CLAIMS

1. An audio signal encoding method, comprising:

obtaining, by an audio signal encoder, an audio signal, wherein the audio signal comprises a plurality of subbands;

obtaining, by the audio signal encoder, spectral coefficients of a current frame of the audio signal;

obtaining, by the audio signal encoder, one or more reference coding parameters of the current frame based on the spectral coefficients;

determining, by the audio signal encoder, whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encoding, by the audio signal encoder, the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the current frame comprises a subband i, a subband j, a subband x and a subband y;

wherein the reference coding parameters comprise:

a subband average energy of spectral coefficients in the subband i, and a subband average energy of spectral coefficients in the subband j; wherein the highest frequency bin of the subband i is lower than the lowest frequency bin of the subband j, and the highest frequency bin of the subband j is higher than 8 kHz; and

a spectral peak of spectral coefficients in the subband x, a spectral average of the spectral coefficients in the subband x, a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y; wherein the highest frequency bin of the subband x is lower than the lowest frequency bin of the subband y;

and wherein the preset parameter condition comprises:

the subband average energy of the spectral coefficients in the subband j is greater than a product of the subband average energy of the spectral coefficients in the subband i multiplied by a constant T4; and

a first product of the spectral peak of the spectral coefficients in the subband x multiplied by the spectral average of the spectral coefficients in the subband y is greater than a second product of the spectral peak of the spectral coefficients in the subband y multiplied by the spectral average of the spectral coefficients in the subband x and multiplied by a lowest value of an interval R1, and the first product is less than the second product multiplied by a highest value of the interval R1.

2. The method according to claim 1, wherein the constant T4 is less than 1/1.2 and no less than 0.5.

3. The method according to claim 1, wherein a range of frequency bins of the subband j is 4.8 kHz to 9.6 kHz; a range of frequency bins of the subband x is 1 kHz to 2.6 kHz; and a range of frequency bins of the subband y is 4.8 kHz to 6.4 kHz.

4. An audio signal encoding method, comprising:

obtaining, by an audio signal encoder, an audio signal, wherein the audio signal comprises a plurality of subbands;

obtaining, by the audio signal encoder, spectral coefficients of a current frame of the audio signal;

obtaining, by the audio signal encoder, one or more reference coding parameters of the current frame based on the spectral coefficients;

determining, by the audio signal encoder, whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encoding, by the audio signal encoder, the spectral coefficients using a transform coded excitation (TCX) algorithm;, wherein the current frame comprises a subband i, a subband j, and a subband y;

wherein the highest frequency bin of the subband i is lower than the lowest frequency bin of the subband j, the highest frequency bin of the subband j is higher than a critical frequency bin F2, and F2 is in a range of 4.8 kHz to 8 kHz;

wherein the reference coding parameters comprise:

a subband average energy of spectral coefficients in the subband i, and a subband average energy of spectral coefficients in the subband j; and

a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y;

wherein the preset parameter condition comprises:

the subband average energy of the spectral coefficients in the subband j is greater than a product of the subband average energy of the spectral coefficients in the subband i multiplied by a constant T4; and

the spectral peak of the spectral coefficients in the subband y is less than a product of the spectral average of the spectral coefficients in the subband y multiplied by a constant T45.

5. The method according to claim 4, wherein the constant T45 is 1.5.

6. The method according to claim 4, wherein a range of frequency bins of the subband j is 4.8 kHz to 9.6 kHz, and a range of frequency bins of the subband y is 4.8 kHz to 6.4 kHz.

