SIGNAL PROCESSING MTHOD AND DEVICE

[0001] ~~This application claims priority to Chinese Patent Application No. 201410177234.3, filed with the Chinese Patent Office on April 29, 2014 and entitled "SIGNAL PROCESSING MTHOD AND DEVICE", which is incorporated herein by reference in its entirety~~.

TECHNICAL FIELD

[0002] The present invention relates to the signal processing field, and specifically, to a signal processing method and device.

BACKGROUND

[0003] In current communication transmission, increasing attention is paid to quality of a voice signal or an audio signal; therefore, a requirement for signal encoding and decoding is increasingly high. In an existing frequency domain encoding algorithm, bit allocation is generally performed on each sub-band of a signal directly according to a size of a frequency envelope, and then each sub-band is encoded by using a quantity of allocated bits. However, practice shows that, in these existing encoding algorithms, a sub-band of a low frequency band has relatively large impact on signal encoding quality; therefore, the sub-band of the low frequency band generally becomes a bottleneck of signal encoding performance. In addition, the foregoing bit allocation manner cannot well adapt to a bit requirement of each sub-band, especially that of a sub-band of a low frequency band, which leads to relatively poor signal encoding performance. Correspondingly, signal decoding performance is also relatively poor.

SUMMARY

[0004] Embodiments of the present invention provide a signal processing method and device, which can improve signal encoding and decoding performance.

of the M sub-bands, modification is performed separately on the original envelope values of the M sub-bands according to the original envelope values of the M sub-bands, and first bit allocation is performed on the N sub-bands according to modified envelope values of the M sub-bands and original envelope values of K sub-bands, so that bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0020] To describe the technical solutions in the embodiments of the present invention more clearly, the following briefly describes the accompanying drawings required for describing the embodiments of the present invention. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, and persons of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

[0021] FIG. 1 is a schematic flowchart of a signal processing method according to an embodiment of the present invention;

[0022] FIG. 2 is a schematic flowchart of a process of a signal processing method according to an embodiment of the present invention;

[0023] FIG. 3 is a schematic block diagram of a signal processing device according to an embodiment of the present invention; and

[0024] FIG. 4 is a schematic block diagram of a signal processing device according to another embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0025] The following clearly ~~and completely~~ describes the technical solutions in the embodiments of the present invention with reference to the accompanying drawings in the embodiments of the present invention. Apparently, the described embodiments are some but not all of the embodiments of the present invention. All other embodiments obtained by persons of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

[0026] A signal encoding technology and a signal decoding technology are widely

applied to various electronic devices, such as a mobile phone, a wireless apparatus, a personal data assistant (Personal Data Assistant, PDA), a handheld or portable computer, a Global Positioning System (Global Positioning System, GPS) receiver/navigation assistant, a camera, an audio/video player, a video camera, a video recorder, and a monitoring device. Generally, such electronic devices include a voice encoder or an audio encoder, and may further include a voice decoder or an audio decoder. The voice encoder or the audio encoder and the voice decoder or the audio decoder may be directly implemented by a digital circuit or a chip, such as a digital signal ~~processing~~ processor (Digital Signal Processor, DSP) chip, or may be implemented by a software code-driven processor by executing a procedure in software code.

[0027] FIG. 1 is a schematic flowchart of a signal processing method according to an embodiment of the present invention. The method in FIG. 1 is executed by an encoder side, such as the foregoing voice encoder or the foregoing audio encoder. The method in FIG. 1 may also be executed by a decoder side, such as the foregoing voice decoder or the foregoing audio decoder.

[0028] In an encoding process, the encoder side may first transform a time-domain signal into a frequency-domain signal. For example, time-frequency transformation may be performed by using an algorithm such as fast Fourier transform (Fast Fourier Transform, FFT) or modified discrete cosine transform (Modified Discrete Cosine Transform, MDCT). Then, a global gain may be used to perform normalization on a spectral coefficient of the frequency-domain signal, and division is performed on a normalized spectral coefficient so as to obtain multiple sub-bands.

[0029] In a decoding process, the decoder side may decode a bitstream received from the encoder side to obtain a normalized spectral coefficient, and division is performed on the normalized spectral coefficient so as to obtain multiple sub-bands.

[0030] 110. Select M sub-bands from N sub-bands, where the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N.

[0031] In this embodiment of the present invention, the signal may be a voice signal, or may be an audio signal. The foregoing K sub-bands are all sub-bands in the N sub-bands except the M sub-bands.

sub-bands to the total energy of the K sub-bands may be determined as the first parameter.

