DECODING METHOD AND DECODING APPARATUS

[0001] ~~This application claims priority to Chinese Patent Application No. 201310298040.4, filed with the Chinese Patent Office on July 16, 2013 and entitled "DECODING METHOD AND DECODING APPARATUS", which is incorporated herein by reference in its entirety.~~

TECHNICAL FIELD

[0002] The present invention relates to the field of coding and decoding, and in particular, to a decoding method and a decoding apparatus.

BACKGROUND

[0003] With continuous progress of technologies, a demand of a user for voice quality is becoming increasingly high. To increase voice bandwidth is a main method of improving voice quality. Generally, bandwidth is increased by using a bandwidth extension technology, and the bandwidth extension technology includes a time domain bandwidth extension technology and a frequency domain bandwidth extension technology.

[0004] In the time domain bandwidth extension technology, a packet loss rate is a key factor that affects signal quality. In a case of packet loss, a lost frame needs to be restored as correctly as possible. A decoder side determines, by parsing bitstream information, whether frame loss occurs. If frame loss does not occur, normal decoding processing is performed. If frame loss occurs, frame loss processing needs to be performed.

[0005] When frame loss processing is performed, the decoder side obtains a high frequency band signal according to a decoding result of a previous frame, and performs gain adjustment on the high frequency band signal by using a set subframe gain and a global gain that is obtained by multiplying a global gain of the previous frame by a fixed attenuation factor, to obtain a final high frequency band signal.

[0006] The subframe gain used during frame loss processing is a set value, and therefore a spectral discontinuity phenomenon may occur, resulting in that transition before and after frame loss is discontinuous, a noise phenomenon appears during signal reconstruction, and speech quality deteriorates.

$+ GainGrad[n-1,2]*\gamma_3 + GainGradFEC[0]*\gamma_4$;

$GainGradFEC[2] = GainGrad[n-1,1]*\gamma_1 + GainGrad[n-1,2]*\gamma_2$

$+ GainGradFEC[0]*\gamma_3 + GainGradFEC[1]*\gamma_4$; and

$GainGradFEC[3] = GainGrad[n-1,2]*\gamma_1 + GainGradFEC[0]*\gamma_2$

$+ GainGradFEC[1]*\gamma_3 + GainGradFEC[2]*\gamma_4$;

where GainGradFEC[j] is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the current frame, $GainGrad[n-1, j]$ is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the previous frame of the current frame, j = 0, 1, 2, ..., I–2, $\gamma_1+\gamma_2+\gamma_3+\gamma_4 = 1.0$, and $\gamma_4 > \gamma_3 > \gamma_2 > \gamma_1$, where γ_1, γ_2, γ_3, and γ_4 are determined by using the frame class of the received last frame, where the subframe gain of the another subframe except for the start subframe in the at least two subframes is determined by using the following formulas:

GainShapeTemp[n,i] = GainShapeTemp[n,i–1] + GainGradFEC[i], where i = 1, 2, 3, and GainShapeTemp[n,0] is the first gain gradient;

$GainShapeTemp[n,i] = \min(\gamma_5 * GainShape[n-1,i], GainShapeTemp[n,i])$; and

$GainShape[n,i] = \max(\gamma_6 * GainShape[n-1,i], GainShapeTemp[n,i])$;

where GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, i = 1, 2, 3, GainShape[n,i] is a subframe gain of the i^{th} subframe of the current frame, γ_5 and γ_6 are determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame, $1 < \gamma_5 < 2$, and $0 \leq \gamma_6 \leq 1$.

[0039] With reference to any one of the eighth to the twelfth possible implementation manners, in a thirteenth possible implementation manner, the determining module estimates the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame, and the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

[0040] With reference to the third aspect or any one of the foregoing possible implementation manners, in a fourteenth possible implementation manner, the determining module estimates a global gain gradient of the current frame according to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame; and estimates the global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame ~~of the current frame~~.

[0062] According to this embodiment of the present invention, it may be determined, by parsing bitstream information, whether frame loss occurs in the current frame. If frame loss does not occur in the current frame, the foregoing normal decoding process is performed. If frame loss occurs in the current frame, that is, the current frame is a lost frame, frame loss processing needs to be performed, that is, the lost frame needs to be recovered.

[0063] FIG. 1 is a schematic flowchart of a decoding method according to an embodiment of the present invention. The method in FIG. 1 may be executed by a decoder, and includes the following ~~content~~steps:

[0064] 110: In a case in which it is determined that a current frame is a lost frame, synthesize a high frequency band signal according to a decoding result of a previous frame of the current frame.

[0065] For example, a decoder side determines, by parsing bitstream information, whether frame loss occurs. If frame loss does not occur, normal decoding processing is performed. If frame loss occurs, frame loss processing is performed. During frame loss processing, firstly, a high frequency band excitation signal is generated according to a decoding parameter of the previous frame; secondly, an LPC parameter of the previous frame is duplicated and used as an LPC parameter of the current frame, thereby obtaining an LPC synthesis filter; and finally, a synthesized high frequency band signal is obtained from the high frequency band excitation signal by using the LPC synthesis filter.

[0066] 120: Determine subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame.

