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(71) Applicant: **Panasonic Corporation**
Kadoma-shi, Osaka 571-8501 (JP)

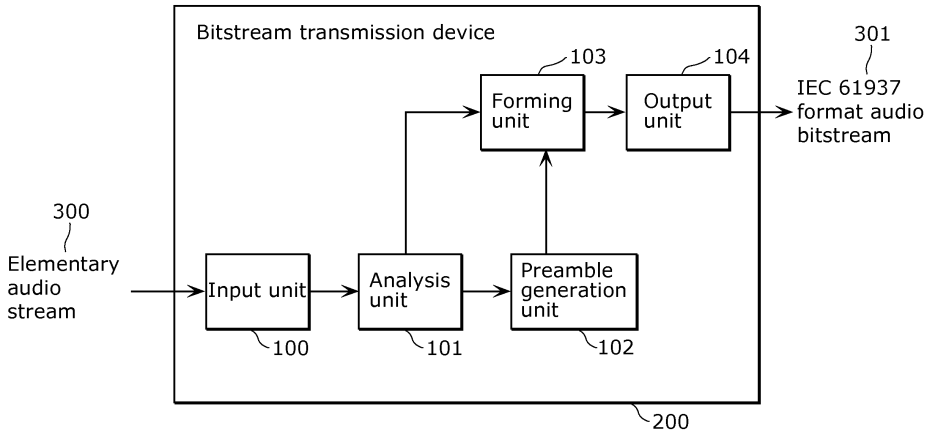
(72) Inventors:
- **NISHIO, Kosuke**
  Osaka 540-6207 (JP)
- **MIYASAKA, Shuji**
  Osaka 540-6207 (JP)

(74) Representative: **Vigand, Philippe et al**
Novagraaf International SA
3 chemin de l'Echo
1213 Onex Geneva (CH)

(54) BIT STREAM TRANSMISSION DEVICE, BIT STREAM RECEPTION/TRANSMISSION SYSTEM, BIT STREAM RECEPTION DEVICE, BIT STREAM TRANSMISSION METHOD, BIT STREAM RECEPTION METHOD, AND BIT STREAM

(57) A bitstream transmission device (200) according to the present invention includes: an input unit (100) which acquires an elementary audio stream obtained by coding an audio signal; an analysis unit (101) which analyzes a sampling frequency and a coding format of the elementary audio stream (300); a preamble generation unit (102) which, when the analyzed sampling frequency and coding format do not comply with a standard, generates a preamble signal specifying a coding format that complies with the standard as information indicating a coding format of the elementary audio stream (300); and a forming unit (103) which forms an audio bitstream (301) in accordance with the standard by incorporating the generated preamble signal in the elementary audio stream (300).

FIG. 1



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Description

[Technical Field]

[0001] The present invention relates to bitstream reception and transmission systems that include a bitstream transmission device that transmits compressed and coded audio signals to other devices and a reception device that receives audio signals transmitted from the bitstream transmission device and outputs audio.

[Background Art]

[0002] Conventional data reproduction devices are known which read compressed and coded video and audio signals recorded on storage media such as CD-ROMs, DVD-ROMs, semiconductor memory, and hard disks, then decode (decompress) and output the read video and audio signals. The data reproduction device sends the decompressed data to a video monitor and acoustic speakers, for example, which are connected to the data reproduction device. Video and audio reproduction is thusly achieved. Moreover, in the case of digital broadcast reproduction, the data reproduction device receives compressed and coded video and audio signals, and similar to reproduction with storage media, decodes and outputs the compressed and coded video and audio signals. Video and audio reproduction is thusly achieved.

[0003] There are many standards for the compression and coding of video and audio signals.

[0004] For example, MPEG-2 and MPEG-4 are main examples of image data coding standards.

[0005] Moreover, Dolby Digital, Digital Theater System (DTS), MPEG Audio, and MPEG-4 Advanced Audio Coding (AAC) are main examples of audio data coding standards. Moreover, the Pulse Code Modulation (PCM) method is an example of an audio data coding standard which does not reduce the amount of data.

[0006] Dolby Digital is a registered trademark of Dolby Laboratories, USA.

[0007] DTS is a registered trademark of Digital Theater Systems, inc., USA.

[0008] Signals coded with these audio data coding methods are hereinafter referred to as elementary audio streams.

[0009] Moreover, the data reproduction device is capable of outputting the elementary audio stream to an external device while decoding the elementary audio stream.

[0010] For example, a digital television and audio-video receiver can be connected over Sony Philips Digital InterFace (S/PDIF) or High-Definition Multimedia Interface (HDMI). In this case, transmission of the elementary audio stream from the digital television to the audio-video receiver in accordance with IEC 60958/IEC 61937 standards is possible.

[0011] Reproduction of the audio signal is achieved by the audio-video receiver decoding and outputting the received elementary audio stream.

[0012] FIG. 7 shows an example of the data construction of an output bitstream output in IEC 60958/IEC 61937. (a) in FIG. 7 shows an example of the data construction of an elementary audio stream defined in IEC 60958/IEC 61937. (b) in FIG. 7 is an example of the data construction of an audio bitstream for transmission of the elementary audio stream.

[0013] As (a) in FIG. 7 shows, the elementary audio stream 300 includes a plurality of frames, which are units including a given number of samples (for example, 1024 samples). Each frame includes a header portion (Header) and a coded data portion (CodedData). A coded signal of actual sound is recorded in the CodedData, and attributes of the coded signal recorded in the CodedData, such as the sampling rate and number of channels, are recorded in the Header.

[0014] Formats for recording the attributes of the coded signal in the Header include Audio Data Transport Stream (ADTS) and Low Overhead Audio Stream (LOAS). FIG. 8A and FIG. 8B show examples of the data format of the Header of the bitstream in IEC 60958/IEC 61937. FIG. 8A is an example of descriptions found in a fixed Header in the ADTS format. The 8th line from the top of the table shown in FIG. 8A shows a format for describing the sampling frequency of the coded signal in the ADTS format. Here, it is stipulated that the sampling frequency of the coded signal be selected from 0x3 to 0x8. FIG. 8B is an example of descriptions found in the Header in the LOAS format. As FIG. 8B shows, a description stipulating the sampling frequency of the coded signal is found in the Header in the LOAS format as well.

[0015] International standard MPEG audio AAC and High-Efficiency Advanced Audio Coding (HEAAC) are well known as coding schemes for the coded signal recorded in the CodedData of the elementary audio stream 300 shown in (a) in FIG. 7. HEAAC applies a bandwidth expansion technique called Spectral Band Replication (SBR) to AAC. Moreover, HEAAC is capable of reproduction processing compatible with AAC if the SBR information is not purposely processed, or if the decoder is not capable of processing the SBR information.

[0016] It is possible to determine whether or not the coded signal described in the CodedData is coded using SBR technology or not by analyzing information in the CodedData. In other words, it is possible to analyze information in the CodedData by looking through the bit construction of the dashed line box in elementary audio stream 300 shown in (a) in FIG. 7. The dashed line box has an information storage structure in the AAC standard called Extension_payload. It is possible to determine whether SBR technology has been applied the coded signal based on whether SBR information is stored in the Extension_payload or not. In the elementary audio stream 300, Extension_payload is located at the end of each frame, but Extension_payload is not necessarily required to be present in every frame.

[0017] As (b) in FIG. 7 shows, the audio bitstream 301

is an IEC 61937 format audio bitstream. The IEC 61937 format audio bitstream has preamble signals named Pa, Pb, Pc, and Pd located in front of the elementary audio stream. Furthermore, there are instances where an invalid signal, called Stuffing, for adjusting signal length is inserted after the elementary audio stream.

