Claims

1. Audio transmitter processor for generating an error protected frame using encoded audio data of an audio frame, the encoded audio data for the audio frame comprising a first amount of information units and a second amount of information units, the audio transmitter processor comprising:

a frame builder for building a codeword frame having a codeword raster defining reference positions for a predefined total number of codewords, wherein the frame builder is configured

to write the information units of the first amount of information units starting at reference positions of a first predefined subset of the codewords; and

to write the information units of the second amount of information units starting at reference positions of a second predefined subset of the codewords,

wherein at least a majority of the information units of the first amount of information units is psychoacoustically more important than a majority of the information units of the second amount of information units,

wherein the frame builder is configured to determine a border between the first amount of information units and the second amount of information units so that a starting information unit of the second amount of information units coincides with a codeword border; and

an error protection coder

for processing one or more of the codewords of the first predefined subset of the codewords to obtain a first processing result or for processing one or more of the codewords of the second predefined subset of the codewords to obtain a second processing result and for adding the first processing result or the second processing result to the predefined number of codewords to obtain a plurality of processed codewords representing the error protected frame, or

for processing the codewords of the first predefined subset of the codewords or of the second predefined subset of the codewords individually to obtain a plurality of processed codewords representing the error protected frame.

2. Audio transmitter processor of claim 1,

wherein the frame builder is configured to determine the border between the first amount of information units and the second amount of information units based on an information capacity of the second predefined subset, so that the information capacity of the second predefined subset of the codewords is equal to the amount of information units of the second amount of information units.

3. Audio transmitter processor of claim 1 or 2, further comprising:

a source encoder for generating the first and the second amounts of information units using a predefined time portion of an audio signal, wherein the information units comprise a number of obligatory information units and a variable number of residual information units, wherein the source encoder is configured for using a variable length coding rule resulting in a signal-dependent number of the obligatory information units for the predefined time portion,

wherein the frame builder is configured to build the codeword frame so that the codeword frame has a fixed size of information units, and

wherein the audio encoder is configured to determine the variable number of residual information units as an information amount being equal to the difference derived from the fixed size of information units for the codeword frame and the number of obligatory information units.

4. Audio transmitter processor of one of the preceding claims,

wherein the frame builder is configured to determine the border between the first amount of information units and the second amount of information units signal-adaptively from codeword frame to codeword frame, so that, depending on the audio signal for a codeword frame, the border represents an encoded information unit

relating to different audio information of the codeword frame or being interpreted differently by an audio decoder.

5. Audio transmitter processor of one of the preceding claims,

wherein the frame builder is configured to use, as the second subset of the codewords, a second predefined number of adjacent codewords at one side of the codeword frame of the encoded audio data, to use, as the first predefined subset of the codewords, a first predefined number of adjacent codewords at another side of the codeword frame of the encoded audio data, and wherein a sum of the first predefined number and the second predefined number is equal to the predefined total number of codewords, or

wherein at least one codeword of the second predefined subset of the codewords is located between two codewords of the first predefined subset of the codewords or vice versa.

6. Audio transmitter processor in accordance with one of the preceding claims, wherein the frame builder is configured

to write the first amount of information units using reference positions of the first predefined subset of the codewords into the first predefined subset of the codewords,

as soon as the first predefined subset of the codewords is filled, to write the second amount of information units using reference positions of the second predefined subset of the codewords, and

wherein the frame builder is configured to determine the border as the information unit written into a last codeword of the first predefined subset of the codewords or as the first information unit written at a reference position of a first codeword of the second predefined subset of the codewords.

7. Audio transmitter processor of one of the preceding claims,

wherein the frame builder is configured to write the information units of the first amount of information units in a first writing direction starting at reference positions of at least two codewords of the first predefined number of codewords, and in a second opposite writing direction starting at reference positions of at least two other codewords of the first predefined number of codewords, or

wherein the frame builder is configured to write the information units of the second amount of information units in a first writing direction starting at reference positions of at least two codewords of the second predefined number of codewords and in a second opposite writing direction starting at reference positions of at least two other codewords of the second predefined number of codewords.

