smallest number of bits among the first estimation and the second estimation and the third estimation.

5. An apparatus according to claim 4,

wherein the encoding unit is configured to estimate the third estimation b_{BW}, estimating the third number of bits that are needed for encoding when the band-wise encoding mode is employed, according to the formula:

$$b_{BW} = nBands + \sum_{i=0}^{nBands-1} \min\left(b_{bwLR}^{i}, b_{bwMS}^{i}\right) \quad ,$$

wherein $nBands$ is a number of spectral bands of the normalized audio signal,

wherein b_{bwMS}^{i} is an estimation for a number of bits that are needed for encoding an i-th spectral band of the mid signal and for encoding the i-th spectral band of the side signal, and

wherein b_{bwLR}^{i} is an estimation for a number of bits that are needed for encoding an i-th spectral band of the first signal and for encoding the i-th spectral band of the second signal.

6. An apparatus according to claim 2 or 3, wherein the encoding unit is configured to choose between the full-mid-side encoding mode and the full-dual-mono encoding mode and the band-wise encoding mode by determining a first estimation estimating a first number of bits that are saved when encoding in the full-mid-side encoding mode, by determining a second estimation estimating a second number of bits that are saved when encoding in the full-dual-mono encoding mode, by determining a third estimation estimating a third number of bits that are saved when encoding in the band-wise encoding mode, and by choosing that encoding mode among the full-mid-side encoding mode and the full-dual-mono encoding mode and the band-wise encoding mode that has a greatest number of bits that are saved among the first estimation and the second estimation and the third estimation.

7. An apparatus according to claim 2 or 3, wherein the encoding unit is configured to choose between the full-mid-side encoding mode and the full-dual-mono encoding mode and the band-wise encoding mode by estimating a first signal-to-noise ratio that occurs when the full-mid-side encoding mode is employed, by estimating a second signal-to-noise ratio that occurs when the full-dual-mono encoding mode is employed, by estimating a third signal-to-noise ratio that occurs when the band-wise encoding mode is employed, and by choosing that encoding mode among the full-mid-side encoding mode and the full-dual-mono encoding mode and the band-

wise encoding mode that has a greatest signal-to-noise-ratio among the first signal-to-noise-ratio and the second signal-to-noise-ratio and the third signal-to-noise-ratio.

8. An apparatus according to claim 1,

wherein the encoding unit is configured to generate the processed audio signal, such that said at least one spectral band of the first channel of the processed audio signal is said spectral band of said mid signal, and such that said at least one spectral band of the second channel of the processed audio signal is said spectral band of said side signal,

wherein, to obtain the encoded audio signal, the encoding unit is configured to encode said spectral band of said side signal by determining a correction factor for said spectral band of said side signal,

wherein the encoding unit is configured to determine said correction factor for said spectral band of said side signal depending on a residual and depending on a spectral band of a previous mid signal, which corresponds to said spectral band of said mid signal, wherein the previous mid signal precedes said mid signal in time,

wherein the encoding unit is configured to determine the residual which indicates a difference of said spectral band of said side signal and a product of said spectral band of said mid signal and a coefficient.

9. An apparatus according to claim 8,

wherein the encoding unit is configured to determine said correction factor for said spectral band of said side signal according to the formula

$$correction_factor_{fb} = ERes_{fb}/(EprevDmx_{fb} + \varepsilon)$$

wherein $correction_factor_{fb} = ERes_{fb}/(EprevDmx_{fb} + \varepsilon)$ indicates said correction factor for said spectral band of said side signal,

wherein $correction_factor_{fb} = ERes_{fb}/(EprevDmx_{fb} + \varepsilon)$ indicates a residual energy depending on an energy of a spectral band of said residual, which corresponds to said spectral band of said mid signal,

wherein $correction_factor_{fb} = ERes_{fb}/(EprevDmx_{fb} + \varepsilon)$ indicates a previous energy depending on an energy of the spectral band of the previous mid signal, and

wherein ε = 0, or wherein 0.1 > ε > 0.