[0047] Specifically, the ratio of the total energy of the M sub-bands to the total energy of the K sub-bands may be determined as the first parameter. ~~In this way,~~

[0048] For example, the first parameter may be obtained by calculation according to the following equations, where the first parameter may be represented by α:

$$\alpha = \frac{E_{P_M}}{E_{P_K}},$$

$$E_{P_M} = \sum_{i=0}^{M-1} E_{P_tmp_i}, \quad E_{P_K} = \sum_{i=M}^{N-M-1} E_{P_tmp_i},$$

$$E_{P_tmp_i} = \sqrt{\frac{E_{P_i}}{band_width_i}}, \text{ and } E_{P_i} = 2^{band_energy_i}, \text{ where}$$

E_{P_M} may represent the total energy of the M sub-bands, E_{P_K} may represent the total energy of the K sub-bands, $band_width_i$ may represent bandwidth of the ith sub-band, and $band_energy_i$ may represent energy of the ith sub-band. $band_energy_i$ may represent an original envelope value of the ith sub-band. For example, the original envelope value $band_energy_i$ of the ith sub-band may be obtained according to a spectral coefficient of the ith sub-band. For example, $band_energy_i$ may be obtained according to the following equations:

$$band_energy_i = \log_2 E_i, \text{ and}$$

$$E_i = \sum_{i=1}^{band_width_i} t_audio[j] * t_audio[j].$$

[0049] It should be understood that persons skilled in the art can apparently make various equivalent modifications or changes according to the foregoing equations, to obtain the first parameter, and such modifications or changes also fall within a scope of this embodiment of the present invention.

[0050] Optionally, as another embodiment, in step 120, according to the original envelope values of the M sub-bands, total energy of the M sub-bands may be determined, and energy of a first sub-band may be determined, where the energy of the first sub-band is the largest in that of the M sub-bands. A ratio of the energy of the first sub-band to the total energy of the M sub-bands may be determined as the second parameter.

[0051] Specifically, the degree of spectral fluctuation of the M sub-bands may be indicated by using a fluctuation degree of the original envelope values of the M sub-bands. For example, the second parameter may be obtained by calculation according to the following equations, where the second parameter may be represented by β:

$$\beta = \frac{E_{P_peak}}{E_{P_M}}$$, and $E_{P_peak} = \max(E_{p_tem_0}, E_{p_tmp_1}, \cdots E_{p_tmp_M})$, where

for calculation manners of $E_{P_tmp_i}$ and E_{p_M}, reference may be made to the foregoing equations.

[0052] It should be understood that persons skilled in the art can apparently make various equivalent modifications or changes according to the foregoing equations, to obtain the second parameter, and such modifications or changes also fall within a scope of this embodiment of the present invention.

[0053] Optionally, as another embodiment, in step 130, total energy of the M sub-bands and energy of a first sub-band may be determined according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands. A modification factor may be determined according to the total energy of the M sub-bands and the energy of the first sub-band. Then, modification may be performed separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0054] For example, the modification factor may be determined according to the following equations, where the modification factor may be represented by γ:

$$\gamma = \min(1.2, \gamma_0 * \frac{E_{P_peak} * M}{E_{P_M}})$$, and $\gamma_0 = 0.575\gamma_0$, where

for calculation manners of $E_{P_tmp_i}$ and E_{P_M}, reference may be made to the foregoing equations.

[0055] Modification may be performed on an original envelope value of each sub-band in the M sub-bands according to the modification factor γ. For example, the original envelope value of each sub-band may be multiplied by the modification factor, so as to obtain a modified envelope value of the sub-band.

[0056] It should be understood that persons skilled in the art can apparently make

various equivalent modifications or changes according to the foregoing equations, to obtain the modification factor, and such modifications or changes also fall within a scope of this embodiment of the present invention.

[0057] Optionally, as another embodiment, in step 130, a modified envelope value of each sub-band in the M sub-bands may be greater than an original envelope value of the sub-band.

[0058] Specifically, the modified envelope value of each sub-band in the M sub-bands is obtained by performing modification on the original envelope value of each sub-band in the M sub-bands. The modified envelope value of each sub-band may be greater than the original envelope value of the sub-band. If the modified envelope value of each sub-band in the M sub-bands is greater than the original envelope value of the sub-band, in step 140, bit allocation is performed according to the modified envelope values of the M sub-bands. In this way, a quantity of bits allocated to each sub-band in the M sub-bands increases, so that the bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0059] Optionally, as another embodiment, in step 130, a modified envelope value of each sub-band in the M sub-bands may be less than an original envelope value of the sub-band.