[0067] A subframe gain of a subframe may refer to a ratio of a difference between a synthesized high frequency band signal of the subframe and an original high frequency band signal to the synthesized high frequency band signal. For example, the subframe gain may refer to a ratio of a difference between an amplitude of the synthesized high frequency band signal of the subframe and an amplitude of the original high frequency band signal to the amplitude of the synthesized high frequency band signal.

[0068] A gain gradient between subframes is used to indicate a change trend and degree, that is, a gain variation, of a subframe gain between adjacent subframes. For example, a gain gradient between a first subframe and a second subframe may refer to a difference between a subframe gain of the second subframe and a subframe gain of the first subframe. This embodiment of the present invention is not limited thereto. For example, the gain gradient between subframes may also refer to a subframe gain attenuation factor.

[0069] For example, a gain variation from a last subframe of a previous frame to a start

[0132] 635: Obtain an LPC synthesis filter according to LPC of the previous frame, and synthesize a high frequency band signal from the high frequency band excitation signal by using the LPC synthesis filter.

[0133] 640: Estimate a first gain gradient from a last subframe of the previous frame to a start subframe of the current frame according to a gain gradient between subframes of the previous frame.

[0134] In this embodiment, description is provided by using an example in which each frame has in total gains of four subframes. It is assumed that the current frame is an n^{th} frame, that is, the n^{th} frame is a lost frame. A previous ~~sub~~frame is an $(n-1)^{th}$ ~~sub~~frame, and a previous frame of the previous frame is an $(n-2)^{th}$ frame. Gains of four subframes of the n^{th} frame are GainShape[n,0], GainShape[n,1], GainShape[n,2], and GainShape[n,3]. Similarly, gains of four subframes of the $(n-1)^{th}$ frame are GainShape[n–1,0], GainShape[n–1,1], GainShape[n–1,2], and GainShape[n–1,3], and gains of four subframes of the $(n-2)^{th}$ frame are GainShape[n–2,0], GainShape[n–2,1], GainShape[n–2,2], and GainShape[n–2,3]. In this embodiment of the present invention, different estimation algorithms are used for a subframe gain GainShape[n,0] (that is, a subframe gain of the current frame whose serial number is 0) of a first subframe of the n^{th} frame and subframe gains of the next three subframes. A procedure of estimating the subframe gain GainShape[n,0] of the first subframe is: a gain variation is calculated according to a change trend and degree between subframe gains of the $(n-1)^{th}$ frame, and the subframe gain GainShape[n,0] of the first subframe is estimated by using the gain variation and the gain GainShape[n–1,3] of the fourth subframe (that is, a gain of a subframe of the previous frame whose serial number is 3) of the $(n-1)^{th}$ frame and with reference to a frame class of a last frame received before the current frame and a quantity of consecutive lost frames. An estimation procedure for the next three subframes is: a gain variation is calculated according to a change trend and degree between a subframe gain of the $(n-1)^{th}$ frame and a subframe gain of the $(n-2)^{th}$ frame, and the gains of the next three subframes are estimated by using the gain variation and the estimated subframe gain of the first subframe of the n^{th} subframe and with reference to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames.

[0135] As shown in FIG. 3A, the change trend and degree (or gradient) between gains of the $(n-1)^{th}$ frame is monotonically increasing. As shown in FIG. 3B, the change trend and degree (or gradient) between gains of the $(n-1)^{th}$ frame is monotonically decreasing. A formula for calculating the first gain gradient may be as follows:

$$GainGradFEC[0] = GainGrad[n-1,1]*\alpha_1 + GainGrad[n-1,2]*\alpha_2,$$

where GainGradFEC[0] is the first gain gradient, that is, a gain gradient between a last

current frame. This step is similar to a conventional technique, and details are not described herein again.

[0148] In this embodiment of the present invention, a conventional frame loss processing method in a time domain high bandwidth extension technology is used, so that transition when frame loss occurs is more natural and more stable, thereby weakening a noise (click) phenomenon caused by frame loss, and improving quality of a speech signal.

[0149] Optionally, as another embodiment, 640 and 645 in this embodiment in FIG. 6 may be replaced with the following steps:

[0150] First step: Use a change gradient GainGrad[n–1,2], from a subframe gain of the second to last subframe to a subframe gain of a last subframe in an $(n-1)^{th}$ frame (which is the previous frame), as a first gain gradient GainGradFEC[0], that is, GainGradFEC[0] = GainGrad[n–1,2].

[0151] Second step: On a basis of the subframe gain of the last subframe of the $(n-1)^{th}$ frame and with reference to a frame class of a last frame received before the current frame and the first gain gradient GainGradFEC[0], calculate an intermediate amount GainShapeTemp[n,0] of a gain GainShape[n,0] of a first subframe:

GainShapeTemp[n,0] = GainShape[n–1,3] + λ_1 * GainGradFEC[0],

where GainShape[n–1,3] is a gain of a fourth subframe of the $(n-1)^{th}$ frame, $0 < \lambda_1 < 1.0$, and λ_1 is determined by using a multiple relationship between a frame class of a last frame received before the n^{th} frame and gains of last two subframes of the previous frame.

[0152] Third step: Obtain GainShape[n,0] through calculation according to the intermediate amount GainShapeTemp[n,0]:

GainShapeTemp[n,0] = min(λ_2 * GainShape[n–1,3],GainShapeTemp[n,0]); and

GainShape[n,0] = max(λ_3 *GainShape[n–1,3],GainShapeTemp[n,0]);

where λ_2 and λ_3 are determined by using the frame class of the last frame received before the current frame and the quantity of consecutive lost frames, and a ratio of the estimated subframe gain GainShape[n,0] of a first subframe to the subframe gain GainShape[n–1,3] of the last subframe of the $(n-1)^{th}$ frame is within a range.