10. An apparatus according to claim 8 or 9,

wherein said residual is defined according to

$$Res_R\, Res = S_R - a_R Dmx_R - a_I Dmx_I,$$

wherein Res_R is said residual, wherein S_R is said side signal, wherein a_R is a coefficient, wherein Dmx_R is said mid signal,

wherein the encoding unit is configured to determine said residual energy according to

$$ERes_{fb} = \sum_{fb} Res_R^2 + \sum_{fb} Res_I^2 \ .$$

11. An apparatus according to claim 8 or 9,

wherein said residual is defined according to

$$Res_R\, Res = S_R - a_R Dmx_R - a_I Dmx_I,$$

wherein Res_R is said residual, wherein S_R is said side signal, wherein a_R is a real part of a complex coefficient, and wherein a_I is an imaginary part of said complex coefficient, wherein Dmx_R is said mid signal, wherein Dmx_I is another mid signal depending on the first channel of the normalized audio signal and depending on the second channel of the normalized audio signal,

wherein another residual of another side signal S_I depending on the first channel of the normalized audio signal and depending on the second channel of the normalized audio signal is defined according to

$$Res_I = S_I\, Res = S_R - a_R Dmx_R - a_I Dmx_I \ ,$$

wherein the encoding unit is configured to determine said residual energy according to

$$ERes_{fb} = \sum_{fb} Res_R^2 + \sum_{fb} Res_I^2$$

wherein the encoding unit is configured to determine the previous energy depending on the energy of the spectral band of said residual, which corresponds to said spectral band of said mid signal, and depending on an energy of a spectral band of said another residual, which corresponds to said spectral band of said mid signal.

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

wherein the normalizer is configured to determine the normalization value for the audio input signal depending on an energy of the first channel of the audio input signal and depending on an energy of the second channel of the audio input signal.

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

wherein the audio input signal is represented in a spectral domain,

wherein the normalizer is configured to determine the normalization value for the audio input signal depending on a plurality of spectral bands of the first channel of the audio input signal and depending on a plurality of spectral bands of the second channel of the audio input signal, and

wherein the normalizer is configured to determine the normalized audio signal by modifying, depending on the normalization value, the plurality of spectral bands of at least one of the first channel and the second channel of the audio input signal.

14. An apparatus according to claim 13,

wherein the normalizer is configured to determine the normalization value based on the formulae:

$$NRG_L = \sqrt{\sum {MDCT_{L,k}}^2}$$

$$NRG_R = \sqrt{\sum {MDCT_{R,k}}^2}$$

$$ILD = \frac{NRG_L}{NRG_L + NRG_R}$$

wherein $MDCT_{L,k}$ is a k-th coefficient of an MDCT spectrum of the first channel of the audio input signal, and $MDCT_{R,k}$ is the k-th coefficient of the MDCT spectrum of the second channel of the audio input signal, and

wherein the normalizer is configured to determine the normalization value by quantizing ILD.

15. An apparatus according to claim 13 or 14,

wherein the apparatus for encoding further comprises a transform unit and a preprocessing unit,

wherein the transform unit is configured to configured to transform a time-domain audio signal from a time domain to a frequency domain to obtain a transformed audio signal,

wherein the preprocessing unit is configured to generate the first channel and the second channel of the audio input signal by applying an encoder-side frequency domain noise shaping operation on the transformed audio signal.

16. An apparatus according to claim 15,

wherein the preprocessing unit is configured to generate the first channel and the second channel of the audio input signal by applying an encoder-side temporal noise shaping operation on the transformed audio signal before applying the encoder-side frequency domain noise shaping operation on the transformed audio signal.

17. An apparatus according to one of claims 1 to 12,

wherein the normalizer is configured to determine a normalization value for the audio input signal depending on the first channel of the audio input signal being represented in a time domain and depending on the second channel of the audio input signal being represented in the time domain,

wherein the normalizer is configured to determine the first channel and the second channel of the normalized audio signal by modifying, depending on the normalization value, at least one of the first channel and the second channel of the audio input signal being represented in the time domain,

wherein the apparatus further comprises a transform unit being configured to transform the normalized audio signal from the time domain to a spectral domain so that the normalized audio signal is represented in the spectral domain, and

wherein the transform unit is configured to feed the normalized audio signal being represented in the spectral domain into the encoding unit.