[0060] Specifically, if the modified envelope value of each sub-band in the M sub-bands ~~may be~~is less than the original envelope value of the sub-band, in step 140, bit allocation is performed according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands. In this way, a quantity of bits allocated to each sub-band in the M sub-bands is relatively small, and accordingly, quantities of bits respectively allocated to the K sub-bands increase, so that the bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0061] Optionally, as another embodiment, in step 130, first bit allocation may be performed on the N sub-bands in descending order of envelope values.

[0062] Optionally, as another embodiment, in step ~~120~~130, a modification factor may be determined according to the second parameter. Then, modification may be performed separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0063] Specifically, the modification factor may be determined according to the

second parameter. Modification may be performed on an original envelope value of each sub-band in the M sub-bands according to the modification factor. For example, the original envelope value of each sub-band may be multiplied by the modification factor to obtain a modified envelope value of the sub-band, so that a quantity of bits allocated to the M sub-bands better meets a bit requirement of the M sub-bands, and therefore, signal encoding and decoding performance can be improved.

[0064] After the first bit allocation is performed, generally, there are redundant bits in ~~a quantity of~~ bits allocated to each sub-band. Redundant bits of each sub-band are not enough for encoding one information unit of the sub-band. Therefore, quantities of redundant bits of all sub-bands may be counted to obtain a total quantity of redundant bits, and then second bit allocation is performed.

[0065] Optionally, as another embodiment, after step 140, a quantity of redundant bits of each sub-band in the N sub-bands may be determined according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, where the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding in the same sub-band. A total quantity of redundant bits may be determined according to the quantity of redundant bits of each sub-band in the N sub-bands. Then, second bit allocation may be performed on the N sub-bands according to the total quantity of redundant bits.

[0066] Specifically, total redundant bits may be equally allocated to the N sub-bands. In this way, redundant bits may be reused, so as to avoid a waste of bits and further improve signal encoding and decoding performance.

[0067] The foregoing describes a process of first bit allocation and second bit allocation. If the foregoing method in FIG. 1 is executed by an encoder side, after the second bit allocation, the encoder side may quantize a spectral coefficient of each sub-band by using a quantity of bits allocated to each sub-band in a process of the two times bit allocation, write an index of a quantized spectral coefficient and an index of an original envelope value of each sub-band into a bitstream, and then send the bitstream to a decoder side.

[0068] If the foregoing method in FIG. 1 is executed by a decoder side, after the second bit allocation, the decoder side may decode a quantized spectral coefficient by using a quantity of bits allocated to each sub-band in a process of the two times bit allocation, so as to obtain a recovered signal.

[0069] The following describes embodiments of the present invention in detail

CLAIMS

What is claimed is:

1. A signal processing method, comprising:

selecting M sub-bands from N sub-bands, wherein the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N;

determining, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, wherein the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands;

performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and

performing first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

2. The method according to claim 1, wherein the determining, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands comprises:

determining a first parameter according to original envelope values of the N sub-bands, wherein the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands;

determining a second parameter according to the original envelope values of the M sub-bands, wherein the second parameter indicates a degree of spectral fluctuation of the M sub-bands; and

determining, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

3. The method according to claim 2, wherein the determining a first parameter according to original envelope values of the N sub-bands comprises:

determining total energy of the M sub-bands according to the original envelope values of the M sub-bands;

determining total energy of the K sub-bands according to the original envelope values of the K sub-bands; and

determining a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

4. The method according to claim 2 or 3, wherein the determining a second parameter according to the original envelope values of the M sub-bands comprises:

determining the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands; and

determining a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

5. The method according to any one of claims 1 to 4, wherein the performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands comprises:

determining the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands;

determining a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and

performing modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

6. The method according to any one of claims 1 to 5, wherein a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

7. The method according to any one of claims 1 to 6, further comprising:

determining a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, wherein the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band;

determining a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands; and

performing second bit allocation on the N sub-bands according to the modified

envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

8. A signal processing device, comprising:

a selection unit, configured to select M sub-bands from N sub-bands, wherein the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N;

a determining unit, configured to determine, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, wherein the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands;

a modification unit, configured to perform modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and

an allocation unit, configured to perform first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