7. An audio signal encoding method, comprising:

obtaining, by an audio signal encoder, an audio signal, wherein the audio signal comprises a plurality of subbands;

obtaining, by the audio signal encoder, spectral coefficients of a current frame of the audio signal;

obtaining, by the audio signal encoder, one or more reference coding parameters of the current frame based on the spectral coefficients;

determining, by the audio signal encoder, whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encoding, by the audio signal encoder, the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the current frame comprises a subband x and a subband y, wherein the reference coding parameters comprise:

a spectral peak of spectral coefficients in the subband x, a spectral average of the spectral coefficients in the subband x, a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y;

and wherein the preset parameter condition comprises:

a product of the spectral peak of the spectral coefficients in the subband x multiplied by the spectral average of the spectral coefficients in the subband y is less than a product of the spectral peak of the spectral coefficients in the subband y multiplied by the spectral average of the spectral coefficients in the subband x multiplied by a constant T44; and

the spectral peak of the spectral coefficients in the subband y is greater than a product of the spectral average of the spectral coefficients in the subband y multiplied by a constant T47.

8. An audio signal encoding method, comprising:

obtaining, by an audio signal encoder, an audio signal, wherein the audio signal comprises a plurality of subbands;

obtaining, by the audio signal encoder, spectral coefficients of a current frame of the audio

signal;

obtaining, by the audio signal encoder, one or more reference coding parameters of the current frame based on the spectral coefficients;

determining, by the audio signal encoder, whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encoding, by the audio signal encoder, the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the current frame comprises a subband x and a subband y;

wherein the reference coding parameters comprise:

a spectral peak of spectral coefficients in the subband x, a spectral average of the spectral coefficients in the subband x, a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y;

and wherein the preset parameter condition comprises:

a product of the spectral peak of the spectral coefficients in the subband x multiplied by the spectral average of the spectral coefficients in the subband y is greater than a product of the spectral peak of the spectral coefficients in the subband y multiplied by the spectral average of the spectral coefficients in the subband x multiplied by a constant T46; and

the spectral peak of the spectral coefficients in the subband y is less than a product of the spectral average of the spectral coefficients in the subband y multiplied by a constant T45.

9. The method according to claim 8, wherein a value range of the constant T46 is 1.5 to 3.

10. An audio singal encoder, comprising:

a processor and a memory storing program instructions for execution by the processor; wherein the processor is configured to execute the program instructions to:

obtain an audio signal, wherein the audio signal comprises a plurality of subbands;

obtain spectral coefficients of a current frame of the audio signal;

obtain one or more reference coding parameters of the current frame based on the spectral coefficients;

determine whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encode the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the current frame comprises a subband i, a subband j, a subband x and a subband y;

wherein the reference coding parameters comprise:

a subband average energy of spectral coefficients in the subband i, and a subband average energy of spectral coefficients in the subband j; wherein the highest frequency bin of the subband i is lower than the lowest frequency bin of the subband j, and the highest frequency bin of the subband j is higher than 8 kHz; and

a spectral peak of spectral coefficients in the subband x, a spectral average of the spectral coefficients in the subband x, a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y; wherein the highest frequency bin of the subband x is lower than the lowest frequency bin of the subband y;

and wherein the preset parameter condition comprise:

the subband average energy of the spectral coefficients in the subband j is greater than a product of the subband average energy of the spectral coefficients in the subband i multiplied by a constant T4; and

a first product of the spectral peak of the spectral coefficients in the subband x multiplied by the spectral average of the spectral coefficients in the subband y is greater than a second product of the spectral peak of the spectral coefficients in the subband y multiplied by the spectral average of the spectral coefficients in the subband x and multiplied by a lowest value of an interval R1, and the first product is less than the second product multiplied by a highest value of the interval R1.

11. The audio signal encoder according to claim 10, wherein the constant T4 is less than 1/1.2 and no less than 0.5.

12. The audio signal encoder according to claim 10, wherein a range of frequency bins of the subband j is 4.8 kHz to 9.6 kHz;

a range of frequency bins of the subband x is 1 kHz to 2.6 kHz; and

a range of frequency bins of the subband y is 4.8 kHz to 6.4 kHz.