[0018] FIG. 9 shows the data format of the preamble signal Pc shown in (b) in FIG. 7. The portion in FIG. 9 enclosed by the dashed line is an example of data for specifying the presence or absence of SBR information (signal indicating AAC or HEAAC) in LOAS format, in the preamble signal Pc. For example, when the value indicated by the 5 bits from bit 0 to bit 4 in the preamble signal Pc is 23, the elementary audio stream 300 is in LOAS format. Furthermore, when the value indicated by the 2 bits from bit 5 to bit 6 in the preamble signal Pc is 1, this indicates that SBR information is not included in the elementary audio stream. In other words, this indicates whether the coded signal recorded in the CodedData is coded in AACLC or AAC. Moreover, when the value indicated by the 5 bits from bit 0 to bit 4 in the preamble signal Pc is 23, and the value indicated by the 2 bits from bit 5 to bit 6 in the preamble signal Pc is 2, this indicates that SBR information is included in the elementary audio stream 300. In other words, this indicates that the coded signal recorded in the CodedData is coded in HEAAC.

[0019] When a bitstream transmission device using the above technology receives an elementary audio stream such as the elementary audio stream 300, the bitstream transmission device detects the presence or absence of SBR information using the Extension_payload in the elementary audio stream. Then, when SBR information is not present, the bitstream transmission device specifies AAC in accordance with the bit structure shown in FIG. 9 in the preamble signal Pc. On the other hand, when SBR information is present in Extension_payload, the bitstream transmission device specifies HEAAC. The other preamble signals Pa, Pb, and Pd are also set in accordance with the bit structure thereof and the regulation of the meaning of the signal. Then, when necessary, an IEC 61937 format audio bitstream is generated by inserting stuffing.

[Citation List]

[Non Patent Literature]

[0020]

[NPL 1] IEC 61937-11 Digital audio - Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 - Part 11: MPEG-4 AAC and its extensions in LATM/LOAS

[NPL 2] ISO/IEC 14496-3 Information technology - Coding of audio-visual objects - Part 3: Audio

[NPL 3] ETSI TS 101 154 Technical Specification Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream

[Summary of Invention]

[Technical Problem]

[0021] However, there are two problems with the above described conventional techniques.

[0022] The first problem is that among the parameters defined by MPEG-4 AAC, there are instances where the bitstream standard is not defined. FIG. 10 shows the relationship between the sampling rate of the elementary audio stream and the audio data coding format of the audio data selectable with respect to the sampling rate.

[0023] As FIG. 10 shows, when the AAC sampling rate is either 16 kHz, 22.05 kHz, or 24 kHz and the audio data coding format is AAC, the bitstream standard is not defined (first through third rows from the top in FIG. 10). Moreover, when the AAC sampling rate is 32 kHz or 44.1 kHz and the audio data coding format is HEAAC (AAC coded signal with SBR information included therein), the bitstream standard is not defined (fourth through fifth rows from the top in FIG. 10). Especially in the latter case-that is to say, when the AAC sampling rate is 32 kHz or 44.1 kHz and the audio data coding format is HEAAC-even though operation is regulated in, for example, digital broadcast, the bitstream standard is not defined. As a result, there is a problem that even if a high sound quality elementary audio stream coded in HEAAC is received, this elementary audio stream cannot be reproduced and listened to on, for example, an external multi-channel speaker system.

[0024] The second problem is that when, for example, coded data of different audio data coding formats are included in the same content, instances of switching between output sampling frequency in the output bitstream increases.

[0025] For example, in digital broadcasting, when the audio data coding format of the program content is HEAAC and the AAC sampling rate is 48 kHz, while on the other hand, the audio data coding format of the commercial content is AACLC and the AAC sampling rate is 48 kHz, switching of the output sampling frequency occurs at switches between program content and commercial content.

[0026] FIG. 11A and FIG. 11B show the difference between the frequency band at which an HEAAC decoder decodes and performs reproduction and the frequency band at which an AAC decoder decodes and performs reproduction. FIG. 11A shows the frequency band in which reproduction in HEAAC of coded data having an AAC sampling rate of 48 KHz is possible. Compared to the reproduction frequency band of a signal in AAC, HEAAC reproduces a signal having a bandwidth twice that of AAC by using SBR (Spectral Band Replication) technology. In other words, the solid line in FIG. 11A

shows a 0-24 kHz signal reproduced in 48 kHz AAC, and the 24-48 kHz band of the dashed line is the band expanded by SBR. With this, a 96 kHz signal is reproduced. On the other hand, FIG. 11B shows the AAC reproduction frequency band of coded data having an AAC sampling rate of 48 KHz. As FIG. 11B shows, a signal is generated having the same frequency band as the frequency band reproduced by the AAC portion in HEAAC.

[0027] As FIG. 11A and FIG. 11B demonstrate, a signal having an IEC 60958 frame rate of 96 kHz is output during the program content portion, and a signal having an IEC 60958 frame rate of 48 kHz is output during the commercial content portion. When such a bitstream is received, processing is required for resynchronization in response to the change in IEC 60958 frame rate of the bitstream received in the audio-video receiver. Since this processing takes time, a problem arises in that a break in sound occurs when a switch is made between program content and commercial content.

[0028] In light of the above, the present invention aims to provide a bitstream transmission device capable of transmission of a compatible audio bitstream even when the actual coding format corresponding to the sampling frequency does not conform to a given format.

[Solution to Problem]

[0029] In order to solve the above described problems, a bitstream transmission device according to an aspect of the present invention is a bitstream transmission device that transmits an audio bitstream in a given format, the bitstream transmission device including: an input unit configured to acquire an elementary audio stream obtained by coding an audio signal; an analysis unit configured to analyze a sampling frequency and a coding format of the elementary audio stream; a preamble generation unit configured to generate, based on a result of the analysis by the analysis unit, a preamble signal including information indicating a coding format of the elementary audio stream; a forming unit configured to form the audio bitstream in the given format by incorporating in the elementary audio stream the preamble signal generated by the preamble generation unit; and an output unit configured to output the audio bitstream formed by the forming unit, wherein based on the sampling frequency and the coding format resulting from the analysis by the analysis unit, the preamble generation unit is configured to specify, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream and is different from the coding format of the elementary audio stream resulting from the analysis by the analysis unit.

[0030] In this way, based on the sampling frequency and the coding format resulting from the analysis by the analysis unit, the preamble generation unit is configured to specify, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream and is different from the coding format of the elementary audio stream resulting from the analysis by the analysis unit. This enables the bitstream transmission device according to an aspect of the present invention to transmit a compatible audio bitstream even when the actual coding format corresponding to the sampling frequency does not conform to a given format.

[0031] Moreover, the preamble generation unit may be configured to specify the information included in the preamble signal and indicating the coding format to limit an output transmission rate of data output from the output unit to a predetermined range.

[0032] Here, the "predetermined range" is, for example, 1536 kbps, 1411.2 kbps, and 1024 kbps, and is a bit rate transmittable in accordance with a standard. This enables the bitstream transmission device according to an aspect of the present invention to make the output transmission rate of an audio bitstream defined in accordance with the sampling frequency and the coding format of the elementary audio stream a transmittable transmission rate.

[0033] Moreover, the audio bitstream in the given format may be an audio bitstream in a format defined by the IEC 61937 standard, and when the sampling frequency resulting from the analysis by the analysis unit is a predetermined first frequency and the coding format corresponding to the first frequency does not comply with the IEC 61937 standard, to generate the preamble signal that conforms the audio bitstream to the IEC 61937 standard, the preamble generation unit may be configured to specify, as the information indicating the coding format, a coding format different from the analyzed coding format in terms of presence or absence of spectral band replication (SBR) information in the elementary audio stream.

[0034] This enables the bitstream transmission device according to an aspect of the present invention to form an audio bitstream which complies with a given format when the sampling frequency and the coding format resulting from the analysis by the analysis unit do not conform to the given format of the audio bitstream, by simply changing the presence or absence of SBR information in the preamble signal. As such, the bitstream transmission device can generate and transmit an audio bitstream compatible with the given format with little processing load.