9. The device according to claim 8, wherein the determining unit is specifically configured to:

determine a first parameter according to original envelope values of the N sub-bands, wherein the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands;

determine a second parameter according to the original envelope values of the M sub-bands, wherein the second parameter indicates a degree of spectral fluctuation of the M sub-bands; and

determine, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

10. The device according to claim 9, wherein the determining unit is specifically configured to:

determine total energy of the M sub-bands according to the original envelope values of the M sub-bands;

determine total energy of the K sub-bands according to the original envelope values of the K sub-bands; and

determine a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

11. The device according to claim 9 or 10, wherein the determining unit is specifically configured to:

determine the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands; and

determine a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

12. The device according to any one of claims 8 to 11, wherein the modification unit is specifically configured to:

determine the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands;

determine a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and

perform modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

13. The device according to any one of claims 8 to 12, wherein a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

14. The device according to any one of claims 8 to 13, wherein:

the determining unit is further configured to determine a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, wherein the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band;

the determining unit is further configured to determine a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands; and

the allocation unit is further configured to perform second bit allocation on the N

sub-bands according to the modified envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

CLAIMS

1. A signal processing method, comprising:

selecting (110) M sub-bands from N sub-bands, wherein the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N;

determining (120), according to an energy characteristic and a spectral characteristic of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands;

performing (130) modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and

performing (140) first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

2. The method according to claim 1, wherein the determining, according to an energy characteristic and a spectral characteristic of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands comprises:

determining the energy characteristic of the M sub-bands according to original envelope values of the N sub-bands, wherein the energy characteristic of the M sub-bands indicates a concentration degree that is of spectral energy of the current frame of the signal and that is on the M sub-bands;

determining the spectral characteristic of the M sub-bands according to the original envelope values of the M sub-bands, wherein the spectral characteristic of the M sub-bands indicates a degree of spectral fluctuation of the M sub-bands; and

determining, when the energy characteristic of the M sub-bands falls within a first range and the spectral characteristic of the M sub-bands falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

3. The method according to claim 2, wherein the first range is [1/6, 2/3].

4. The method according to claim 2 or 3, wherein the second range is

$[\frac{1}{0.575*M}, \infty)$ or $[\frac{1}{0.5*M}, \infty)$.

5. The method according to anyone of claims 2 to 4, wherein the determining an energy characteristic of the M sub-bands according to original envelope values of the N sub-bands comprises:

determining total energy of the M sub-bands according to the original envelope values of the M sub-bands;

determining total energy of the K sub-bands according to the original envelope values of the K sub-bands; and

determining a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the energy characteristic of the M sub-bands.

6. The method according to anyone of claims 2 to 5, wherein the determining a spectral characteristic of the M sub-bands according to the original envelope values of the M sub-bands comprises:

determining the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands; and

determining a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the spectral characteristic of the M sub-bands.

7. The method according to any one of claims 1 to 6, wherein the performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands comprises:

determining the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands;

determining a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and

performing modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

8. The method according to any one of claims 1 to 7, wherein a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

9. A signal processing device (300), comprising:

a selection unit (310), configured to select M sub-bands from N sub-bands, wherein the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N;

a determining unit (320), configured to determine, according to an energy characteristic and a spectral characteristic of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands;

a modification unit (330), configured to perform modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and

an allocation unit (340), configured to perform first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

10. The device (300) according to claim 8, wherein the determining unit (320) is specifically configured to:

determine the energy characteristic of the M sub-bands according to original envelope values of the N sub-bands, wherein the energy characteristic of the M sub-bands indicates a concentration degree that is of spectral energy of the current frame of the signal and that is on the M sub-bands;

determine the spectral characteristic of the M sub-bands according to the original envelope values of the M sub-bands, wherein the spectral characteristic of the M sub-bands indicates a degree of spectral fluctuation of the M sub-bands; and

determine, when the energy characteristic of the M sub-bands falls within a first range and the spectral characteristic of the M sub-bands falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

11. The device (300) according to claim 10, wherein the first range is [1/6, 2/3].

12. The device (300) according to claim 10 or 11, wherein the second range is $[\frac{1}{0.575*M}, \infty)$ or $[\frac{1}{0.5*M}, \infty)$.

13. The device (300) according to anyone of claims 10 to 12, wherein the determining unit (320) is specifically configured to:

determine total energy of the M sub-bands according to the original envelope values of the M sub-bands;

determine total energy of the K sub-bands according to the original envelope values of the K sub-bands; and

determine a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the energy characteristic of the M sub-bands.

14. The device (300) according to anyone of claims 10 to 13, wherein the determining unit (320) is specifically configured to:

determine the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands; and

determine a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the spectral characteristic of the M sub-bands.

15. The device (300) according to any one of claims 9 to 14, wherein the modification unit (330) is specifically configured to:

determine the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands;

determine a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and

perform modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

16. The device (300) according to any one of claims 9 to 15, wherein a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.