[0153] Optionally, as another embodiment, ~~550~~ 650 in this embodiment in FIG. ~~5~~6 may be replaced with the following steps:

[0154] First step: ~~Predict and e~~Estimate gain gradients GainGradFEC[1] to GainGradFEC[3] between subframes of an n^{th} frame according to GainGrad[n–1,x] and GainGradFEC[0]:

GainGradFEC[1] = GainGrad[n–1,0]*γ_1 + GainGrad[n–1,1]*γ_2

+ GainGrad[n–1,2]*γ_3 + GainGradFEC[0]*γ_4;

GainShape[n,i] = max(γ_6 * GainShape[n–1,i],GainShapeTemp[n,i]);

where GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, i = 1, 2, 3, GainShape[n,i] is a subframe gain of the i^{th} subframe of the current frame, γ_5 and γ_6 are determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame, $1 < \gamma_5 < 2$, and $0 < \gamma_6 \leq 1$.

[0169] According to this embodiment of the present invention, the determining module 720 estimates a global gain gradient of the current frame according to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame; and estimates the global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame ~~of the current frame~~.

[0170] According to this embodiment of the present invention, the global gain of the current frame is determined by using the following formula:

GainFrame = GainFrame_prevfrm*GainAtten, where GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < \text{GainAtten} \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.

[0171] FIG. 8 is a schematic structural diagram of a decoding apparatus 800 according to another embodiment of the present invention. The decoding apparatus 800 includes a generating module 810, a determining module 820, and an adjusting module 830.

[0172] In a case in which it is determined that a current frame is a lost frame, the generating module 810 synthesizes a high frequency band signal according to a decoding result of a previous frame of the current frame. The determining module 820 determines subframe gains of at least two subframes of the current frame, estimates a global gain gradient of the current frame according to a frame class of a last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame, and estimates a global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame. The adjusting module 830 adjusts, according to the global gain and the subframe gains of the at least two subframes that are determined by the determining module, the high frequency band signal synthesized by the generating module, to obtain a high frequency band signal of the current frame.

[0173] According to this embodiment of the present invention, GainFrame = GainFrame_prevfrm*GainAtten, where GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame,

+ GainGradFEC[0]*γ_3 + GainGradFEC[1]*γ_4; and

GainGradFEC[3] = GainGrad[n–1,2]*γ_1 + GainGradFEC[0]*γ_2

+ GainGradFEC[1]*γ_3 + GainGradFEC[2]*γ_4;

where GainGradFEC[j] is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the current frame, $GainGrad[n-1, j]$ is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the previous frame of the current frame, j = 0, 1, 2, ..., I–2, $\gamma_1+\gamma_2+\gamma_3+\gamma_4 = 1.0$, and $\gamma_4 > \gamma_3 > \gamma_2 > \gamma_1$, where γ_1, γ_2, γ_3, and γ_4 are determined by using the frame class of the received last frame, where the subframe gain of the another subframe except for the start subframe in the at least two subframes is determined by using the following formulas:

GainShapeTemp[n,i] = GainShapeTemp[n,i–1] + GainGradFEC[i], where i = 1, 2, 3, and GainShapeTemp[n,0] is the first gain gradient;

GainShapeTemp[n,i] = min(γ_5*GainShape[n–1,i],GainShapeTemp[n,i]); and

GainShape[n,i] = max(γ_6*GainShape[n–1,i],GainShapeTemp[n,i]);

where GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, i = 1, 2, 3, GainShape[n,i] is a subframe gain of the i^{th} subframe of the current frame, γ_5 and γ_6 are determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame, $1 < \gamma_5 < 2$, and $0 \leq \gamma_6 \leq 1$.

[0186] According to this embodiment of the present invention, the processor 910 estimates a global gain gradient of the current frame according to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame; and estimates the global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame ~~of the current frame~~.

[0187] According to this embodiment of the present invention, the global gain of the current frame is determined by using the following formula: GainFrame = GainFrame_prevfrm*GainAtten, where GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < GainAtten \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.

[0188] FIG. 10 is a schematic structural diagram of a decoding apparatus 1000 according to an embodiment of the present invention. The decoding apparatus 1000 includes a processor 1010, a memory 1020, and a communications bus 1030.

CLAIMS

What is claimed is:

1. A decoding method, comprising:

in a case in which it is determined that a current frame is a lost frame, synthesizing a high frequency band signal according to a decoding result of a previous frame of the current frame;

determining subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame;

determining a global gain of the current frame; and

adjusting, according to the global gain and the subframe gains of the at least two subframes, the synthesized high frequency band signal to obtain a high frequency band signal of the current frame.

2. The method according to claim 1, wherein the determining subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame comprises:

determining a subframe gain of a start subframe of the current frame according to the subframe gains of the subframes of the at least one frame and the gain gradient between the subframes of the at least one frame; and

determining a subframe gain of another subframe except for the start subframe in the at least two subframes according to the subframe gain of the start subframe of the current frame and the gain gradient between the subframes of the at least one frame.