[0035] Moreover, when the sampling frequency resulting from the analysis by the analysis unit is a predetermined second frequency, the preamble generation unit may be further configured to specify, as the information included in the preamble signal and indicating the coding format, that the elementary audio stream is coded in a coding format not including the SBR information.

[0036] This enables the bitstream transmission device according to an aspect of the present invention to, when the sampling frequency of the elementary audio stream is a second frequency, specify, as the information included in the preamble signal and indicating the coding for-

mat, that the elementary audio stream is coded in a coding format not including the SBR information. Consequently, when the sampling frequency of the elementary audio stream is the second frequency, since the elementary audio stream can be regularly decoded in a coding format without SBR information, it is possible to prevent fluctuation in the sampling frequency.

[0037] Moreover, when the sampling frequency resulting from the analysis by the analysis unit is a predetermined third frequency, the preamble generation unit may be configured to generate the preamble signal indicating that the elementary audio stream is coded in a coding format including the SBR information, even when the elementary audio stream is not coded in a coding format including the SBR information.

[0038] This enables the bitstream transmission device according to an aspect of the present invention to perform control so that SBR processing is compulsory when the sampling frequency of the elementary audio stream is the third frequency. With this, the bitstream transmission device is capable of adapting the audio bitstream to a given format when the third frequency is in the low band.

[0039] Moreover, when the sampling frequency resulting from the analysis by the analysis unit is a predetermined fourth frequency, the preamble generation unit may be configured to generate the preamble signal indicating that the elementary audio stream is coded in a coding format not including the SBR information, even when the elementary audio stream is coded in a coding format including the SBR information.

[0040] This enables the bitstream transmission device according to an aspect of the present invention to perform control so that decoding in AAC without SBR is performed when the sampling frequency of the elementary audio stream is the fourth frequency. With this, the bitstream transmission device is capable of adapting the audio bitstream to a given format when the fourth frequency is in the high band.

[0041] Moreover, a bitstream reception and transmission system according to an aspect of the present invention may be a bitstream reception and transmission system including the bitstream transmission device and a bitstream reception device that receives the audio bitstream transmitted from the bitstream transmission device and decodes the received audio bitstream, wherein the bitstream reception device includes: a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal included in the received audio bitstream; and an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decode the elementary audio stream according to the coding format indicated by the information specified in the preamble signal.

[0042] Moreover, a bitstream reception and transmission system according to an aspect of the present invention may be a bitstream reception and transmission system including the bitstream transmission device and a bitstream reception device that receives the audio bitstream transmitted from the bitstream transmission device and decodes the received audio bitstream, wherein the bitstream reception device includes: a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal included in the received audio bitstream; and an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, perform decoding where a signal with an expanded high band is 0 and which uses the SBR information, in accordance with the information specified in the preamble signal and indicating the coding format.

[0043] Moreover, a bitstream reception and transmission system according to an aspect of the present invention may be a bitstream reception and transmission system including the bitstream transmission device and a bitstream reception device that receives the audio bitstream transmitted from the bitstream transmission device and decodes the received audio bitstream, wherein the bitstream reception device includes: a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal from the received audio bitstream; and an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, generate a signal having a sampling frequency that is half a sampling frequency when decoding processing using the SBR information is performed, in accordance with the information specified in the preamble signal and indicating the coding format.

[0044] Moreover, the bitstream reception device may include a capability notification unit configured to notify the bitstream transmission device with information indicating a capability of the bitstream reception device, the analysis unit may be configured to analyze Fs information indicating a sampling rate of the elementary audio stream, and when the Fs information indicates a predetermined value, the preamble generation unit may be configured to switch between generating or not generating a preamble signal indicating inclusion of SBR information, based on the information from the capability notification unit.

[0045] Moreover, a bitstream reception device according to an aspect of the present invention may include: a reception unit configured to receive, from a bitstream transmission device, an audio bitstream in a given format that (i) is formed by incorporating, into an elementary audio stream which is a coded audio signal, a preamble

signal including information indicating a coding format of the elementary audio stream, and (ii) specifies, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream when a sampling frequency and the coding format of the elementary audio stream do not comply with the given format of the audio bitstream; a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal included in the received audio bitstream; and an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decode the elementary audio stream according to the coding format indicated by the information specified in the preamble signal.

[0046] This enables the bitstream reception device in the bitstream reception and transmission system to, when information specified in the preamble signal and indicating a coding format and information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decode the elementary audio stream in the coding format indicated by the information that is specified in the preamble signal. As such, the bitstream reception device is capable of decoding audio bitstreams without discrepancy, even if information indicating a coding format included in the elementary audio stream and information indicating a coding format included in the preamble signal are inconsistent.

[0047] Moreover, the bitstream reception device may receive the audio bitstream including the preamble signal indicating that the elementary audio stream is coded in a coding format including SBR information when the sampling frequency of the elementary audio stream is a predetermined third frequency, even when the elementary audio stream is not coded in a coding format including the SBR information, and the elementary decoding unit may be configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, perform decoding where a signal with an expanded high band is 0 and which uses the SBR information, in accordance with the information specified in the preamble signal and indicating the coding format.

[0048] Moreover, the bitstream reception device may receive the audio bitstream including the preamble signal indicating that the elementary audio stream is coded in a coding format not including SBR information when the sampling frequency of the elementary audio stream is a predetermined fourth frequency, even when the elementary audio stream is coded in a coding format including the SBR information, and the elementary decoding unit may be configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, generate a signal having a sampling frequency that is half a sampling frequency when decoding processing using the SBR information is performed, in accordance with the information specified in the preamble signal and indicating the coding format.

[0049] It should be noted that general or specific embodiments may be realized as a system, method, integrated circuit, computer program, storage media, or any elective combination thereof. Moreover, the present invention may be realized as an audio bitstream generated by the above-described bitstream transmission device.

[Advantageous Effects of Invention]

[0050] In this way, the present invention provides a bitstream transmission device capable of transmission of a compatible audio bitstream even when the actual coding format corresponding to the sampling frequency does not conform to a given format.

[0051] Moreover, according to an aspect of the present invention, it is possible to reduce disadvantages when the sampling rate of an input elementary audio stream and the coding format corresponding to that sampling rate are transmitted in accordance with the IEC 61937 standard.

[0052] Moreover, according to another aspect of the present invention, bitstream transmission in IEC 61937 is possible even if the input elementary audio stream does not comply with the IEC 61937 standard.

[0053] Furthermore, according to yet another aspect of the present invention, it is possible to keep the sampling rate of the decoded signal from varying when input elementary audio streams are continuously decoded.

[0054] Moreover, according to yet another aspect of the present invention, it is possible to normally generate a decoded signal even when a parameter P specified in the preamble signal added to the received bitstream and a parameter E corresponding to the parameter P and included in the elementary audio stream making up a part of the bitstream are inconsistent.

[0055] Moreover, according to yet another aspect of the present invention, bitstream transmission in IEC 61937 is possible even in the case of AAC at a low Fs.

[0056] According to yet another aspect of the present invention, it is possible to generate reproduced sound at the sampling rate according to the predetermined mid Fs, even in the case of AAC at a low Fs.

[0057] According to yet another aspect of the present invention, bitstream transmission in IEC 61937 is possible even in the case of HEAAC at a high Fs.

[0058] According to yet another aspect of the present invention, it is possible to generate reproduced sound at the sampling rate according to the predetermined mid Fs, even in the case of AAC at a high Fs.

