CLAIMS

1. A device configured to decode a bitstream representative of a higher order ambisonic audio signal, the device comprising:

a memory configured to store the bitstream; and

one or more processors configured to:

obtain, from the bitstream, an indication of a number of layers specified in the bitstream;

obtain, from the bitstream, an indication of a number of channels specified in the bitstream; and

obtain the layers of the bitstream based on the indication of the number of layers specified in the bitstream and the indication of the number of channels specified in the bitstream.

2. The device of claim 1,

wherein the one or more processors are configured to obtain an indication of a number of foreground channels specified in the bitstream for at least one of the layers, and

wherein the one or more processors are configured to obtain the foreground channels for the at least one of the layers of the bitstream based on the indication of the number of foreground channels.

3. The device of claim **1**,

wherein the one or more processors are configured to obtain an indication of a number of background channels specified in the bitstream for at least one of the layers, and

wherein the one or more processors are configured to obtain the background channels for the at least one of the layers of the bitstream based on the indication of the number of background channels.

4. The device of claim **1**,

wherein the indication of the number of the layers indicates that the number of layer is two,

wherein the two layers comprise a base layer and an enhancement layer, and

wherein the one or more processors are configured to obtain an indication that a number of foreground channels is zero for the base layer and two for the enhancement layer.

5. The device of claim **1**,

wherein the indication of the number of the layers indicates that the number of layer is two,

wherein the two layers comprise a base layer and an enhancement layer, and

wherein the one or more processors are configured to obtain an indication that a number of background channels is four for the base layer and zero for the enhancement layer.

6. The device of claim **1**,

wherein the indication of the number of the layers indicates that the number of layer is three,

wherein the three layers comprise a base layer, a first enhancement layer and a second enhancement layer, and

wherein the one or more processors are configured to obtain an indication that a number of foreground channels is zero for the base layer, two for the first enhancement layer and two for the third enhancement layer.

7. The device of claim **1**,

wherein the indication of the number of the layers indicates that the number of layer is three,

wherein the three layers comprise a base layer, a first enhancement layer and a second enhancement layer, and

wherein the one or more processors are further configured to obtain an indication that a number of background channels is two for the base layer, zero for the first enhancement layer and zero for the third enhancement layer.

8. The device of claim **1**,

wherein the indication of the number of the layers indicates that the number of layer is three,

wherein the three layers comprise a base layer, a first enhancement layer and a second enhancement layer, and

wherein the one or more processors are configured to obtain an indication that a number of foreground channels is two for the base layer, two for a first enhancement layer and two for a third enhancement layer.

9. The device of claim **1**,

wherein the indication of the number of the layers indicates that the number of layer is three,

wherein the three layers comprise a base layer, a first enhancement layer and a second enhancement layer, and

wherein the one or more processors are further configured to obtain a background syntax element indicating that the number of background channels is zero for the base layer, zero for the first enhancement layer and zero for the third enhancement layer.

10. The device of claim **1**,

wherein the indication of the number of layers comprises an indication of a number of layers in a previous frame of the bitstream, and

wherein the one or more processors are further configured to:

obtain an indication of whether a number of layers of the bitstream has changed in a current frame when compared to the number of layers of the bitstream in the previous frame; and

obtain the number of layers of the bitstream in the current frame based on the indication of whether the number of layers of the bitstream has changed in the current frame.

11. The device of claim **10**, wherein the one or more processors are further configured to determine the number of layers of the bitstream in the current frame as the same as the number of layers of the bitstream in the previous frame when the indication indicates that the number of layers of the

bitstream has not changed in the current frame when compared to the number of layers of the bitstream in the previous frame.

12. The device of claim **10**, wherein the one or more processors are further configured to, when the indication indicates that the number of layers of the bitstream has not changed in the current frame when compared to the number of layers of the bitstream in the previous frame, obtain an indication of a current number of components in one or more of the layers for the current frame to be the same as a previous number of components in one or more of the layers of the previous frame.