18. An apparatus according to claim 17,

wherein the apparatus further comprises a preprocessing unit being configured to receive a time-domain audio signal comprising a first channel and a second channel,

wherein the preprocessing unit is configured to apply a filter on the first channel of the time-domain audio signal that produces a first perceptually whitened spectrum to obtain the first channel of the audio input signal being represented in the time domain, and

wherein the preprocessing unit is configured to apply the filter on the second channel of the time-domain audio signal that produces a second perceptually whitened spectrum to obtain the second channel of the audio input signal being represented in the time domain.

19. An apparatus according to claim 17 or 18,

wherein the transform unit is configured to transform the normalized audio signal from the time domain to the spectral domain to obtain a transformed audio signal,

wherein the apparatus furthermore comprises a spectral-domain preprocessor being configured to conduct encoder-side temporal noise shaping on the transformed audio signal to obtain the normalized audio signal being represented in the spectral domain.

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

wherein the encoding unit is configured to obtain the encoded audio signal by applying encoder-side Stereo Intelligent Gap Filling on the normalized audio signal or on the processed audio signal.

21. An apparatus according to one of the preceding claims, wherein the audio input signal is an audio stereo signal comprising exactly two channels.

22. A system for encoding four channels of an audio input signal comprising four or more channels to obtain an encoded audio signal, wherein the system comprises:

a first apparatus according to one of claims 1 to 20, for encoding a first channel and a second channel of the four or more channels of the audio input signal to obtain a first channel and a second channel of the encoded audio signal, and

a second apparatus according to one of claims 1 to 20, for encoding a third channel and a fourth channel of the four or more channels of the audio input signal to obtain a third channel and a fourth channel of the encoded audio signal.

23. An apparatus for decoding an encoded audio signal comprising a first channel and a second channel to obtain a first channel and a second channel of a decoded audio signal comprising two or more channels,

wherein the apparatus comprises a decoding unit configured to determine for each spectral band of a plurality of spectral bands, whether said spectral band of the first channel of the encoded audio signal and said spectral band of the second channel of the encoded audio signal was encoded using dual-mono encoding or using mid-side encoding,

wherein the decoding unit is configured to use said spectral band of the first channel of the encoded audio signal as a spectral band of a first channel of an intermediate audio signal and is configured to use said spectral band of the second channel of the encoded audio signal as a spectral band of a second channel of the intermediate audio signal, if the dual-mono encoding was used,

wherein the decoding unit is configured to generate a spectral band of the first channel of the intermediate audio signal based on said spectral band of the first channel of the encoded audio signal and based on said spectral band of the second channel of the encoded audio signal, and to generate a spectral band of the second channel of the intermediate audio signal based on said spectral band of the first channel of the encoded audio signal and based on said spectral band of the second channel of the encoded audio signal, if the mid-side encoding was used, and

wherein the apparatus comprises a de-normalizer configured to modify, depending on a de-normalization value, at least one of the first channel and the second channel of the intermediate audio signal to obtain the first channel and the second channel of the decoded audio signal.

24. An apparatus according to claim 23,

wherein the decoding unit is configured to determine whether the encoded audio signal is encoded in a full-mid-side encoding mode or in a full-dual-mono encoding mode or in a band-wise encoding mode,

wherein the decoding unit is configured, if it is determined that the encoded audio signal is encoded in the full-mid-side encoding mode, to generate the first channel of the intermediate audio signal from the first channel and from the second channel of the encoded audio signal, and to generate the second channel of the intermediate audio signal from the first channel and from the second channel of the encoded audio signal,

wherein the decoding unit is configured, if it is determined that the encoded audio signal is encoded in the full-dual-mono encoding mode, to use the first channel of the encoded audio signal as the first channel of the intermediate audio signal, and to use the second channel of the encoded audio signal as the second channel of the intermediate audio signal, and

wherein the decoding unit is configured, if it is determined that the encoded audio signal is encoded in the band-wise encoding mode,

to determine for each spectral band of a plurality of spectral bands, whether said spectral band of the first channel of the encoded audio signal and said spectral band of the second channel of the encoded audio signal was encoded using the dual-mono encoding or using the mid-side encoding,

to use said spectral band of the first channel of the encoded audio signal as a spectral band of the first channel of the intermediate audio signal and to use said spectral band of the second channel of the encoded audio signal as a spectral band of the second channel of the intermediate audio signal, if the dual-mono encoding was used, and

to generate a spectral band of the first channel of the intermediate audio signal based on said spectral band of the first channel of the encoded audio signal and based on said spectral band of the second channel of the encoded audio signal, and to generate a spectral band of the second channel of the intermediate audio signal based on said spectral band of the first channel of the encoded audio signal and based on said spectral band of the second channel of the encoded audio signal, if the mid-side encoding was used.