3. The method according to claim 2, wherein the determining a subframe gain of a start subframe of the current frame according to the subframe gains of the subframes of the at least one frame and the gain gradient between the subframes of the at least one frame comprises:

estimating a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame; and

estimating the subframe gain of the start subframe of the current frame according to a subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient.

4. The method according to claim 3, wherein the estimating a first gain gradient between a last

subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame comprises:

performing weighted averaging on a gain gradient between at least two subframes of the previous frame of the current frame, to obtain the first gain gradient, wherein when the weighted averaging is performed, a gain gradient between subframes of the previous frame of the current frame that are closer to the current frame occupies a larger weight.

5. The method according to claim 3 or 4, wherein when the previous frame of the current frame is an $(n-1)^{th}$ frame, the current frame is an n^{th} frame, and each frame comprises I subframes, the first gain gradient is obtained by using the following formula:

$$GainGradFEC[0] = \sum_{j=0}^{I-2} GainGrad[n-1, j] * \alpha_j ,$$

wherein $GainGradFEC[0]$ is the first gain gradient, $GainGrad[n-1, j]$ is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the previous frame of the current frame, $\alpha_{j+1} \geq \alpha_j$, $\sum_{j=0}^{I-2} \alpha_j = 1$, and j = 0, 1, 2, ..., I–2;

wherein the subframe gain of the start subframe is obtained by using the following formulas:

$GainShapeTemp[n,0] = GainShape[n-1, I-1] + \varphi_1 * GainGradFEC[0]$; and

$GainShape[n,0] = GainShapeTemp[n,0] * \varphi_2$;

wherein $GainShape[n-1, I-1]$ is a subframe gain of an $(I-1)^{th}$ subframe of the $(n-1)^{th}$ frame, $GainShape[n,0]$ is the subframe gain of the start subframe of the current frame, $GainShapeTemp[n,0]$ is a subframe gain intermediate value of the start subframe, $0 \leq \varphi_1 \leq 1.0$, $0 < \varphi_2 \leq 1.0$, φ_1 is determined by using a frame class of a last frame received before the current frame and a plus or minus sign of the first gain gradient, and φ_2 is determined by using the frame class of the last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame.

6. The method according to claim 3, wherein the estimating a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame comprises:

using a gain gradient, between a subframe previous to the last subframe of the previous frame

of the current frame and the last subframe of the previous frame of the current frame, as the first gain gradient.

7. The method according to claim 3 or 6, wherein when the previous frame of the current frame is an $(n-1)^{th}$ frame, the current frame is an n^{th} frame, and each frame comprises I subframes, the first gain gradient is obtained by using the following formula: $GainGradFEC[0] = GainGrad[n-1, I-2]$,

wherein $GainGradFEC[0]$ is the first gain gradient, $GainGrad[n-1, I-2]$ is a gain gradient between an $(I-2)^{th}$ subframe and an $(I-1)^{th}$ subframe of the previous frame of the current frame,

wherein the subframe gain of the start subframe is obtained by using the following formulas:

$GainShapeTemp[n,0] = GainShape[n-1, I-1] + \lambda_1 * GainGradFEC[0]$;

$GainShapeTemp[n,0] = \min(\lambda_2 * GainShape[n-1, I-1], GainShapeTemp[n,0])$; and

$GainShape[n,0] = \max(\lambda_3 * GainShape[n-1, I-1], GainShapeTemp[n,0])$;

wherein $GainShape[n-1, I-1]$ is a subframe gain of the $(I-1)^{th}$ subframe of the previous frame of the current frame, $GainShape[n,0]$ is the subframe gain of the start subframe, $GainShapeTemp[n,0]$ is a subframe gain intermediate value of the start subframe, $0 < \lambda_1 < 1.0$, $1 < \lambda_2 < 2$, $0 < \lambda_3 < 1.0$, λ_1 is determined by using a frame class of a last frame received before the current frame and a multiple relationship between subframe gains of last two subframes of the previous frame of the current frame, and λ_2 and λ_3 are determined by using the frame class of the last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame.

8. The method according to any one of claims 3 to 7, wherein the estimating the subframe gain of the start subframe of the current frame according to a subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient comprises:

estimating the subframe gain of the start subframe of the current frame according to the subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient, and the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

9. The method according to any one of claims 2 to 8, wherein the determining a subframe gain of another subframe except for the start subframe in the at least two subframes according to the subframe gain of the start subframe of the current frame and the gain gradient between the subframes of the at least one frame comprises:

estimating a gain gradient between the at least two subframes of the current frame according to the gain gradient between the subframes of the at least one frame; and

estimating the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame.

10. The method according to claim 9, wherein each frame comprises I subframes, and the estimating a gain gradient between the at least two subframes of the current frame according to the gain gradient between the subframes of the at least one frame comprises:

performing weighted averaging on a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of the previous frame of the current frame and a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of a previous frame of the previous frame of the current frame, and estimating a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of the current frame, wherein i = 0, 1, ..., I–2, and a weight occupied by the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the current frame is greater than a weight occupied by the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the previous frame of the current frame.