13. The device of claim **1**,

wherein the indication of the number of layers indicates that three layers are specified in the bitstream, and

wherein the one or more processors are configured to:

obtain a first one of the layers of the bitstream indicative of background components of the higher order ambisonic audio signal that provide for stereo channel playback;

obtain a second one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for three dimensional playback by three or more speakers arranged on one or more horizontal planes; and

obtain a third one of the layers of the bitstream indicative of foreground components of the higher order ambisonic audio signal.

14. The device of claim **1**,

wherein the indication of the number of layers indicates that three layers are specified in the bitstream, and

wherein the one or more processors are configured to:

obtain a first one of the layers of the bitstream indicative of background components of the higher order ambisonic audio signal that provide for mono channel playback;

obtain a second one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for three dimensional playback by three or more speakers arranged on one or more horizontal planes; and

obtain a third one of the layers of the bitstream indicative of foreground components of the higher order ambisonic audio signal.

15. The device of claim **1**,

wherein the indication of the number of layers indicates that three layers are specified in the bitstream, and

wherein the one or more processors are configured to:

obtain a first one of the layers of the bitstream indicative of background components of the higher order ambisonic audio signal that provide for stereo channel playback;

obtain a second one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for multi-channel playback by three or more speakers arranged on a single horizontal plane;

obtain a third one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for three dimensional playback by three or more speakers arranged on two or more horizontal planes; and

obtain a fourth one of the layers of the bitstream indicative of foreground components of the higher order ambisonic audio signal.

16. The device of claim **1**,

wherein the indication of the number of layers indicates that three layers are specified in the bitstream, and

wherein the one or more processors are configured to:

obtain a first one of the layers of the bitstream indicative of background components of the higher order ambisonic audio signal that provide for mono channel playback;

obtain a second one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for multi-channel playback by three or more speakers arranged on a single horizontal plane;

obtain a third one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for three dimensional playback by three or more speakers arranged on two or more horizontal planes; and

obtain a fourth one of the layers of the bitstream indicative of foreground components of the higher order ambisonic audio signal.

17. The device of claim **1**,

wherein the indication of the number of layers indicates that two layers are specified in the bitstream, and

wherein the one or more processors are configured to:

obtain a first one of the layers of the bitstream indicative of background components of the higher order ambisonic audio signal that provide for stereo channel playback; and

obtain a second one of the layers of the bitstream indicative of the background components of the higher order ambisonic audio signal that provide for horizontal multi-channel playback by three or more speakers arranged on a single horizontal plane.

18. The device of claim **1**, further comprising loudspeakers configured to reproduce a soundfield based on the higher order ambisonic audio signal.

19. A method of decoding a bitstream representative of a higher order ambisonic audio signal, the method comprising:

obtaining, by one or more processors and from the bitstream, an indication of a number of layers specified in the bitstream;

obtaining, by the one or more processors, an indication of a number of channels specified in the bitstream; and

obtaining, by the one or more processors, the layers of the bitstream based on the indication of the number of layers specified in the bitstream and the indication of the number of channels specified in the bitstream.

20. The method of claim **19**, wherein obtaining the indication of the number of channels specified in the bitstream comprises obtaining an indication of a number of foreground channels specified in the bitstream for at least one of the layers,

wherein obtaining the layers comprises obtaining the foreground channels for the at least one of the layers of the bitstream based on the indication of the number of foreground channels.

21. The method of claim **19**, wherein obtaining the indication of the number of channels specified in the bitstream comprises obtaining an indication of a number of background channels specified in the bitstream for at least one of the layers,

wherein obtaining the layers comprises obtaining the background channels for the at least one of the layers of the bitstream based on the indication of the number of background channels.

22. The method of claim **19**, wherein obtaining the indication of the number of channels specified in the bitstream comprises parsing an indication of a number of foreground channels specified in the bitstream for at least one of the layers based on a number of channels remaining in the bitstream after the at least one of the layers is obtained,

wherein obtaining the layers comprises obtaining the foreground channels of the at least one of the layers based on the indication of the number of foreground channels.

23. The method of claim **22**, wherein the number of channels remaining in the bitstream after the at least one of the layers is obtained is represented by a syntax element.

