Claims

1. Audio encoder for encoding an audio signal having a lower frequency band and an upper frequency band, comprising:

a detector for detecting a peak spectral region in the upper frequency band of the audio signal;

a shaper for shaping the lower frequency band using shaping information for the lower band and for shaping the upper frequency band using at least a portion of the shaping information for the lower frequency band, wherein the shaper is configured to additionally attenuate spectral values in the detected peak spectral region in the upper frequency band; and

a quantizer and coder stage for quantizing a shaped lower frequency band and a shaped upper frequency band and for entropy coding quantized spectral values from the shaped lower frequency band and the shaped upper frequency band.

2. Audio encoder of claim 1, further comprising:

a linear prediction analyzer for deriving linear prediction coefficients for a time frame of the audio signal by analyzing a block of audio samples in the time frame, the audio samples being band-limited to the lower frequency band,

wherein the shaper is configured to shape the lower frequency band using the linear prediction coefficients as the shaping information, and

wherein the shaper is configured to use at least the portion of the linear prediction coefficients derived from the block of audio samples band-limited to the lower frequency band for shaping the upper frequency band in the time frame of the audio signal.

3. Audio encoder of claim 1 or 2, wherein the shaper is configured to calculate a plurality of shaping factors for a plurality of subbands of the lower frequency band using linear prediction coefficients derived from the lower frequency band of the audio signal,

wherein the shaper is configured to weight, in the lower frequency band, spectral coefficients in a subband of the lower frequency band using a shaping factor calculated for the corresponding subband, and

to weight spectral coefficients in the upper frequency band using a shaping factor calculated for one of the subbands of the lower frequency band.

4. Audio encoder of claim 3, wherein the shaper is configured to weight the spectral coefficients of the upper frequency band using a shaping factor calculated for a highest subband of the lower frequency band, the highest subband having a highest center frequency among all center frequencies of subbands of the lower frequency band.

5. Audio encoder of one of the preceding claims,

wherein the detector is configured to determine a peak spectral region in the upper frequency band, when at least one of a group of conditions is true, the group of conditions comprising at least the following:

a low frequency band amplitude condition, a peak distance condition, and a peak amplitude condition.

6. Audio encoder of claim 5, wherein the detector is configured to determine, for the low-frequency band amplitude condition,

a maximum spectral amplitude in the lower frequency band;

a maximum spectral amplitude in the upper frequency band,

wherein the low frequency band amplitude condition is true, when the maximum spectral amplitude in the lower frequency band weighted by a predetermined number greater than zero is greater than the maximum spectral amplitude in the upper frequency band.

7. Audio encoder of claim 6,

wherein the detector is configured to detect the maximum spectral amplitude in the lower frequency band or the maximum spectral amplitude in the upper frequency band before a shaping operation applied by the shaper is applied, or wherein the predetermined number is between 4 and 30.

8. Audio encoder of one of claims 5 to 7,

wherein the detector is configured to determine, for the peak distance condition,

a first maximum spectral amplitude in the lower frequency band;

a first spectral distance of the first maximum spectral amplitude from a border frequency between a center frequency of the lower frequency band and a center frequency of the upper frequency band;

a second maximum spectral amplitude in the upper frequency band;

a second spectral distance of the second maximum spectral amplitude from the border frequency to the second maximum spectral amplitude,

wherein the peak distance condition is true, when the first maximum spectral amplitude weighted by the first spectral distance and weighted by a predetermined number being greater than 1 is greater than the second maximum spectral amplitude weighted by the second spectral distance.

9. Audio encoder of claim 8,

wherein the detector is configured to determine the first maximum spectral amplitude or the second maximum spectral amplitude subsequent to a shaping operation by the shaper without the additional attenuation, or

wherein the border frequency is the highest frequency in the lower frequency band or the lowest frequency in the upper frequency band, or

wherein the predetermined number is between 1.5 and 8.

10. Audio encoder of one of claims 5 to 9,

wherein the detector is configured to determine a first maximum spectral amplitude in a portion of the lower frequency band, the portion extending from a predetermined start frequency of the lower frequency band until a maximum frequency of the lower frequency band, the predetermined start frequency being greater than a minimum frequency of the lower frequency band,

to determine a second maximum spectral amplitude in the upper frequency band,

wherein the peak amplitude condition is true, when the second maximum spectral amplitude is greater than the first maximum spectral amplitude weighted by a predetermined number being greater than or equal to 1.

11. Audio encoder of claim 10,

wherein the detector is configured to determine the first maximum spectral amplitude or the second maximum spectral amplitude after a shaping operation applied by the shaper without the additional attenuation, or wherein the predetermined start frequency is at least 10% of the lower frequency band above the minimum frequency of the lower frequency band or wherein the predetermined start frequency is at a frequency being equal to half a maximum frequency of the lower frequency band within a tolerance of plus/minus 10 percent of the half the maximum frequency, or

wherein the predetermined number depends on a bitrate to be provided by the quantizer/coder stage, so that the predetermined number is higher for a higher bitrate, or

wherein the predetermined number is between 1.0 and 5.0.

12. Audio encoder of one of claims 6 to 11,

wherein the detector is configured to determine the peak spectral region only when at least two conditions out of the three conditions or the three conditions are true.

