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(54) Title: EMBEDDED SILENCE AND BACKGROUND NOISE COMPRESSION

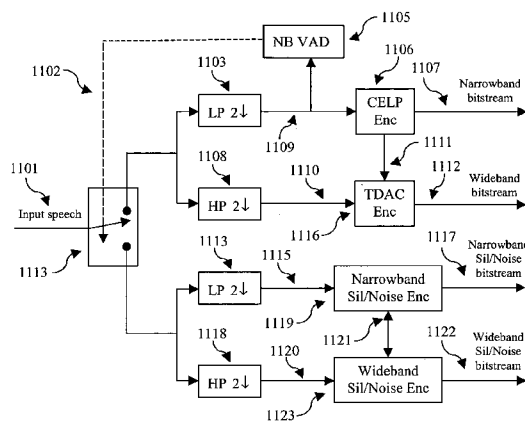


Figure 11: Silence/Background-Noise Encoding Mode for G.729.1 with Narrowband VAD and Separate Decimation Elements

(57) Abstract: There is provided a method for use by a speech encoder to encode an input speech signal. The method comprises receiving the input speech signal; determining whether the input speech signal includes an active speech signal or an inactive speech signal; low-pass filtering the inactive speech signal to generate a narrowband inactive speech signal; high-pass filtering the inactive speech signal to generate a high-band inactive speech signal; encoding the narrowband inactive speech signal using a narrowband inactive speech encoder to generate an encoded narrowband inactive speech; generating a low-to-high auxiliary signal by the narrowband inactive speech encoder based on the narrowband inactive speech signal; encoding the high-band inactive speech signal using a wideband inactive speech encoder to generate an encoded wideband inactive speech based on the low-to-high auxiliary signal from the narrowband inactive speech encoder; and transmitting the encoded narrowband inactive speech and the encoded wideband inactive speech.

WO 2008/100385 A4

AMENDED CLAIMS

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1. A method for use by a speech encoder to encode an input speech signal, the method
5 comprising
receiving the input speech signal;
determining whether the input speech signal includes an active speech signal or an inactive
speech signal;
low-pass filtering the inactive speech signal to generate a narrowband inactive speech signal;
10 high-pass filtering the inactive speech signal to generate a high-band inactive speech signal;
encoding the narrowband inactive speech signal using a narrowband inactive speech encoder
to generate an encoded narrowband inactive speech;
generating a first auxiliary signal by the narrowband inactive speech encoder based on the
narrowband inactive speech signal;
15 encoding the high-band inactive speech signal using a wideband inactive speech encoder to
generate an encoded wideband inactive speech based on the first auxiliary signal from the
narrowband inactive speech encoder;
transmitting the encoded narrowband inactive speech and the encoded wideband inactive
speech.
20
2. The method of claim 1 further comprising:
generating a second auxiliary signal by the wideband inactive speech encoder based on the
high-band inactive speech signal;
wherein the narrowband inactive speech encoder encodes the narrowband inactive speech
25 signal based on the second auxiliary signal from the wideband inactive speech encoder.
3. The method of claim 1, wherein the transmitting includes a discontinuous
transmission (DTX) scheme.
4. A method for use by a speech encoder to encode an input speech signal, the method
30 comprising
receiving the input speech signal;
determining whether the input speech signal includes an active speech signal or an inactive
speech signal;
35 low-pass filtering the inactive speech signal to generate a narrowband inactive speech signal;
high-pass filtering the inactive speech signal to generate a high-band inactive speech signal;

encoding the narrowband inactive speech signal in accordance with ITU-T G.729 Annex B Recommendation to generate a G.729B encoded narrowband inactive speech;

encoding the high-band inactive speech signal to generate an encoded wideband inactive speech;

5 transmitting the G.729B encoded narrowband inactive speech as a G.729B bitstream; and
transmitting the encoded wideband inactive speech as a wideband base layer bitstream following the G.729B bitstream.

5. The method of claim 4 further comprising:

10 encoding the narrowband inactive speech signal to generate an enhanced narrowband base layer bitstream;

transmitting the enhanced narrowband base layer bitstream following the wideband base layer bitstream.

15 6. The method of claim 5 further comprising:

encoding the high-band inactive speech signal to generate an enhanced wideband base layer bitstream;

transmitting the enhanced wideband base layer bitstream following the enhanced narrowband base layer bitstream.