25. An apparatus according to claim 23,

wherein the decoding unit is configured to determine for each spectral band of said plurality of spectral bands, whether said spectral band of the first channel of the encoded audio signal and said spectral band of the second channel of the encoded audio signal was encoded using dual-mono encoding or using mid-side encoding,

wherein the decoding unit is configured to obtain said spectral band of the second channel of the encoded audio signal by reconstructing said spectral band of the second channel,

wherein, if mid-side encoding was used, said spectral band of the first channel of the encoded audio signal is a spectral band of a mid signal, and said spectral band

of the second channel of the encoded audio signal is spectral band of a side signal,

wherein, if mid-side encoding was used, the decoding unit is configured to reconstruct said spectral band of the side signal depending on a correction factor for said spectral band of the side signal and depending on a spectral band of a previous mid signal, which corresponds to said spectral band of said mid signal, wherein the previous mid signal precedes said mid signal in time.

26. An apparatus according to claim 25,

wherein, if mid-side encoding was used, the decoding unit is configured to reconstruct said spectral band of the side signal, by reconstructing spectral values of said spectral band of the side signal according to

$$S_i = N_i + facDmx_{fb} \cdot prevDmx_i \,, i \in [fb, fb+1],$$

wherein S_i indicates the spectral values of said spectral band of the side signal,

wherein $prevDmx_i$ indicates spectral values of the spectral band of said previous mid signal,

wherein N_i indicates spectral values of a noise filled spectrum,

wherein $facDmx_{fb}$ is defined according to

$$facDmx_{fb} = \sqrt{correction_factor_{fb} - {EN_{fb}}/{(EprevDmx_{fb} + \varepsilon)}}$$

wherein $correction_factor_{fb}$ is said correction factor for said spectral band of the side signal,

wherein EN_{fb}, is an energy of the noise-filled spectrum,

wherein $EprevDmx_{fb}$ is an energy of said spectral band of said previous mid signal, and

wherein $\varepsilon = 0$, or wherein $0.1 > \varepsilon > 0$.

27. An apparatus according to one of claims 23 to 26,

wherein the de-normalizer is configured to modify, depending on the de-normalization value, the plurality of spectral bands of at least one of the first channel and the second channel of the intermediate audio signal to obtain the first channel and the second channel of the decoded audio signal.

28. An apparatus according to one of claims 23 to 26,

wherein the de-normalizer is configured to modify, depending on the de-normalization value, the plurality of spectral bands of at least one of the first channel and the second channel of the intermediate audio signal to obtain a de-normalized audio signal,

wherein the apparatus furthermore comprises a postprocessing unit and a transform unit, and

wherein the postprocessing unit is configured to conduct at least one of decoder-side temporal noise shaping and decoder-side frequency domain noise shaping on the de-normalized audio signal to obtain a postprocessed audio signal,

wherein the transform unit is configured to configured to transform the postprocessed audio signal from a spectral domain to a time domain to obtain the first channel and the second channel of the decoded audio signal.

29. An apparatus according to one of claims 23 to 26,

wherein the apparatus further comprises a transform unit configured to transform the intermediate audio signal from a spectral domain to a time domain,

wherein the de-normalizer is configured to modify, depending on the de-normalization value, at least one of the first channel and the second channel of the intermediate audio signal being represented in a time domain to obtain the first channel and the second channel of the decoded audio signal.

30. An apparatus according to one of claims 23 to 26,

wherein the apparatus further comprises a transform unit configured to transform the intermediate audio signal from a spectral domain to a time domain,

wherein the de-normalizer is configured to modify, depending on the de-normalization value, at least one of the first channel and the second channel of the intermediate audio signal being represented in a time domain to obtain a de-normalized audio signal,

wherein the apparatus further comprises a postprocessing unit being configured to process the de-normalized audio signal, being a perceptually whitened audio signal, to obtain the first channel and the second channel of the decoded audio signal.