13. Audio encoder of one of claims 6 to 12,

wherein the detector is configured to determine, as the spectral amplitude, an absolute value of spectral value of the real spectrum, a magnitude of a complex spectrum, any power of the spectral value of the real spectrum or any power of a magnitude of the complex spectrum, the power being greater than 1.

14. Audio encoder of one of the preceding claims,

wherein the shaper is configured to attenuate at least one spectral value in the detected peak spectral region based on a maximum spectral amplitude in the upper frequency band or based on a maximum spectral amplitude in the lower frequency band.

15. Audio encoder of claim 14,

wherein the shaper is configured to determine the maximum spectral amplitude in a portion of the lower frequency band, the portion extending from a predetermined start frequency of the lower frequency band until a maximum frequency of the lower frequency band, the predetermined start frequency being greater than a minimum frequency of the lower frequency band, wherein the predetermined start frequency is preferably at least 10% of the lower frequency band above the minimum frequency of the lower frequency band or wherein the predetermined start frequency is preferably at a frequency being equal to half a maximum frequency of the lower frequency band within a tolerance of plus/minus 10 percent of the half the maximum frequency.

16. Audio encoder of one of claims 14 or 15,

wherein the shaper is configured to additionally attenuate the spectral values using an attenuation factor, the attenuation factor being derived from the maximum spectral amplitude in the lower frequency band multiplied by a predetermined number being greater than or equal to 1 and divided by the maximum spectral amplitude in the upper frequency band.

17. Audio encoder of one of the preceding claims,

wherein the shaper is configured to shape the spectral values in the detected peak spectral region based on:

a first weighting operation using at least the portion of the shaping information for the lower frequency band and a second subsequent weighting operation using an attenuation information; or

a first weighting operation using the attenuation information and a second subsequent weighting information using at least a portion of the shaping information for the lower frequency band, or

a single weighting operation using a combined weighting information derived from the attenuation information and at least the portion of the shaping information for the lower frequency band.

18. Audio encoder of claim 17,

wherein the weighting information for the lower frequency band is a set of shaping factors, each shaping factor being associated with a subband of the lower frequency band,

wherein the at least the portion of the weighting information for the lower frequency band used in the shaping operation for the higher frequency band is a shaping factor associated with a subband of the lower frequency band having a highest center frequency of all subbands in the lower frequency band, or

wherein the attenuation information is an attenuation factor applied to the at least one spectral value in the detected spectral region or to all the spectral values in the detected spectral region or to all spectral values in the upper frequency band for which the peak spectral region has been detected by the detector for a time frame of the audio signal, or

wherein the shaper is configured to perform the shaping of the lower and the upper frequency band without any additional attenuation when the detector has not de-

tected any peak spectral region in the upper frequency band of a time frame of the audio signal.

19. Audio encoder of one of the preceding claims,

wherein the quantizer and coder stage comprises a rate loop processor for estimating a quantizer characteristic so that a predetermined bitrate of an entropy encoded audio signal is obtained.

20. Audio encoder of claim 19, wherein the quantizer characteristic is a global gain,

wherein the quantizer and coder stage comprises:

a weighter for weighting shaped spectral values in the lower frequency band and shaped spectral values in the upper frequency band by the same global gain,

a quantizer for quantizing values weighted by the global gain; and

an entropy coder for entropy coding the quantized values, wherein the entropy coder comprises an arithmetic coder or an Huffman coder.

21. Audio encoder of one of the preceding claims, further comprising:

a tonal mask processor for determining, in the upper frequency band, a first group of spectral values to be quantized and entropy encoded and a second group of spectral values to be parametrically coded by a gap-filling procedure, wherein the tonal mask processor is configured to set the second group of spectral values to zero values.

22. Audio encoder of one of the preceding claims, further comprising:

a common processor;

a frequency domain encoder; and

a linear prediction encoder,

wherein the frequency domain encoder comprises the detector, the shaper and the quantizer and coder stage, and

wherein the common processor is configured calculate data to be used by the frequency domain encoder and the linear prediction encoder.

23. Audio encoder of claim 22,

wherein the common processor is configured to resample the audio signal to obtain a resampled audio signal band limited to the lower frequency band for a time frame of the audio signal, and

wherein the common processor comprises a linear prediction analyzer for deriving linear prediction coefficients for the time frame of the audio signal by analyzing a block of audio samples in the time frame, the audio samples being band-limited to the lower frequency band, or

wherein the common processor is configured to control that the time frame of the audio signal is to be represented by either an output of the linear prediction encoder or an output of the frequency domain encoder.

24. Audio encoder of one of claims 22 to 23,

wherein the frequency domain encoder comprises a time-to-frequency converter for converting a time frame of the audio signal into a frequency representation comprising the lower frequency band and the upper frequency band.

25. Method for encoding an audio signal having a lower frequency band and an upper frequency band, comprising:

detecting a peak spectral region in the upper frequency band of the audio signal;

shaping the lower frequency band of the audio signal using shaping information for the lower frequency band and shaping the upper frequency band of the audio signal using at least a portion of the shaping information for the lower frequency band,

wherein the shaping of the upper frequency band comprises an additional attenuation of a spectral value in the detected peak spectral region in the upper frequency band.

26. Computer program for performing, when running on a computer or processor, the method of claim 25.