13. An audio singal encoder, comprising:

a processor and a memory storing program instructions for execution by the processor; wherein the processor is configured to execute the program instructions to:

obtain an audio signal, wherein the audio signal comprises a plurality of subbands;

obtain spectral coefficients of a current frame of the audio signal;

obtain one or more reference coding parameters of the current frame based on the spectral coefficients;

determine whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encode the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the current frame comprises a subband i, a subband j and a subband y;

wherein the highest frequency bin of the subband i is lower than the lowest frequency bin of the subband j, the highest frequency bin of the subband j is higher than a critical frequency bin F2, and F2 is in a range of 4.8 kHz to 8 kHz;

wherein the reference coding parameters comprise:

a subband average energy of spectral coefficients in the subband i, and a subband average energy of spectral coefficients in the subband j; and

a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y;

wherein the preset parameter condition comprises:

the subband average energy of the spectral coefficients in the subband j is greater than a product of the subband average energy of the spectral coefficients in the subband i multiplied by a constant T4; and

the spectral peak of the spectral coefficients in the subband y is less than a product of the spectral average of the spectral coefficients in the subband y multiplied by a constant T45.

14. The audio signal encoder according to claim 13, wherein the constant T45 is 1.5.

15. The audio signal encoder according to claim 13, wherein a range of frequency bins of the subband j is 4.8 kHz to 9.6 kHz, and a range of frequency bins of the subband y is 4.8 kHz to 6.4 kHz.

16. An audio singal encoder, comprising:

a processor and a memory storing program instructions for execution by the processor; wherein the processor is configured to execute the program instructions to:

obtain an audio signal, wherein the audio signal comprises a plurality of subbands;

obtain spectral coefficients of a current frame of the audio signal;

obtain one or more reference coding parameters of the current frame based on the spectral coefficients;

determine whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition,

encode the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the frequency band of the current frame comprises a subband x and a subband y;

wherein the reference coding parameters comprise:

a spectral peak of spectral coefficients in the subband x, a spectral average of the spectral coefficients in the subband x, a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y;

and wherein the preset parameter condition comprises:

a product of the spectral peak of the spectral coefficients in the subband x multiplied by the spectral average of the spectral coefficients in the subband y is less than a product of the spectral peak of the spectral coefficients in the subband y multiplied by the spectral average of the spectral coefficients in the subband x multiplied by a constant T44; and

the spectral peak of the spectral coefficients in the subband y is greater than a product of the spectral average of the spectral coefficients in the subband y multiplied by a constant T47.

17. An audio singal encoder, comprising:

a processor and a memory storing program instructions for execution by the processor; wherein the processor is configured to execute the program instructions to:

obtain an audio signal, wherein the audio signal comprises a plurality of subbands;

obtain spectral coefficients of a current frame of the audio signal;

obtain one or more reference coding parameters of the current frame based on the spectral coefficients;

determine whether the reference coding parameters satisfy a preset paramater condition;

based on a determination that the reference coding parameters satisfy the preset paramater condition, encode the spectral coefficients using a transform coded excitation (TCX) algorithm;

wherein the frequency band of the current frame comprises a subband x and a subband y;

wherein the reference coding parameters comprise:

a spectral peak of spectral coefficients in the subband x, a spectral average of the spectral coefficients in the subband x, a spectral peak of spectral coefficients in the subband y, and a spectral average of the spectral coefficients in the subband y;

and wherein the preset parameter condition comprises:

a product of the spectral peak of the spectral coefficients in the subband x multiplied by the spectral average of the spectral coefficients in the subband y is greater than a product of the spectral peak of the spectral coefficients in the subband y multiplied by the spectral average of the spectral coefficients in the subband x multiplied by a constant T46; and

the spectral peak of the spectral coefficients in the subband y is less than a product of the spectral average of the spectral coefficients in the subband y multiplied by a constant T45.

18. The audio signal encoder according to claim 17, wherein a value range of the constant T46 is 1.5 to 3.