31. An apparatus according to claim 29 or 30,

wherein the apparatus furthermore comprises a spectral-domain postprocessor being configured to conduct decoder-side temporal noise shaping on the intermediate audio signal,

wherein the transform unit is configured to transform the intermediate audio signal from the spectral domain to the time domain, after decoder-side temporal noise shaping has been conducted on the intermediate audio signal.

32. An apparatus according to one of claims 23 to 31,

wherein the decoding unit is configured to apply decoder-side Stereo Intelligent Gap Filling on the encoded audio signal.

33. An apparatus according to one of claims 23 to 32, wherein the decoded audio signal is an audio stereo signal comprising exactly two channels.

34. A system for decoding an encoded audio signal comprising four or more channels to obtain four channels of a decoded audio signal comprising four or more channels, wherein the system comprises:

a first apparatus according to one of claims 23 to 32 for decoding a first channel and a second channel of the four or more channels of the encoded audio signal to obtain a first channel and a second channel of the decoded audio signal, and

a second apparatus according to one of claims 23 to 32 for decoding a third channel and a fourth channel of the four or more channels of the encoded audio signal to obtain a third channel and a fourth channel of the decoded audio signal.

35. A system for generating an encoded audio signal from an audio input signal and for generating a decoded audio signal from the encoded audio signal, comprising:

an apparatus according to one of claims 1 to 21, wherein the apparatus according to one of claims 1 to 21 is configured to generate the encoded audio signal from the audio input signal, and

an apparatus according to one of claims 23 to 33, wherein the apparatus according to one of claims 23 to 33 is configured to generate the decoded audio signal from the encoded audio signal.

36. A system for generating an encoded audio signal from an audio input signal and for generating a decoded audio signal from the encoded audio signal, comprising:

a system according to claim 22, wherein the system according to claim 22 is configured to generate the encoded audio signal from the audio input signal, and

a system according to claim 34, wherein the system according to claim 34 is configured to generate the decoded audio signal from the encoded audio signal.

37. A method for encoding a first channel and a second channel of an audio input signal comprising two or more channels to obtain an encoded audio signal, wherein the method comprises:

determining a normalization value for the audio input signal depending on the first channel of the audio input signal and depending on the second channel of the audio input signal,

determining a first channel and a second channel of a normalized audio signal by normalizing, depending on the normalization value, at least one of the first channel and the second channel of the audio input signal,

generating a processed audio signal having a first channel and a second channel, such that one or more spectral bands of the first channel of the processed audio signal are one or more spectral bands of the first channel of the normalized audio signal, such that one or more spectral bands of the second channel of the processed audio signal are one or more spectral bands of the second channel of the normalized audio signal, such that at least one spectral band of the first channel of the processed audio signal is a spectral band of a mid signal depending on a spectral band of the first channel of the normalized audio signal and depending on a spectral band of the second channel of the normalized audio signal, and such that at least one spectral band of the second channel of the processed audio signal is a spectral band of a side signal depending on a spectral band of the first channel of the normalized audio signal and depending on a spectral band of the second channel of the normalized audio signal, and encoding the processed audio signal to obtain the encoded audio signal.

38. A method for decoding an encoded audio signal comprising a first channel and a second channel to obtain a first channel and a second channel of a decoded audio signal comprising two or more channels, wherein the method comprises:

determining for each spectral band of a plurality of spectral bands, whether said spectral band of the first channel of the encoded audio signal and said spectral band of the second channel of the encoded audio signal was encoded using dual-mono encoding or using mid-side encoding,

using said spectral band of the first channel of the encoded audio signal as a spectral band of a first channel of an intermediate audio signal and using said spectral band of the second channel of the encoded audio signal as a spectral band of a second channel of the intermediate audio signal, if dual-mono encoding was used,

generating a spectral band of the first channel of the intermediate audio signal based on said spectral band of the first channel of the encoded audio signal and based on said spectral band of the second channel of the encoded audio signal, and generating a spectral band of the second channel of the intermediate audio

signal based on said spectral band of the first channel of the encoded audio signal and based on said spectral band of the second channel of the encoded audio signal, if mid-side encoding was used, and

modifying, depending on a de-normalization value, at least one of the first channel and the second channel of the intermediate audio signal to obtain the first channel and the second channel of a decoded audio signal.

39. A computer program for implementing the method of claim 37 or 38 when being executed on a computer or signal processor.