11. The method according to claim 9 or 10, wherein when the previous frame of the current frame is the $(n-1)^{th}$ frame, and the current frame is the n^{th} frame, the gain gradient between the at least two subframes of the current frame is determined by using the following formula:

$$GainGradFEC[i+1] = GainGrad[n-2,i]*\beta_1 + GainGrad[n-1,i]*\beta_2,$$

wherein $GainGradFEC[i+1]$ is a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe, $GainGrad[n-2,i]$ is the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the previous frame of the current frame, $GainGrad[n-1,i]$ is the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the current frame, $\beta_2 > \beta_1$, $\beta_2 + \beta_1 = 1.0$, and i = 0, 1, 2, ..., I–2;

wherein the subframe gain of the another subframe except for the start subframe in the at least two subframes is determined by using the following formulas:

$$GainShapeTemp[n,i] = GainShapeTemp[n,i-1] + GainGradFEC[i]*\beta_3; \text{ and}$$

$$GainShape[n,i] = GainShapeTemp[n,i]*\beta_4;$$

wherein GainShape[n,i] is a subframe gain of an i^{th} subframe of the current frame, GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, $0 \le \beta_3 \le 1.0$, $0 < \beta_4 \le 1.0$, β_3 is determined by using a multiple relationship between

GainGrad[n–1,i] and GainGrad[n–1,i+1] and a plus or minus sign of GainGrad[n–1,i+1], and β_4 is determined by using the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

12. The method according to claim 9, wherein each frame comprises I subframes, and the estimating a gain gradient between the at least two subframes of the current frame according to the gain gradient between the subframes of the at least one frame comprises:

performing weighted averaging on I gain gradients between (I+1) subframes previous to an i^{th} subframe of the current frame, and estimating a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of the current frame, wherein i = 0, 1, ..., I–2, and a gain gradient between subframes that are closer to the i^{th} subframe occupies a larger weight.

13. The method according to claim 9 or 12, wherein when the previous frame of the current frame is the $(n-1)^{th}$ frame, the current frame is the n^{th} frame, and each frame comprises four subframes, the gain gradient between the at least two subframes of the current frame is determined by using the following formulas:

GainGradFEC[1] = GainGrad[n–1,0]*γ_1 + GainGrad[n–1,1]*γ_2

+ GainGrad[n–1,2]*γ_3 + GainGradFEC[0]*γ_4;

GainGradFEC[2] = GainGrad[n–1,1]*γ_1 + GainGrad[n–1,2]*γ_2

+ GainGradFEC[0]*γ_3 + GainGradFEC[1]*γ_4; and

GainGradFEC[3] = GainGrad[n–1,2]*γ_1 + GainGradFEC[0]*γ_2

+ GainGradFEC[1]*γ_3 + GainGradFEC[2]*γ_4;

wherein GainGradFEC[j] is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the current frame, $\mathrm{GainGrad}[n-1, j]$ is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the previous frame of the current frame, j = 0, 1, 2, ..., I–2, $\gamma_1+\gamma_2+\gamma_3+\gamma_4 = 1.0$, and $\gamma_4 > \gamma_3 > \gamma_2 > \gamma_1$, wherein γ_1, γ_2, γ_3, and γ_4 are determined by using the frame class of the received last frame,

wherein the subframe gain of the another subframe except for the start subframe in the at least two subframes is determined by using the following formulas:

GainShapeTemp[n,i] = GainShapeTemp[n,i–1] + GainGradFEC[i], wherein i = 1, 2, 3, and GainShapeTemp[n,0] is the first gain gradient;

GainShapeTemp[n,i] = min(γ_5*GainShape[n–1,i],GainShapeTemp[n,i]); and

GainShape[n,i] = max(γ_6*GainShape[n–1,i],GainShapeTemp[n,i]);

wherein i = 1, 2, 3, GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, GainShape[n,i] is a subframe gain of the i^{th} subframe of the current frame, γ_5 and γ_6 are determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame, $1 < \gamma_5 < 2$, and $0 \leq \gamma_6 \leq 1$.

14. The method according to any one of claims 9 to 13, wherein the estimating the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame comprises:

estimating the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame, and the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

15. The method according to any one of claims 1 to 14, wherein the estimating a global gain of the current frame comprises:

estimating a global gain gradient of the current frame according to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame; and

estimating the global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame.

16. The method according to claim 15, wherein the global gain of the current frame is determined by using the following formula:

GainFrame = GainFrame_prevfrm*GainAtten, wherein GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < \text{GainAtten} \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.

17. A decoding method, comprising:

in a case in which it is determined that a current frame is a lost frame, synthesizing a high frequency band signal according to a decoding result of a previous frame of the current frame;

determining subframe gains of at least two subframes of the current frame;

estimating a global gain gradient of the current frame according to a frame class of a last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame;

estimating a global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame; and

adjusting, according to the global gain and the subframe gains of the at least two subframes, the synthesized high frequency band signal to obtain a high frequency band signal of the current frame.

18. The method according to claim 17, wherein the global gain of the current frame is determined by using the following formula:

GainFrame = GainFrame_prevfrm*GainAtten, wherein GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < \text{GainAtten} \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.

19. A decoding apparatus, comprising:

a generating module, configured to: in a case in which it is determined that a current frame is a lost frame, synthesize a high frequency band signal according to a decoding result of a previous frame of the current frame;

a determining module, configured to determine subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame, and determine a global gain of the current frame; and

an adjusting module, configured to adjust, according to the global gain and the subframe gains of the at least two subframes that are determined by the determining module, the high frequency band signal synthesized by the generating module, to obtain a high frequency band signal of the current frame.

