Furthermore, the concept can be combined with a noise reduction scheme applied at the encoder side. Noise reduction enhances the signal-to-noise ratio (SNR) level, and improves the performance of the subsequent audio coding. The missing amount of noise in the decoded audio signal is then compensated by the comfort noise at the decoder side. However, it usually sounds more degraded or less natural, as noise reduction might distort the audio components and cause audible musical noise artifacts in addition to the coding artifacts. One aspect of the present invention is to mask such unpleasant distortions by adding a comfort noise at the decoder side. When using a noise reduction scheme, the addition of comfort noise does not deteriorate the SNR. Moreover, the comfort noise conceals a great part of the annoying musical noise typical to noise reduction techniques.

In a preferred embodiment of the invention the decoded frame is an active frame. This feature extends the principle of comfort noise addition to decoded active frames.

In a preferred embodiment of the invention the decoded frame is an ~~active~~ inactive frame. This feature extends the principle of comfort noise addition to decoded inactive frames.

In a preferred embodiment of the invention the noise estimating device comprises a spectral analysis device configured to create an analysis signal containing the level and the spectral shape of the noise in the decoded audio signal and a noise estimation producing device configured to produce the noise estimation signal based on the analysis signal.

In a preferred embodiment of the invention the comfort noise generating device comprises a noise generator configured to create a frequency domain comfort noise signal based on the noise estimation signal and a spectral

Claims

1. A decoder being configured for processing an encoded audio bitstream, wherein the decoder comprises:

a bitstream decoder configured to derive a decoded audio signal from the bitstream, wherein the decoded audio signal comprises at least one decoded frame;

a noise estimation device configured to produce a noise estimation signal containing an estimation of the level and/or the spectral shape of a noise in the decoded audio signal;

a comfort noise generating device configured to derive a comfort noise signal from the noise estimation signal; and

a combiner configured to combine the decoded frame of the decoded audio signal and the comfort noise signal in order to obtain an audio output signal, in such way that the decoded frame in the audio output signal comprises artificial noise.

2. A decoder according to the preceding claim, wherein the decoded frame is an active frame.

3. A decoder according to ~~one of the preceding claims~~claim 1, wherein the decoded frame is an inactive frame.

4. A decoder according to one of the preceding claims, wherein the noise estimating device comprises a spectral analysis device configured to create an analysis signal containing the level and the

13. A decoder according to the preceding claim, wherein the side information indicating whether the present frame is active or inactive consists of at least one dedicated bit in the bitstream.

14. A decoder according to claim 4 and according to one of the claims 7 to 13, wherein the control device is configured to determine the energy of the wanted signal of the decoded audio signal based on the analysis signal.

15. A decoder according to one of the claims 7 to 14, wherein the control device is configured to determine the energy of the noise of the decoded audio signal based on the noise estimation signal.

16. A decoder according to one of the preceding claims, wherein the comfort noise generating device is configured to create the comfort noise signal based on a target comfort noise level signal.

17. A decoder according to the preceding claim, wherein the target comfort noise level signal is adjusted depending on a bit-rate of the bitstream.

18. A decoder according to claim ~~15~~ 16 or 17, wherein the target comfort noise level signal is adjusted depending on a noise attenuation level caused by a noise reduction method applied to the bitstream .

19. A decoder according to one of the claims 16 to 18, wherein an energy $E_{\mathrm{w}}(k)$ of a frequency band k of the frequency domain comfort noise signal is adjusted depending on the target comfort noise level signal, which indicates a target comfort noise level g_{tar}, for each frequency band k as $E_{\mathrm{w}}(k) = \max\{(g_{\mathrm{tar}} - 1)\, \hat{E}_{\mathrm{n}}(k)\, ; 0\}$, wherein $\hat{E}_{\mathrm{n}}(k)$