20 7. The method of claim 4 further comprising:
encoding the high-band inactive speech signal to generate an enhanced wideband base layer bitstream;

25 transmitting the wideband narrowband base layer bitstream following the wideband base layer bitstream.

8. The method of claim 7 further comprising:

encoding the narrowband inactive speech signal to generate an enhanced narrowband base layer bitstream;

30 transmitting the enhanced narrowband base layer bitstream following the enhanced wideband base layer bitstream.

9. A method for use by a speech decoder to decode a decoded speech signal, the method comprising

35 receiving the decoded speech signal;

determining whether the decoded speech signal includes an active decoded speech signal or an inactive decoded speech signal;

decoding the active decoded speech signal as an embedded bitstream using a narrowband decoder and a wideband decoder to generate narrowband active speech parameters and wideband active speech parameters;

5 decoding the inactive decoded speech signal as narrowband bitstream to generate narrowband inactive speech parameters;

applying bandwidth extension to narrowband inactive speech parameters to generate wideband inactive speech parameters using the narrowband active speech parameters and the wideband active speech parameters.

10 10. A method for use by a speech encoder to encode an input speech signal, the method comprising

receiving the input speech signal;

low-pass filtering the speech signal to generate a narrowband speech signal;

high-pass filtering the speech signal to generate a high-band speech signal;

15 determining whether the narrowband input speech signal includes an active speech signal or an inactive speech signal;

encoding the narrowband speech signal using a narrowband inactive speech encoder to generate an encoded narrowband inactive speech if the determining determines that the narrowband input speech signal includes the inactive speech signal;

20 encoding the high-band speech signal using a wideband inactive speech encoder to generate an encoded wideband inactive speech if the determining determines that the narrowband input speech signal includes the inactive speech signal;

transmitting the encoded narrowband inactive speech and the encoded wideband inactive speech.

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11. The method of claim 10 further comprising:

generating a second auxiliary signal by the wideband inactive speech encoder based on the high-band speech signal;

30 wherein the narrowband inactive speech encoder encodes the narrowband speech signal based on the second auxiliary signal from the wideband inactive speech encoder.

12. The method of claim 10 further comprising:

generating a first auxiliary signal by the narrowband inactive speech encoder based on the narrowband speech signal;

35 wherein the wideband inactive speech encoder encodes the wideband speech signal based on the first auxiliary signal from the narrowband inactive speech encoder.

13. The method of claim 10, wherein the low-pass filtering for the active speech signal is different than the low-pass filtering for the inactive speech signal, and the high-pass filtering for the active speech signal is different than the high-pass filtering for the inactive speech signal.

5 14. The method of claim 10, wherein the transmitting includes a discontinuous transmission (DTX) scheme.

15. A speech encoder adapted to encode an input speech signal, the speech encoder comprising

10 a receiver configured to receive the input speech signal;

a voice activity detector configured to determine whether the input speech signal includes an active speech signal or an inactive speech signal;

a low-pass filter for low-pass filtering the inactive speech signal to generate a narrowband inactive speech signal;

15 a high-pass filter for high-pass filtering the inactive speech signal to generate a high-band inactive speech signal;

a narrowband inactive speech encoder configured to encode the narrowband inactive speech signal to generate an encoded narrowband inactive speech, and the narrowband inactive speech encoder further configured to generate a first auxiliary signal based on the narrowband inactive speech signal;

20 a wideband inactive speech encoder configured to encode the high-band inactive speech signal to generate an encoded wideband inactive speech based on the first auxiliary signal from the narrowband inactive speech encoder;

25 a transmitter configured to transmit the encoded narrowband inactive speech and the encoded wideband inactive speech.

16. The speech encoder of claim 15, wherein the wideband inactive speech encoder further configured to generate a second auxiliary signal based on the high-band inactive speech signal, and wherein the narrowband inactive speech encoder is further configured to encode the narrowband inactive speech signal based on the second auxiliary signal from the wideband inactive speech encoder.

17. The speech encoder of claim 15, wherein the transmitter is configured to transmit according to a discontinuous transmission (DTX) scheme.

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18. A speech encoder adapted to encode an input speech signal, the speech encoder comprising