[Brief Description of Drawings]

[0059]

[FIG. 1] FIG. 1 shows an example of the configuration of the bitstream transmission device according to Embodiment 1 of the present invention.
[FIG. 2] FIG. 2 shows an example of the configuration of the bitstream reception device according to Embodiment 1 of the present invention.
[FIG. 3] FIG. 3 shows an example of usage of the bitstream reception and transmission system according to Embodiment 1 of the present invention with an audio system.
[FIG. 4A] FIG. 4A illustrates the difference in the reproduction band between AAC and HEAAC according to Embodiment 1 of the present invention.
[FIG. 4B] FIG. 4B illustrates the difference in the reproduction band between AAC and HEAAC according to Embodiment 1 of the present invention.
[FIG. 5A] FIG. 5A illustrates the meaning of the stream output regulations shown in FIG. 10, according to Embodiment 1 of the present invention.
[FIG. 5B] FIG. 5B illustrates the meaning of the stream output regulations shown in FIG. 10, according to Embodiment 1 of the present invention.
[FIG. 5C] FIG. 5C illustrates the meaning of the stream output regulations shown in FIG. 10, according to Embodiment 1 of the present invention.
[FIG. 6] FIG. 6 shows an example of the configuration of the bitstream transmission device according to Embodiment 2 of the present invention.
[FIG. 7] FIG. 7 shows an example of the data construction of an output bitstream in IEC 60958/IEC 61937.
[FIG. 8A] FIG. 8A is an example of descriptions found in a fixed Header in the ADTS format.
[FIG. 8B] FIG. 8B is an example of descriptions found in the Header in the LOAS format.
[FIG. 9] FIG. 9 shows the data format of the preamble signal Pc shown in (b) in FIG. 7.
[FIG. 10] FIG. 10 shows the presence or absence of a stream output regulation under IEC 61937 with respect to the combination of the sampling rate and the audio data coding format of the elementary audio stream.
[FIG. 11A] FIG. 11A shows the frequency band in which reproduction in HEAAC of coded data having an AAC sampling rate of 48 KHz is possible.
[FIG. 11B] FIG. 11B shows the frequency band in which reproduction in AAC of coded data having an AAC sampling rate of 48 KHz is possible.

[Description of Embodiments]

[0060] Hereinafter, certain exemplary embodiments are described in greater detail with reference to the accompanying Drawings. It is to be noted that the embodiment described below shows a specific example of the present disclosure. The numerical values, shapes, materials, structural elements, the arrangement and connection of the structural elements, steps, the processing order of the steps etc. shown in the following exemplary embodiment are mere examples, and therefore do not limit the present disclosure. The present invention is defined by the scope of the claims. Therefore, among the structural elements in the following exemplary embodiment, structural elements not recited in any one of the independent claims defining the most generic part of the inventive concept are described as preferred structural elements, and are not absolutely necessary to overcome the problem according to the present invention.

(Embodiment 1)

[0061] The bitstream transmission device according to Embodiment 1 of the present invention will hereinafter be described with reference to the Drawings.

[0062] FIG. 1 shows the configuration of the bitstream transmission device 200 according to Embodiment 1. As FIG. 1 shows, the bitstream transmission device 200 includes an input unit 100, an analysis unit 101, a preamble generation unit 102, a forming unit 103, and an output unit 104.

[0063] The input unit 100 acquires an elementary audio stream 300 obtained by coding an audio signal.

[0064] The analysis unit 101 analyzes the sampling rate and the audio data coding format of the acquired elementary audio stream 300.

[0065] The preamble generation unit 102 generates, based on the result of the analysis by the analysis unit 101, a preamble signal forming a portion of the audio bitstream which is in a format defined by IEC 61937. Here, when the sampling frequency resulting from the analysis by the analysis unit 101 is a predetermined value, the preamble generation unit 102 generates the preamble signal by changing the parameter indicating the audio data coding format of the elementary audio stream 300 to a value in accordance with IEC 61937.

[0066] The forming unit 103 forms an IEC 61937 format audio bitstream by incorporating in the elementary audio stream 300 the preamble signal generated by the preamble generation unit 102.

[0067] The output unit 104 outputs the audio bitstream 301 formed by the forming unit 103.

[0068] FIG. 2 shows an example of the configuration of the bitstream reception device according to Embodiment 1. As FIG. 2 shows, the bitstream reception device 201 receives the audio bitstream 301 transmitted from the bitstream transmission device 200 shown in FIG. 1, and decodes the received audio bitstream 301. This bitstream reception device 201 includes a preamble removal unit 202 and an elementary decoding unit 203.

[0069] The preamble removal unit 202 is installed in the bitstream reception device 201 and extracts the elementary audio stream 300 by removing the preamble sig-

nals Pa, Pb, Pc, and Pd from the IEC 61937 format audio bitstream 301 transmitted from the bitstream transmission device 200.

[0070] The elementary decoding unit 203 is installed in the bitstream reception device 201 and generates an audio signal (multi-channel decoded signal) by decoding the elementary audio stream 300 extracted by the preamble removal unit 202, and outputs the generated audio signal. Upon decoding the elementary audio stream 300, when the audio data coding format indicated in the preamble signal Pc and the audio data coding format indicated in Extension_payload are inconsistent, the elementary decoding unit 203 decodes the elementary audio stream 300 in the audio data coding format indicated in the preamble signal Pc.

[0071] FIG. 3 shows an example of implementation of a transmission and reception system including the bitstream transmission device 200 shown in FIG. 1 and the bitstream reception device 201 shown in FIG. 2 with audio equipment.

[0072] As FIG. 3 shows, the bitstream transmission device 200 and the bitstream reception device 201 included in the bitstream reception and transmission system 210 are connected via a cable for transmitting the IEC 61937 format audio bitstream 301. This cable is, for example, an HDMI cable. The bitstream transmission device 200 is installed in, for example, a television 220, and is connected to, for example, two-channel stereo speakers via a decoder inside the television 220 and a two-channel downmix unit. The television 220 obtains the elementary audio stream 300 from broadcast waves via an antenna or tuner (not shown in the Drawings) or from a CD via a CD driver (not shown in the Drawings), and inputs the elementary audio stream 300 to the input unit 100 of the bitstream transmission device 200. The decoder 221 takes the elementary audio stream 300 inputted from the input unit 100 to the forming unit 103, and temporarily decodes it into a multi-channel audio signal. The two-channel downmix unit 222 (2ch downmix unit) downmixes, into a two-channel stereo audio signal, the multi-channel audio signal obtained as a result of the elementary audio stream 300 being decoded by the decoder, and outputs the stereo audio signal to the stereo speakers 223.

[0073] The bitstream reception device 201 is installed in, for example, a theater system 230 including multi-channel speakers 231, such as 5.1 channel speakers. This bitstream reception device 201 decodes the audio bitstream 301 that is in accordance with IEC 61937 and is inputted from the bitstream transmission device 200 over HDMI, for example, and outputs the multi-channel audio signal obtained as a result of the decoding to the multi-channel speakers 231.

[0074] Hereinafter, operations performed by the bitstream transmission device 200 having the above-described configuration will be described in further detail.

[0075] First, the input unit 100 obtains the elementary audio stream 300. The elementary audio stream 300 is a stream having the data format like that shown in FIG. 7, and in Embodiment 1, the format of the header is LOAS, and the coded data is AAC coded data which does not include SBR information. The Extension_payload 310 is not included in the CodedData in the elementary audio stream 300, and the sampling rate (sampling frequency) specified in the header is 24 kHz.

[0076] Next, the analysis unit 101 analyzes the elementary audio stream 300. In Embodiment 1, the inputted elementary audio stream 300 has a sampling rate of 24 kHz and does not include SBR information, as described above, and this information is analyzed by the analysis unit 101. The sampling rate is obtained by analyzing the bitstream in accordance with the stipulations in the LOAS header format shown in FIG. 8B. Moreover, the presence or absence of SBR information is obtained by analyzing the bitstream in accordance with the stipulations in the Extension_payload shown in FIG. 7.