8. Audio transmitter processor of one of the preceding claims,

wherein only a partial frame loss concealment is envisioned in an audio receiver processor when only information units in the second amount of information units are determined as corrupted and wherein a full frame loss concealment is envisioned in the audio receiver processor when information units in the first amount of information units are determined as corrupted.

9. Audio transmitter processor of one of the preceding claims, further comprising a source encoder for generating at least two categories of information units, the at least two categories being selected from the group consisting of fixed length side information, variable length side information, temporal noise shaping information, one or more most significant bits of a spectrum of a first frequency portion of the spectrum, one or more most significant bits of a second frequency portion having higher frequencies than the first frequency portion, one or more least significant bits or sign bits of a first frequency portion, one or more least significant bits or sign bits of a second frequency portion, the second frequency portion having higher frequencies than the first frequency portion, and residual bits,

wherein, if generated as a category by the source encoder, the fixed length side information, the variable length side information, the temporal noise shaping information, the one or more most significant bits of a spectrum of the first frequency portion, and the least significant bits or sign bits of a first frequency portion are

located in the first amount of information units, and wherein, if generated as a category by the source encoder, at least the one of the one or more most significant bits of the second frequency portion, the one or more least significant bits or sign bits of a second frequency portion and the residual bits are in the second amount of the information units.

10. Audio transmitter processor of one of the preceding claims,

wherein the frame builder is configured to use a first writing pointer (810) and a second writing pointer,

wherein the frame builder is configured to increment the first writing pointer in a direction from a lower information unit position in the codeword frame to a higher information unit position in the codeword frame,

wherein the frame builder is configured to decrement the second writing pointer in a direction from a higher information position in the codeword frame to a lower information position in the codeword frame,

wherein the frame builder is configured to start the first writing pointer (810) at a reference position indicating a start of a first codeword in a predefined sequence of codewords of the first predefined subset of the codewords,

wherein the frame builder is configured to start the second writing pointer at a reference position indicating an end of a last codeword in the predefined first sequence of codewords of the predefined first set of codewords,

wherein the frame builder is configured to write information units belonging to one or more first categories of information units from the first amount of information units at the positions indicated by the first writing pointer, and

wherein the frame builder is configured to write information units belonging to one or more second categories of information units from the first amount of information units at the position indicated by the second writing pointer until the first and second writing pointers meet each other at a meeting information unit position,

wherein the information unit written at the meeting information unit position represents the border between the first and the second amount of information units.

11. Audio transmitter processor of claim 10,

wherein the frame builder is configured to set the first pointer (810) to a reference position indicating the start of a first codeword of a second predefined sequence of codewords of the second predefined subset of the codewords,

to set the second writing pointer to a reference position indicating the end of a last codeword of the second predefined sequence of codewords of the second predefined subset of the codewords, and

to write information units of one or more third categories from the second amount of information units using the first writing pointer and to write information units of one or more fourth categories from the second amount of information units using the second writing pointer.

12. Audio transmitter processor of claim 10 or 11, wherein the one or more first categories of information units comprise at least one of temporal noise shaping information, and/or one or more most significant bits of a spectrum of a first frequency portion, or

wherein the one or more second categories of information units comprise at least one of fixed or variable length side information, and least significant bits or sign bits of the first frequency portion, or

wherein the one or more third categories of information units comprise at least one of most significant bits of a second frequency portion, or

wherein the one or more fourth categories of information units comprise at least one of least significant bits or sign bits of the second frequency portion and residual data.

13. Audio transmitter processor of claim 10 to 12,

wherein the frame builder is configured to use, as the one or more first category, most significant bits derived from spectral values ordered in an ascending order with respect to frequency until a spectral value or a combination of spectral values at the meeting information unit,

to use, as the one or more second category, least significant bits or sign bits derived from spectral values until the spectral value or the combination of spectral values of the meeting information unit;

to use, as the one or more third category, one or more most significant bits associated with a frequency at or above the value at the meeting information unit; and

to use, as the fourth category, least significant bits or sign bits associated with frequencies at or above the frequency value associated with the meeting information unit.