20. The decoding apparatus according to claim 19, wherein the determining module determines a subframe gain of a start subframe of the current frame according to the subframe gains of the subframes of the at least one frame and the gain gradient between the subframes of the at least one frame, and determines a subframe gain of another subframe except for the start subframe in the at least two subframes according to the subframe gain of the start subframe of the current frame and the gain gradient between the subframes of the at least one frame.

21. The decoding apparatus according to claim 20, wherein the determining module estimates a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame, and estimates the subframe gain of the start subframe of the current frame

according to a subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient.

22. The decoding apparatus according to claim 21, wherein the determining module performs weighted averaging on a gain gradient between at least two subframes of the previous frame of the current frame, to obtain the first gain gradient, wherein when the weighted averaging is performed, a gain gradient between subframes of the previous frame of the current frame that are closer to the current frame occupies a larger weight.

23. The decoding apparatus according to claim 21 or 22, wherein when the previous frame of the current frame is an $(n-1)^{th}$ frame, the current frame is an n^{th} frame, and each frame comprises I subframes, the first gain gradient is obtained by using the following formula:

$$\text{GainGradFEC}[0] = \sum_{j=0}^{I-2} \text{GainGrad}[n-1, j] * \alpha_j ,$$

wherein $\text{GainGradFEC}[0]$ is the first gain gradient, $\text{GainGrad}[n-1, j]$ is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the previous frame of the current frame, $\alpha_{j+1} \geq \alpha_j$, $\sum_{j=0}^{I-2} \alpha_j = 1$, and j = 0, 1, 2, ..., I–2,

wherein the subframe gain of the start subframe is obtained by using the following formulas:

$$\text{GainShapeTemp}[n,0] = \text{GainShape}[n-1, I-1] + \varphi_1 * \text{GainGradFEC}[0]; \text{ and}$$

$$\text{GainShape}[n,0] = \text{GainShapeTemp}[n,0] * \varphi_2 ;$$

wherein $\text{GainShape}[n-1, I-1]$ is a subframe gain of an $(I-1)^{th}$ subframe of the $(n-1)^{th}$ frame, $\text{GainShape}[n,0]$ is the subframe gain of the start subframe of the current frame, $\text{GainShapeTemp}[n,0]$ is a subframe gain intermediate value of the start subframe, $0 \leq \varphi_1 \leq 1.0$, $0 < \varphi_2 \leq 1.0$, φ_1 is determined by using a frame class of a last frame received before the current frame and a plus or minus sign of the first gain gradient, and φ_2 is determined by using the frame class of the last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame.

24. The decoding apparatus according to claim 21, wherein the determining module uses a gain gradient, between a subframe previous to the last subframe of the previous frame of the current frame and the last subframe of the previous frame of the current frame, as the first gain gradient.

25. The decoding apparatus according to claim 21 or 24, wherein when the previous frame of the current frame is an $(n-1)^{th}$ frame, the current frame is an n^{th} frame, and each frame comprises I

subframes, the first gain gradient is obtained by using the following formula: $GainGradFEC[0] = GainGrad[n-1, I-2]$,

wherein $GainGradFEC[0]$ is the first gain gradient, $GainGrad[n-1, I-2]$ is a gain gradient between an $(I-2)^{th}$ subframe and an $(I-1)^{th}$ subframe of the previous frame of the current frame,

wherein the subframe gain of the start subframe is obtained by using the following formulas:

$GainShapeTemp[n,0] = GainShape[n-1, I-1] + \lambda_1 * GainGradFEC[0]$;

$GainShapeTemp[n,0] = \min(\lambda_2 * GainShape[n-1, I-1], GainShapeTemp[n,0])$; and

$GainShape[n,0] = \max(\lambda_3 * GainShape[n-1, I-1], GainShapeTemp[n,0])$;

wherein $GainShape[n-1, I-1]$ is a subframe gain of the $(I-1)^{th}$ subframe of the previous frame of the current frame, $GainShape[n,0]$ is the subframe gain of the start subframe, $GainShapeTemp[n,0]$ is a subframe gain intermediate value of the start subframe, $0 < \lambda_1 < 1.0$, $1 < \lambda_2 < 2$, $0 < \lambda_3 < 1.0$, λ_1 is determined by using a frame class of a last frame received before the current frame and a multiple relationship between subframe gains of last two subframes of the previous frame of the current frame, and λ_2 and λ_3 are determined by using the frame class of the last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame.

26. The decoding apparatus according to any one of claims 21 to 25, wherein the determining module estimates the subframe gain of the start subframe of the current frame according to the subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient, and the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

27. The decoding apparatus according to any one of claims 20 to 26, wherein the determining module estimates a gain gradient between the at least two subframes of the current frame according to the gain gradient between the subframes of the at least one frame, and estimates the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame.

28. The decoding apparatus according to claim 27, wherein each frame comprises I subframes, and the determining module performs weighted averaging on a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of the previous frame of the current frame and a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of a previous frame of the previous frame of the

current frame, and estimates a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of the current frame, wherein i = 0, 1, ..., I–2, and a weight occupied by the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the current frame is greater than a weight occupied by the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the previous frame of the current frame.