[0077] Next, the preamble generation unit 102 generates, based on the result of the analysis by the analysis unit 101, an IEC 61937 format preamble signal. When the elementary audio stream 300 has a sampling rate of 24 kHz and does not include SBR information, requirements to be an IEC 61937 format audio bitstream are not met, as FIG. 10 shows. As such, the preamble generation unit 102 generates a preamble signal which indicates that the elementary audio stream 300 includes SBR information. More specifically, the preamble generation unit 102 sets the value indicated by the five bits from bit 0 to bit 4 of the preamble signal Pc to 23. This causes the preamble signal Pc to indicate that the header format is LOAS. Furthermore, the preamble generation unit 102 sets the value indicated by the two bits from bit 5 to bit 6 of the preamble signal Pc to 2. This causes the preamble signal Pc to indicate that the elementary audio stream 300 includes SBR information. Here, inclusion of SBR information means that the preamble signal Pc indicates that the elementary audio stream 300 is coded in HEAAC. In Embodiment 1, the sampling rate is 24 kHz, but it goes without saying that the above holds true even if the sampling rate is 22.05 kHz or 16 kHz.

[0078] Next, the forming unit 103 incorporates the preamble signal outputted by the preamble generation unit 102 in the elementary audio stream 300. In other words, the forming unit 103 forms an IEC 61937 format audio bitstream such as the audio bitstream 301 shown in FIG. 7.

[0079] Lastly, the output unit 104 outputs the audio bitstream 301, which is a signal from the forming unit 103, to an external device.

[0080] Hereinafter, operations performed by the bitstream reception device 201 having the configuration shown in FIG. 2 will be described.

[0081] First, the bitstream transmission device 200 forms the inputted elementary audio stream 300 into the IEC 61937 format audio bitstream 301, and outputs the audio bitstream 301.

[0082] For example, when the sampling rate (sampling

frequency) of the inputted elementary audio stream 300 is 24 kHz and coding which does not include SBR information is performed (AAC), a code is specified in the preamble signal Pc among the preamble signals that indicates that SBR information is present (HEAAC). Moreover, for example, when the sampling rate (sampling frequency) of the inputted elementary audio stream 300 is 48 kHz and SBR information is present (HEAAC), a code is specified in the preamble signal Pc among the preamble signals that indicates that SBR information is not present (AAC).

[0083] The preamble removal unit 202 extracts the elementary audio stream 300 by removing the preamble signals Pa, Pb, Pc, and Pd from the IEC 61937 format audio bitstream 301 transmitted from the bitstream transmission device 1000. If a stuffing signal is included in the IEC 61937 audio bitstream 301, the preamble removal unit 202 extracts the stuffing signal as well, and generates the elementary audio stream 300. The elementary audio stream 300 generated in this manner is an AAC or HEAAC elementary audio stream, and as such, can be decoded in accordance with the decoding processes defined by MPEG standards. Moreover, the preamble removal unit 202 detects SBR presence/absence information, which indicates the presence or absence of SBR information, in the preamble signal Pc, and sends this SBR presence/absence information to the elementary decoding unit 203 down line.

[0084] The elementary decoding unit 203 generates an audio signal by decoding the extracted elementary audio stream 300. Moreover, the elementary decoding unit 203 refers to the SBR presence/absence information sent from the preamble removal unit 202, and determines whether the information indicating the presence or absence of the SBR information is included in the elementary audio stream 300 and the SBR presence/absence information from the preamble removal unit 202 are inconsistent or not. When inconsistent, the information shown in the SBR presence/absence information from the preamble removal unit 202 is followed.

[0085] For example, when the SBR presence/absence information indicates "SBR information present" even if the elementary audio stream 300 has a sampling rate of 24 kHz and indicates "no SBR", the elementary decoding unit 203 performs bandwidth expansion processing. Of course, since SBR information is not actually present in the Extension_payload of the elementary audio stream 300, the elementary decoding unit 203 cannot perform complete bandwidth expansion processing, but, for example, can perform processing which up-samples the sampling rate of the decoded signal by two times. In other words, the elementary decoding unit 203 performs processing equivalent to bandwidth expansion processing which makes a component duplicated in the high band by SBR 0.

[0086] Moreover, for example, when the SBR presence/absence information indicates "no SBR" even if the elementary audio stream 300 has a sampling rate of 48 kHz and indicates "(SBR information present", the elementary decoding unit 203 does not perform bandwidth expansion processing. The elementary decoding unit 203, for example, ignores and skips over the SBR information which is actually present. Moreover, the elementary decoding unit 203 does apply the SBR information which is actually present, but performs processing which generates a signal at 48 kHz as a result of down-sampling the outputted sampling rate in half.

[0087] It should be noted that when the information indicating the presence or absence of the SBR information included in the elementary audio stream 300 and the SBR presence/absence information from the preamble removal unit 202 are inconsistent, the elementary decoding unit 203 may follow the information indicating the presence or absence of the SBR information included in the elementary audio stream 300.

[0088] The decoded signal generated in this manner is transmitted from the elementary decoding unit 203 to an external device, and converted into a signal listenable with speakers or headphones, for example.

[0089] As described above, the bitstream transmission device 200 according to Embodiment 1 includes an input unit 100 which acquires an elementary audio stream obtained by coding an audio signal; an analysis unit 101 which analyzes a sampling frequency and a coding format of the elementary audio stream; a preamble generation unit 102 which generates, based on a result of the analysis by the analysis unit 101, a preamble signal included in an IEC 61937 format audio bitstream; a forming unit 103 which forms the IEC 61937 format audio bitstream by incorporating in the elementary audio stream the preamble signal generated by the preamble generation unit 102; and an output unit 104 which outputs the audio bitstream formed by the forming unit 103, wherein when the sampling frequency resulting from the analysis by the analysis unit 101 is a predetermined value, the preamble generation unit 102 changes a parameter indicating the audio data coding format of the elementary audio stream to a format that complies with the IEC 61937 format of the audio bitstream.

[0090] This enables the bitstream transmission device 200 transmit the audio bitstream 301 to the bitstream reception device 201 without a problem, which was previously not transmittable due to incompatibility with IEC 61937. As a result, the bitstream transmission device 200 is capable of outputting an audio bitstream 301 that complies with the IEC 61937 standard, even if the combination of the sampling rate and the audio data coding format of the elementary audio stream 300 does not comply with the IEC 61937 standard. In particular, in accordance with Embodiment 1, since it is possible to do this merely by changing the presence or absence of SBR information described in the preamble signal, processing is substantially simplified.

[0091] It should be noted that in Embodiment 1, an example is given that a sampling rate of 24 kHz (or 22.05 kHz or 16 kHz) and "no SBR information" are specified

in the header, but the same processing can be performed when a sampling rate of 44.1 kHz (or 32 kHz) and "SBR information present" are specified in the header. The operations performed when this is the case are described below.

[0092] The analysis unit 101 analyzes the sampling rate and the audio data coding format of the elementary audio stream 300. The analysis unit 101 analyzes that the inputted elementary audio stream 300 has a sampling rate of 44.1 kHz and includes SBR information.

[0093] Next, the preamble generation unit 102 generates, based on the result of the analysis by the analysis unit 101, a preamble signal to be included in an IEC 61937 format audio bitstream 301. Here, when the sampling rate of the elementary audio stream 300 is 44.1 kHz and SBR information is included, the audio bitstream does not comply with IEC 61937 standards, as FIG. 10 shows, and as such, the preamble generation unit 102 generates a preamble signal that indicates that SBR information is not included. More specifically, the preamble generation unit 102 sets the value indicated by the five bits from bit 0 to bit 4 of the preamble signal Pc to 23. This causes the preamble signal Pc to indicate that the header format is LOAS. Furthermore, the preamble generation unit 102 sets the value indicated by the two bits from bit 5 to bit 6 of the preamble signal Pc to 1. With this, the preamble signal Pc indicates that SBR information is not included. In other words, the preamble signal Pc indicates that the audio data coding format of the elementary audio stream 300 is AAC.

[0094] Next, the forming unit 103 incorporates the preamble signal outputted by the preamble generation unit 102 in the elementary audio stream 300. In other words, the forming unit 103 forms an IEC 61937 format audio bitstream 301 such as is shown in FIG. 7.

[0095] Lastly, the output unit 104 outputs, to an external device, the audio bitstream 301 formed by the forming unit 103.