14. Audio transmitter processor of claim 13,

wherein the frame builder is configured to write the one or more first categories and the one or more second categories, or to write the one or more third categories and the one or more fourth categories in synchrony with each other, so that the at least one or more most significant bits of a spectral value or a combination of spectral values are written by the first writing pointer and the one or more least significant bits or sign bits of the same spectral value or of the same combination of spectral values are written, before information units from a further spectral value or a further combination of spectral values is written by the writing pointers.

15. Audio transmitter processor of one of the preceding claims, further comprising a source encoder for generating the encoded audio data in an intermediate representation extending from a start position to an end position, wherein the frame builder is configured to rearrange the encoded audio data in the intermediate representation into the order represented by the first and second predefined subsets of the codewords.

16. Audio transmitter processor of claim 15,

wherein the frame builder is configured to read and parse, from the start position and the end position, until a predefined amount of information units represented by a capacity of the first predefined subset of the codewords is obtained, and

to write the information units read and parsed into the first predefined subset of the codewords and to write remaining information units between the intermediate information unit obtained when the predefined amount determined by the capacity is read and parsed, into the second predefined subset of the codewords.

17. Audio transmitter processor of claim 16, wherein encoded temporal noise shaping data, side information data and the most significant data portion and the least significant data portion are read and written to the first predefined subset of the codewords and wherein the most significant data portion and the least significant data portion of spectral values above a specific frequency and residual data are written into the second predefined subset of the codewords.

18. Audio transmitter processor of one of the preceding claims,

wherein a number of codewords of the second predefined subset of the codewords is derived from a characteristic of the error protection code, and/or a total size of the plurality of processed codewords.

19. Audio transmitter processor of one of the preceding claims, wherein the error protection coder is configured

to calculate the first processing result as a first Hash value,

to calculate the second processing result as a second Hash value,

to add the first Hash value to the first predefined subset of the codewords and to add the second Hash value to the second predefined subset of the codewords, and

to apply a codeword-wise block code to obtain the error protected codewords.

20. Audio transmitter processor of one of the preceding claims,

further comprising an audio encoder having an arithmetic encoder (60) generating minimum size data portions in a first granularity of information units,

wherein the error protection coder is configured to operate in a second granularity of information units,

wherein the first granularity is different from the second granularity.

21. Audio transmitter processor of claim 20,

wherein the first granularity is greater than the second granularity, and

wherein at a reference position of a first codeword of the first predefined subset an adaption amount of information units corresponding to a granularity difference between the first and the second granularity is located.

22. Audio transmitter processor of claim 21, wherein the first granularity is greater than the second granularity and in an integer ratio, and wherein the adaption amount of information units together with data located at a reference position of a codeword of the second predefined subset of the codewords represent the minimum size data portion output by the arithmetic encoder.

23. Method of generating an error protected frame using encoded audio data of an audio frame, the encoded audio data for the audio frame comprising a first amount of information units and a second amount of information units, the method comprising:

building a codeword frame having a codeword raster defining reference positions for a predefined total number of codewords, wherein the building comprises:

writing the information units of the first amount of information units starting at reference positions of a first predefined subset of the codewords; and

writing the information units of the second amount of information units starting at reference positions of a second predefined subset of the codewords,

wherein at least a majority of the information units of the first amount of information units is psychoacoustically more important than a majority of the information units of the second amount of information units,

determining a border between the first amount of information units and the second amount of information units so that a starting information unit of the second amount of information units coincides with a codeword border; and

performing an error protection processing comprising:

processing one or more of the codewords of the first predefined subset of the codewords to obtain a first processing result or processing one or more of the codewords of the second predefined subset of the codewords to obtain a second processing result and adding the first processing result or the second processing result to the predefined number of codewords to obtain a plurality of processed codewords representing the error protected frame, or

processing the codewords of the first predefined subset of the codewords or of the second predefined subset of the codewords individually to obtain a plurality of processed codewords representing the error protected frame.

24. Computer program for performing, when running on a computer or a processor, a method of claim 23.