29. The decoding apparatus according to claim 27 or 28, wherein the gain gradient between the at least two subframes of the current frame is determined by using the following formula:

$$GainGradFEC[i+1] = GainGrad[n-2,i]*\beta_1 + GainGrad[n-1,i]*\beta_2,$$

wherein $GainGradFEC[i+1]$ is a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe, $GainGrad[n-2,i]$ is the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the previous frame of the current frame, $GainGrad[n-1,i]$ is the gain gradient between the i^{th} subframe and the $(i+1)^{th}$ subframe of the previous frame of the current frame, $\beta_2 > \beta_1$, $\beta_2 + \beta_1 = 1.0$, and i = 0, 1, 2, ..., I–2;

wherein the subframe gain of the another subframe except for the start subframe in the at least two subframes is determined by using the following formulas:

GainShapeTemp[n,i] = GainShapeTemp[n,i–1] + GainGradFEC[i]* β_3; and

GainShape[n,i] = GainShapeTemp[n,i]* β_4;

wherein GainShape[n,i] is a subframe gain of an i^{th} subframe of the current frame, GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, $0 \le \beta_3 \le 1.0$, $0 < \beta_4 \le 1.0$, β_3 is determined by using a multiple relationship between GainGrad[n–1,i] and GainGrad[n–1,i+1] and a plus or minus sign of GainGrad[n–1,i+1], and β_4 is determined by using the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

30. The decoding apparatus according to claim 27, wherein the determining module performs weighted averaging on I gain gradients between (I+1) subframes previous to an i^{th} subframe of the current frame, and estimates a gain gradient between an i^{th} subframe and an $(i+1)^{th}$ subframe of the current frame, wherein i = 0, 1, ..., I–2, and a gain gradient between subframes that are closer to the i^{th} subframe occupies a larger weight.

31. The decoding apparatus according to claim 27 or 30, wherein when the previous frame of the current frame is the $(n-1)^{th}$ frame, the current frame is the n^{th} frame, and each frame comprises four subframes, the gain gradient between the at least two subframes of the current frame is determined by using the following formulas:

GainGradFEC[1] = GainGrad[n–1,0]*γ_1 + GainGrad[n–1,1]*γ_2

+ GainGrad[n–1,2]*γ_3 + GainGradFEC[0]*γ_4;

GainGradFEC[2] = GainGrad[n–1,1]*γ_1 + GainGrad[n–1,2]*γ_2

+ GainGradFEC[0]*γ_3 + GainGradFEC[1]*γ_4; and

GainGradFEC[3] = GainGrad[n–1,2]*γ_1 + GainGradFEC[0]*γ_2

+ GainGradFEC[1]*γ_3 + GainGradFEC[2]*γ_4;

wherein GainGradFEC[j] is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the current frame, $GainGrad[n-1, j]$ is a gain gradient between a j^{th} subframe and a $(j+1)^{th}$ subframe of the previous frame of the current frame, j = 0, 1, 2, ..., I–2, $\gamma_1+\gamma_2+\gamma_3+\gamma_4 = 1.0$, and $\gamma_4 > \gamma_3 > \gamma_2 > \gamma_1$, wherein γ_1, γ_2, γ_3, and γ_4 are determined by using the frame class of the received last frame,

wherein the subframe gain of the another subframe except for the start subframe in the at least two subframes is determined by using the following formulas:

GainShapeTemp[n,i] = GainShapeTemp[n,i–1] + GainGradFEC[i], wherein i = 1, 2, 3, and GainShapeTemp[n,0] is the first gain gradient;

GainShapeTemp[n,i] = min(γ_5*GainShape[n–1,i],GainShapeTemp[n,i]); and

GainShape[n,i] = max(γ_6*GainShape[n–1,i],GainShapeTemp[n,i]);

wherein GainShapeTemp[n,i] is a subframe gain intermediate value of the i^{th} subframe of the current frame, i = 1, 2, 3, GainShape[n,i] is a subframe gain of the i^{th} subframe of the current frame, γ_5 and γ_6 are determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame, $1 < \gamma_5 < 2$, and $0 \leq \gamma_6 \leq 1$.

32. The decoding apparatus according to any one of claims 27 to 31, wherein the determining module estimates the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame, and the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

33. The decoding apparatus according to any one of claims 19 to 32, wherein the determining module estimates a global gain gradient of the current frame according to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame; and

estimates the global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame of the current frame.

34. The decoding apparatus according to claim 33, wherein the global gain of the current frame is determined by using the following formula:

GainFrame = GainFrame_prevfrm*GainAtten, wherein GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < \text{GainAtten} \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.

35. A decoding apparatus, comprising:

a generating module, configured to: in a case in which it is determined that a current frame is a lost frame, synthesize a high frequency band signal according to a decoding result of a previous frame of the current frame;

a determining module, configured to determine subframe gains of at least two subframes of the current frame, estimate a global gain gradient of the current frame according to a frame class of a last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame, and estimate a global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame; and

an adjusting module, configured to adjust, according to the global gain and the subframe gains of the at least two subframes that are determined by the determining module, the high frequency band signal synthesized by the generating module, to obtain a high frequency band signal of the current frame.

36. The decoding apparatus according to claim 35, wherein GainFrame = GainFrame_prevfrm*GainAtten, wherein GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < \text{GainAtten} \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.