[0096] With this, the bitstream transmission device 200 is capable of outputting an audio bitstream 301 that complies with the IEC 61937 standard even if the inputted elementary audio stream 300 does not comply with the IEC 61937 standard.

[0097] It should be noted that by forcefully changing the SBR information in the manner described above, the information indicating the presence or absence of SBR included in the preamble signal and the information indicating the presence or absence of SBR included in the coded data will be inconsistent, but in this case, processing may be preset to follow the information indicating the presence or absence of SBR included in the preamble signal. As previously described, since an AAC elementary audio stream and an HEAAC elementary audio stream have reproduction compatibility, even if the audio bitstream is an inconsistent IEC 61937 audio bitstream, the stream is capable of being reproduced by an external reception device.

[0098] This concept is depicted in FIG. 4A and FIG. 4B. The horizontal axes in (a) through (b2) in FIG. 4A and (a) through (b2) in FIG. 4B represent frequency.

(a) in FIG. 4A schematically shows a frequency spectrum of the frequency component included in the elementary audio stream 300 coded in HEAAC. The signal depicted by the solid line of the low band lower than 1/4 of the sampling frequency in FIG. 4A is coded in AAC, and signal depicted by the dashed line of the high band higher than 1/4 of the sampling frequency is coded in SBR.

(b1) in FIG. 4A shows the frequency component when the HEAAC signal shown in (a) in FIG. 4A is processed with an HEAAC decoder. In this case, the signal of the whole band including both the low band and the high band is reproduced.

(b2) in FIG. 4A shows the frequency component when the HEAAC signal shown in (a) in FIG. 4A is processed with an AAC decoder. In this case, the high band coded in SBR is not decoded, and only the signal of the low band coded in AAC is decoded and reproduced by the AAC decoder.

(a) in FIG. 4B schematically shows a frequency spectrum of the frequency component included in the elementary audio stream 300 coded in AAC. In this case, the whole band is coded in AAC.

(b1) in FIG. 4B shows the frequency component when the AAC signal shown in (a) in FIG. 4B is processed with an HEAAC decoder. In this case, the signal of the whole band is decoded and reproduced by the HEAAC decoder.

(b2) in FIG. 4B shows the frequency component when the AAC signal shown in (a) in FIG. 4B is processed with an AAC decoder. In this case as well, just like the case shown in (b1) in FIG. 4B, the signal of the whole band is decoded and reproduced by the AAC decoder.

[0099] In other words, when the signal is actually an HEAAC signal-that is to say, when the elementary audio stream 300 is a elementary audio stream coded in the HEAAC audio data coding format-and the preamble signal shows that the elementary audio stream 300 is coded in AAC, the elementary audio stream 300 is processed with an AAC decoder. Even in this case, while the same sound quality as when the audio is decoded in conventional HEAAC cannot be obtained, audible audio decoded in AAC is reproduced ((b2) in FIG. 4A). Moreover, if the preamble signal were to indicate AAC when the signal actually is AAC, there would be no harm in processing this AAC signal with an HEAAC decoder. In other words, when this AAC signal is decoded with an HEAAC decoder, it is possible to obtain the same sound quality as when decoded with a conventional AAC decoder ((b2) in FIG. 4B).

(Application Example of Embodiment 1)

[0100] It should be noted that in Embodiment 1, "a sampling rate of 24 kHz (or 22.05 kHz or 16 kHz) and 'no SBR information' are specified in the header" and "a sampling rate of 44.1 kHz (or 32 kHz) and 'SBR information present' are specified in the header" are used as examples of solutions to the first problem. However, it is also possible to solve the second problem when "a sampling rate of 48 kHz and 'SBR information present' are specified in the header" by performing the same processes as above. Hereinafter, processing performed when "a sampling rate of 48 kHz and 'SBR information present' are specified in the header" will be described in detail.

[0101] First, the analysis unit 101 analyzes the sampling rate and the audio data coding format of the elementary audio stream 300. Here, as previously described, the analysis unit 101 analyzes that the inputted elementary audio stream 300 has a sampling rate of 48 kHz and includes SBR information.

[0102] Next, the preamble generation unit 102 generates, based on the result of the analysis by the analysis unit 101, an IEC 61937 format preamble signal. When the sampling rate is 48 kHz, regardless of inclusion or exclusion of SBR information, in either case, the audio bitstream meets IEC 61937 standards, as FIG. 10 shows. However, the preamble generation unit 102 according to this embodiment always generates the preamble signal to indicate that SBR information is not included, even if SBR information is included. More specifically, the preamble generation unit 102 sets the value indicated by the five bits from bit 0 to bit 4 of the preamble signal Pc to 23. This causes the preamble signal Pc to indicate that the header format is LOAS. Furthermore, the preamble generation unit 102 sets the value indicated by the two bits from bit 5 to bit 6 of the preamble signal Pc to 1. This causes the preamble signal Pc to indicate that the elementary audio stream 300 does not include SBR information. In other words, when the sampling rate is 48 kHz, the preamble signal Pc is always generated to indicate that the elementary audio stream 300 is coded in AAC.

[0103] Next, the forming unit 103 incorporates the preamble signal outputted by the preamble generation unit 102 in the elementary audio stream 300. In other words, the forming unit 103 forms an IEC 61937 format audio bitstream 301 such as is shown in FIG. 7.

[0104] Lastly, the output unit 104 outputs, to an external device, the audio bitstream 301 generated by the forming unit 103.

[0105] With this, it is possible to restrict an increase in instances of switches between output sampling frequencies in actual DTV broadcasts, for example. For example, in digital broadcasting, when the audio data coding format of the program content is HEAAC and the AAC sampling rate is 48 kHz, while on the other hand, the audio data coding format of the commercial content is AACLC and the AAC sampling rate is 48 kHz, the bitstream transmission device outputs a signal having an IEC 60958 frame rate of 96 KHz for the program content, and outputs a signal having a 48 KHz IEC 60958 frame rate for the commercial content. However, by changing the presence or absence of SBR information with the preamble generation unit 102 as described above, it is possible to prevent variation in reproduction frame rate upon switching between program content and commercial content. As a result, high quality audio reproduction cannot be expected in the program content due to bandwidth expansion, but it is possible to avoid defects such as jumps in audio resulting from the time it takes to keep up with the changes in IEC 60958 frame rate in the bitstream reception device 201.

[0106] FIG. 5A through FIG. 5C illustrate transmission examples of streams based on the stream output stipulations shown in FIG. 10. In FIG. 5A through FIG. 5C, the circles containing the letters a, b, c, and d represent the preamble signals Pa, Pb, Pc, and Pd, the shaded circles represent the elementary audio stream, and the blank circles represent padding data, which is invalid data for adjusting the data length. Moreover, here it is assumed that the header format of the transmitted stream is LOAS.

[0107] FIG. 5A illustrates why it is possible to transmit a stream coded in AAC (no SBR information) at a sampling rate of 48 kHz, for example. Here, one sample indicates 32 bits. Since the sampling frequency of the elementary audio stream is 48 kHz, the bitstream transmission device transmits data at a transmission rate of 1536 kbps (48 kHz x 32 bits). More specifically, the preamble signals Pa, Pb, Pc, and Pd are added every 21.333 msec (time for 1024 samples at 48 kHz), and 32768-bit, one frame signals are continuously transmitted.

[0108] Consequently, when AAC at 48 kHz, the decoder generates PCM data every 21.333 msec. As such, since the signal supply rate and the decoder processing rate match, the decoder can processes the signals without discrepancy.

[0109] FIG. 5B illustrates why it is possible to transmit a stream coded in AAC (no SBR information) at a sampling rate of 24 kHz, for example. When the signal has a sampling rate of 24 kHz, it is preferable that the bitstream transmission device transmit data at a transmission rate of 768 kbps (24 kHz x 32 bits), but the bitstream transmission device does not have a 768 kbps mode. If the bitstream transmission device were to use a transmission rate of 1536 kbps, the data would be transmitted as is shown in FIG. 5B. In this case, since the decoder generates 42.6667 msec PCM data per signal supplied every 21.333 msec (because 1024 samples at 24 kHz equates to 42.6667 msec), the supply of signals from the bitstream transmission device becomes excessive with respect to the processing rate of the decoder. This causes the stream to overflow.