24. The method of claim **19**, wherein obtaining the indication of the number of channels specified in the bitstream comprises parsing an indication of a number of background channels specified in the bitstream for at least one of the layers based on a number of channels after the at least one of the layers is obtained,

wherein obtaining the layers comprises obtaining the background channels for the at least one of the layers from the bitstream based on the indication of the number of background channels.

25. The method of claim **24**, wherein the number of channels remaining in the bitstream after the at least one of the layers is obtained is represented by a syntax element.

26. The method of claim **19**,

wherein the layers of the bitstream comprise a base layer and an enhancement layer, and

wherein the method further comprises applying a correlation transform with respect to one or more channels of the base layer to obtain a correlated representation of background components of the higher order ambisonic audio signal.

27. The method of claim **26**, wherein the correlation transform comprises an inverse UHJ transform with U of the UHJ transform referring to U from Universal (UD-4), H of the UHJ transform referring to H from Matrix H, and J of the UHJ transform referring to J from system 45J.

28. The method of claim **26**, wherein the correlation transform comprises an inverse mode matrix transform.

29. The method of claim **19**, wherein a number of channels for each of the layers of the bitstream is fixed.

30. An apparatus configured to decode a bitstream representative of a higher order ambisonic audio signal, the apparatus comprising:

means for storing the bitstream;

means for obtaining, from the bitstream, an indication of a number of layers specified in the bitstream;

means for obtaining an indication of a number of channels specified in the bitstream; and

means for obtaining the layers of the bitstream based on the indication of the number of layers specified in the bitstream and the indication of the number of channels specified in the bitstream.

31. A non-transitory computer-readable storage medium having stored thereon instructions that, when executed, cause one or more processors to:

obtain, from a bitstream, an indication of a number of layers specified in the bitstream;

obtain an indication of a number of channels specified in the bitstream; and

obtain the layers of the bitstream based on the indication of the number of layers specified in the bitstream and the indication of the number of channels specified in the bitstream.

32. A device configured to encode a higher order ambisonic audio signal to generate a bitstream, the device comprising:

a memory configured to store the bitstream; and

one or more processors configured to specify an indication of a number of layers in the bitstream, specify an indication of a number of channels included in the bitstream, and output the bitstream that includes the indicated number of the layers including the indicated number of channels.

33. The device of claim **32**, wherein the indication of the number of layers comprises an indication of a number of layers in the bitstream for a previous frame, and

wherein the one or more processors are further configured to:

specify, in the bitstream, an indication of whether a number of layers of the bitstream has changed for a current frame when compared to the number of layers of the bitstream for the previous frame; and

specify the indicated number of layers of the bitstream in the current frame.

34. The device of claim **33**, wherein the one or more processors are configured to, when the indication indicates that the number of layers of the bitstream has not changed in the current frame when compared to the number of layers of the bitstream in the previous frame, specify the indicated number of layers without specifying, in the bitstream, an indication of a current number of background components in one or more of the layers for the current frame to be equal to a previous number of background components in one or more of the layers of the previous frame.

35. The device of claim **32**, further comprising a microphone to capture the higher order ambisonic audio signal.

36. A method of generating a bitstream representative of a higher order ambisonic audio signal, the method comprising:

specifying, by one or more processors, an indication of a number of layers in the bitstream;

specifying, by the one or more processors, an indication of a number of channels included in the bitstream; and

outputting, by the one or more processors, the bitstream that includes the indicated number of the layers including the indicated number of channels.

37. The method of claim **36**, wherein the layers are hierarchical such that a first layer, when combined with a second layer, provides a higher resolution representation of the higher order ambisonic audio signal.

38. The method of claim **36**,

wherein the layers of the bitstream comprise a base layer and an enhancement layer, and

wherein the method further comprises applying a decorrelation transform with respect to one or more channels of the base layer to obtain a decorrelated representation of background components of the higher order ambisonic audio signal.

39. The method of claim **38**, wherein the decorrelation transform comprises a UHJ transform with U of the UHJ transform referring to U from Universal (UD-4), H of the UHJ transform referring to H from Matrix H, and J of the UHJ transform referring to J from system 45J.

40. The method of claim **38**, wherein the decorrelation transform comprises a mode matrix transform.