CLAIMS

1. A decoding method, comprising:

in a case in which it is determined that a current frame is a lost frame, synthesizing a high frequency band signal according to a decoding result of a previous frame of the current frame;

determining subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame;

determining a global gain of the current frame; and

adjusting, according to the global gain and the subframe gains of the at least two subframes, the synthesized high frequency band signal to obtain a high frequency band signal of the current frame.

2. The method according to claim 1, wherein the determining subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame comprises:

determining a subframe gain of a start subframe of the current frame according to the subframe gains of the subframes of the at least one frame and the gain gradient between the subframes of the at least one frame; and

determining a subframe gain of another subframe except for the start subframe in the at least two subframes according to the subframe gain of the start subframe of the current frame and the gain gradient between the subframes of the at least one frame.

3. The method according to claim 2, wherein the determining a subframe gain of a start subframe of the current frame according to the subframe gains of the subframes of the at least one frame and the gain gradient between the subframes of the at least one frame comprises:

estimating a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame; and

estimating the subframe gain of the start subframe of the current frame according to a subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient.

4. The method according to claim 3, wherein the estimating a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame

according to a gain gradient between subframes of the previous frame of the current frame comprises:

performing weighted averaging on a gain gradient between at least two subframes of the previous frame of the current frame, to obtain the first gain gradient, wherein when the weighted averaging is performed, a gain gradient between subframes of the previous frame of the current frame that are closer to the current frame occupies a larger weight.

5. The method according to claim 3, wherein the estimating a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame comprises:

using a gain gradient, between a subframe previous to the last subframe of the previous frame of the current frame and the last subframe of the previous frame of the current frame, as the first gain gradient.

6. The method according to any one of claims 1 to 5, wherein the determining a global gain of the current frame comprises:

determining a global gain gradient of the current frame according to the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame; and

estimating the global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame.

7. A decoding apparatus, comprising:

a generating module, configured to: in a case in which it is determined that a current frame is a lost frame, synthesize a high frequency band signal according to a decoding result of a previous frame of the current frame;

a determining module, configured to determine subframe gains of at least two subframes of the current frame according to subframe gains of subframes of at least one frame previous to the current frame and a gain gradient between the subframes of the at least one frame, and determine a global gain of the current frame; and

an adjusting module, configured to adjust, according to the global gain and the subframe gains of the at least two subframes that are determined by the determining module, the high frequency band signal synthesized by the generating module, to obtain a high frequency band signal of the current frame.

8. The decoding apparatus according to claim 7, wherein the determining module determines a subframe gain of a start subframe of the current frame according to the subframe gains of the

subframes of the at least one frame and the gain gradient between the subframes of the at least one frame, and determines a subframe gain of another subframe except for the start subframe in the at least two subframes according to the subframe gain of the start subframe of the current frame and the gain gradient between the subframes of the at least one frame.

9. The decoding apparatus according to claim 8, wherein the determining module estimates a first gain gradient between a last subframe of the previous frame of the current frame and the start subframe of the current frame according to a gain gradient between subframes of the previous frame of the current frame, and estimates the subframe gain of the start subframe of the current frame according to a subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient.

10. The decoding apparatus according to claim 9, wherein the determining module performs weighted averaging on a gain gradient between at least two subframes of the previous frame of the current frame, to obtain the first gain gradient, wherein when the weighted averaging is performed, a gain gradient between subframes of the previous frame of the current frame that are closer to the current frame occupies a larger weight.

11. The decoding apparatus according to claim 9, wherein the determining module uses a gain gradient, between a subframe previous to the last subframe of the previous frame of the current frame and the last subframe of the previous frame of the current frame, as the first gain gradient.

12. The decoding apparatus according to any one of claims 9 to 11, wherein the determining module estimates the subframe gain of the start subframe of the current frame according to the subframe gain of the last subframe of the previous frame of the current frame and the first gain gradient, and the frame class of the last frame received before the current frame and the quantity of consecutive lost frames previous to the current frame.

13. The decoding apparatus according to any one of claims 8 to 12, wherein the determining module estimates a gain gradient between the at least two subframes of the current frame according to the gain gradient between the subframes of the at least one frame, and estimates the subframe gain of the another subframe except for the start subframe in the at least two subframes according to the gain gradient between the at least two subframes of the current frame and the subframe gain of the start subframe of the current frame.

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14. A decoding apparatus, comprising:

a generating module, configured to: in a case in which it is determined that a current frame is a lost frame, synthesize a high frequency band signal according to a decoding result of a previous frame of the current frame;

a determining module, configured to determine subframe gains of at least two subframes of the current frame, estimate a global gain gradient of the current frame according to a frame class of a last frame received before the current frame and a quantity of consecutive lost frames previous to the current frame, and estimate a global gain of the current frame according to the global gain gradient and a global gain of the previous frame of the current frame; and

an adjusting module, configured to adjust, according to the global gain and the subframe gains of the at least two subframes that are determined by the determining module, the high frequency band signal synthesized by the generating module, to obtain a high frequency band signal of the current frame.

15. The decoding apparatus according to claim 14, wherein GainFrame = GainFrame_prevfrm*GainAtten, wherein GainFrame is the global gain of the current frame, GainFrame_prevfrm is the global gain of the previous frame of the current frame, $0 < \text{GainAtten} \leq 1.0$, GainAtten is the global gain gradient, and GainAtten is determined by using the frame class of the received last frame and the quantity of consecutive lost frames previous to the current frame.