[0110] FIG. 5C illustrates why it is possible to transmit a stream coded in HEAAC (SBR information present) at a sampling rate of 24 kHz, for example. When the stream is coded in HEAAC, even if the sampling rate of the AAC portion is 24 kHz, as FIG. 11A shows, the bitstream trans-

mission device considers the entire stream to be a signal having a sampling rate of 48 kHz, and as such, transmits the data at a transmission rate of 1536 kbps (48 kHz x 32 bits). More specifically, the preamble signals Pa, Pb, Pc, and Pd are added every 42.6667 msec (time for 2048 samples at 48 kHz), and signals are continuously transmitted per frame.

[0111] Consequently, since the decoder generates PCM data every 42.6667 msec when HEAAC at 24 kHz, the supply rate of the signals and the processing rate of the decoder match. As such, the decoder can process the signals without discrepancy.

[0112] Similarly, it is possible to explain the reason why a stream coded in AAC at a sampling rate of 22.05 kHz cannot be transmitted, even though a stream coded in AAC at a sampling rate of 44.1 kHz and a stream coded in HEAAC at a sampling rate of 22.05 kHz can be transmitted. Moreover, it is possible to explain the reason why a stream coded in AAC at a sampling rate of 16 kHz cannot be transmitted, even though a stream coded in AAC at a sampling rate of 32 kHz and a stream coded in HEAAC at a sampling rate of 16 kHz can be transmitted.

[0113] This is because the output transmission rates 1411.2 kbps (44.1 kHz x 32 bits) and 1024 kbps (32 kHz x 32 bits) are each standardized by IEC 60958, and as such, the bitstream transmission device can use these transmission rates, but 705.6 kbps (22.05 kHz x 32 bits) and 512 kbps (16 kHz x 32 bits) are not standardized.

[0114] Different from the above example, streams coded in AAC at a sampling rate of 48 kHz and streams coded in HEAAC at a sampling rate of 48 kHz can be transmitted with no problem.

[0115] This is because in a stream coded in AAC at a sampling rate 48 kHz, the sampling rate is 48 kHz, and as such, the bitstream transmission device transmits data at a transmission rate of 1536 kbps (48 kHz x32 bits). More specifically, the preamble signals Pa, Pb, Pc, and Pd are added every 21.333 msec (time for 1024 samples at 48 kHz), and signals are continuously transmitted per frame (32768 bits).

[0116] Consequently, since the decoder generates PCM data every 21.333 msec when AAC at 48 kHz, the supply rate of the signals and the processing rate of the decoder match. As such, the decoder can process the signals without discrepancy.

[0117] Moreover, with a stream coded in HEAAC at a sampling rate of 48 kHz, the bitstream transmission device regards the sampling rate to be 96 kHz, and as such, transmits data at a transmission rate of 3072 kbps (96 kHz x 32 bits). Moreover, the preamble signals Pa, Pb, Pc, and Pd are added every 21.333 msec (time for 2048 samples at 96 kHz), and signals are transmitted per frame (32768 bits).

[0118] Consequently, since the decoder generates PCM data every 21.333 msec when HEAAC at 48 kHz, the supply rate of the signals and the processing rate of the decoder match. As such, the decoder can process the signals without discrepancy.

[0119] With the above, when the elementary audio stream is coded at a sampling rate of 48 kHz, it is possible to perform transmission without problem when either AAC or HEAAC. On the other hand, when a stream coded in AAC at a sampling rate of 48 kHz and a stream coded in HEAAC at a sampling rate of 48 kHz are switched between, switching between a stream having a transmission rate of 1536 kbps and a stream having a transmission rate of 3072 kbps occurs. At this time, in the whole bitstream reception and transmission system, it is necessary to perform processing which regains synchronization such as the switching of operating frequency of the A/D converter, for example. Since time is required for the processing which regains synchronization of the entire bitstream transmission and reception system, a time lag occurs upon switching of the sampling rate. For example, a defect like a break in audio at the transition from program to commercial occurs.

[0120] In response to this, it is possible to make the transmission rate a constant sampling rate by transmitting, as "no SBR", the stream coded in HEAAC (SBR present) at a sampling rate of 48 kHz. This makes it possible to prevent defects such as jumps in audio.

[0121] It should be noted that in the above embodiment, since a time lag occurs at the switching of the sampling rate, when the sampling rate of the elementary audio stream is 48 kHz, the bitstream reception and transmission system is described as performing processing as if the elementary audio stream were always coded in AAC, regardless of whether it is coded in HEAAC or AAC, but the present invention is not limited to this example. For example, if time lag occurring at the switching of the sampling rate is not a concern, the bitstream reception and transmission system may perform processing as if the elementary audio stream were always an HEAAC signal.

(Embodiment 2)

[0122] Hereinafter, a bitstream transmission and reception system 210 according to Embodiment 2 of the present invention will hereinafter be described with reference to the Drawings.

[0123] FIG. 6 shows the configuration of the bitstream transmission and reception system according to Embodiment 2. In FIG. 6, the bitstream transmission and reception system 210 according to Embodiment 2 includes the bitstream transmission device 1000 and a bitstream reception device 1001.

[0124] The bitstream transmission device 1000 includes the input unit 100, the analysis unit 101, the forming unit 103, the output unit 104, and a preamble generation unit 1010. In the bitstream transmission device 1000, all processing units having the same reference numerals as those in the bitstream transmission device 200 are the same as those disclosed in FIG. 1 according to Embodiment 1, and as such, descriptions thereof will be omitted. The following focuses on the description of the

preamble generation unit 1010.

[0125] The preamble generation unit 1010 receives capability information on the bitstream reception device 1001 from the bitstream reception device 1001, and based on the capability information, changes information included in the preamble signal Pc that indicates the audio data coding format of the elementary audio stream. More specifically, the preamble generation unit 1010 determines, based on the capability information received from the bitstream reception device 1001, whether or not the bitstream reception device 1001 is capable of decoding the elementary audio stream 300 coded in HEAAC at a sampling rate of 48 kHz. If the preamble generation unit 1010 determines that the bitstream reception device 1001 is capable of decoding the elementary audio stream 300 coded in HEAAC at a sampling rate of 48 kHz, and the elementary audio stream 300 is coded in HEAAC at a sampling rate of 48 kHz, the preamble generation unit 1010 generates the preamble signal Pc showing that the elementary audio stream 300 is coded in HEAAC, different than in Embodiment 1. More specifically, the preamble generation unit 1010 sets the value indicated by the five bits from bit 0 to bit 4 of the preamble signal Pc to 23. This causes the preamble signal Pc to indicate that the header format is LOAS. Furthermore, the preamble generation unit 1010 sets the value indicated by the two bits from bit 5 to bit 6 of the preamble signal Pc to 2. This causes the preamble signal Pc to indicate that the elementary audio stream 300 includes SBR information. In other words, the preamble signal Pc indicates that the elementary audio stream 300 is coded in HEAAC.

[0126] Regarding the previously described bitstream transmission device 1000, the bitstream reception device 1001 according to Embodiment 2 receives the audio bitstream 301 transmitted from the bitstream transmission device 1000, and decodes the received audio bitstream 301. The bitstream reception device 1001 includes the preamble removal unit 202, the elementary decoding unit 203, and a capability information notification unit 1011. In FIG. 6, all processing units having the same reference numerals as those in the bitstream reception device 201 are the same as those disclosed in FIG. 2 according to Embodiment 1, and as such, descriptions thereof will be omitted. The following focuses on the description of the capability information notification unit 1011.

[0127] The capability information notification unit 1011 stores, in internal memory, capability information indicating whether or not the elementary decoding unit 203 in the bitstream reception device 1001 is capable of decoding the elementary audio stream 300 coded in HEAAC at a sampling rate of 48 kHz. When a transmission request for capability information is made from the bitstream transmission device 1000, the capability information notification unit 1011 notifies the preamble generation unit 1010 of the bitstream transmission device 1000 with the capability information stored in memory.

[0128] With this configuration, when the elementary decoding unit 203 of the bitstream reception device 1001 is capable of decoding the elementary audio stream coded in HEAAC at a sampling rate of 48 kHz and the elementary audio stream 300 is coded w in HEAAC and even if it has a sampling rate of 48 kHz, the bitstream transmission device 1000 is capable of describing a parameter indicating that SBR information is present in the preamble signal Pc. As such, when a defect such as a break in sound at the switching point between content coded in AAC and content coded in HEAAC is not problematic, the bitstream reception device 1001 is capable of decoding the elementary audio stream 300 in accordance with the preamble signal included in the audio bitstream 301 transmitted from the bitstream transmission device 1000. This has the advantageous effect that the user can enjoy content coded in HEAAC in high audio quality and having a bandwidth that has been expanded into the high band.

[0129] Moreover, even when the elementary decoding unit 203 of the bitstream reception device 1001 is capable of decoding a stream coded in HEAAC at a sampling rate of 48 kHz, the bitstream reception device 1001 is not required to notify the bitstream transmission device 1000 of capability information. In this case, the bitstream reception device 1001 may, for example, interpret the header and Extension_payload of the elementary audio stream 300 extracted from the audio bitstream 301 received from the bitstream transmission device 200 according to Embodiment 1, and decode the elementary audio stream 300 according to the SBR information when SBR information is included in the elementary audio stream 300. Furthermore, even when SBR information is not included in the elementary audio stream 300 extracted from the audio bitstream 301, the bitstream reception device 1001 may perform HEAAC decoding in which the bandwidth is expanded into the high band.

[0130] When the sampling frequency resulting from the analysis by the analysis unit 101 is a predetermined second frequency, the preamble generation unit 1010 specifies, as information included in the preamble signal and indicating the coding format, a coding format in which SBR information is not included in the elementary audio stream. With this, for example, in an actual DTV broadcast, even when the programming content is broadcast having an audio data coding format of HEAAC and an AAC sampling rate of 48 kHz, while on the other hand the commercial content is broadcast having an audio data coding format of AACLC and an AAC sampling rate of 48 kHz, processing can be done without changing a final sampling rate of the decoded signal. As such, the transition between program content and commercial content is smooth. By doing this, when the elementary audio stream 300 is coded in HEAAC and has a sampling frequency of 48 kHz and the bitstream reception device 1001 is capable of decoding such an elementary audio stream 300, the bitstream reception device 1001 is capable of reproducing the high audio quality audio signal decoded in HEAAC.

[0131] Moreover, in an actual DTV broadcast, when

the broadcast has a sampling rate of 24 kHz and indicates "(SBR information present", even if SBR information is lost as a result of a defect in the signal from poor reception of the broadcast waves, the final sampling rate of the output signal is held constant. In this way, it is possible for the bitstream reception and transmission system to keep the influences caused by poor reception to a minimum.

[0132] It should be noted that in Embodiment 2, the preamble removal unit 202 extracts SBR presence/absence information and transmits it to the elementary decoding unit 203, but when the sampling rate that the elementary audio stream 300 indicates is from 16 kHz to 24 kHz, the bitstream reception device may, without doing the above, decode the elementary audio stream 300 under the pretense that "(SBR information present" is always indicated. Moreover, in contrast, when the sampling rate that the elementary audio stream 300 indicates is from 32 kHz to 48 kHz, the bitstream reception device may decode the elementary audio stream 300 under the pretense that "no SBR information" is always indicated

[0133] Hereinbefore, the bitstream transmission device and the bitstream transmission and reception system according to the embodiments of the present invention has been described, but the present invention is not limited to these embodiments.

[0134] Moreover, each processing unit included in the bitstream transmission device or the bitstream transmission and reception system according to the above embodiments are typical realized as an LSI, which is an integrated circuit. Each of these processing units may be individually realized as a single chip, or a portion or all of the processing units may be realized as a single chip.

[0135] Moreover, a portion or all of the functions of the bitstream transmission device or the bitstream reception and transmission system according to the embodiments of the present invention may be realized by a processor such as a CPU executing a computer program.

[0136] Moreover, the present invention may be the above-described computer program, and may be a non-transitory computer-readable recording medium having the computer program recorded thereon. Moreover, it goes without saying that the above-described computer program is capable of being circulated over a transmission medium such as the Internet.

[0137] Moreover, the functions of the bitstream transmission device and the bitstream reception and transmission system according to the above-described Embodiment 1 and Embodiment 2, as well the variations thereof, may be, at least in part, combined.

[0138] Moreover, the division of the function blocks in the block diagrams is just one example. A plurality of function blocks may be realized as a single function block, a single function block may be divided into a plurality of function blocks, or a portion of functions of one block may be may be transferred to a different function block. Moreover, the functions of a plurality of function blocks having similar functions may be processed by a single piece of hardware or software in parallel or by time-division.

[0139] Furthermore, as long as they do not depart from the essence of the present invention, various modifications to the present embodiment which may be conceived by those skilled in the art are intended to be included within the scope of this invention.

[Industrial Applicability]

[0140] The bitstream transmission device according to the present invention is capable of changing information relating to the presence or absence of SBR information, and thus is capable of transmitting bitstreams using the IEC 61937 standard even if the bitstream inputted is not defined by the IEC 61937 standard. As such, the present invention is widely applicable to DTV broadcast reception devices and reproduction devices which read and reproduce a signal from a recording medium storing an audio coded signal. Moreover, since the present invention is capable of suppressing occurrences of changes in sampling rate at the time of switching between content of different audio data coding formats, the present invention can reproduce quality sound without interruptions.

[Reference Signs List]

[0141]

100 input unit
101 analysis unit
102, 1010 preamble generation unit
103 forming unit
104 output unit
200, 1000 bitstream transmission device
201, 1001 bitstream reception device
202 preamble removal unit
203 elementary decoding unit
210 bitstream reception and transmission system
220 television
221 decoder
222 two-channel downmix unit
223 speakers
230 theater system
231 multi-channel speakers
300 elementary audio stream
301 audio bitstream
1011 capability information notification unit

Claims

1. A bitstream transmission device that transmits an audio bitstream in a given format, the bitstream transmission device comprising:

   an input unit configured to acquire an elementary audio stream obtained by coding an audio signal;

an analysis unit configured to analyze a sampling frequency and a coding format of the elementary audio stream;
a preamble generation unit configured to generate, based on a result of the analysis by the analysis unit, a preamble signal including information indicating a coding format of the elementary audio stream;
a forming unit configured to form the audio bitstream in the given format by incorporating in the elementary audio stream the preamble signal generated by the preamble generation unit; and
an output unit configured to output the audio bitstream formed by the forming unit,
wherein based on the sampling frequency and the coding format resulting from the analysis by the analysis unit, the preamble generation unit is configured to specify, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream and is different from the coding format of the elementary audio stream resulting from the analysis by the analysis unit.

2. The bitstream transmission device according to Claim 1,
wherein the preamble generation unit is configured to specify the information included in the preamble signal and indicating the coding format to limit an output transmission rate of data output from the output unit to a predetermined range.

3. The bitstream transmission device according to Claim 1,
wherein the audio bitstream in the given format is an audio bitstream in a format defined by the IEC 61937 standard, and
when the sampling frequency resulting from the analysis by the analysis unit is a predetermined first frequency and the coding format corresponding to the first frequency does not comply with the IEC 61937 standard, to generate the preamble signal that conforms the audio bitstream to the IEC 61937 standard, the preamble generation unit is configured to specify, as the information indicating the coding format, a coding format different from the analyzed coding format in terms of presence or absence of spectral band replication (SBR) information in the elementary audio stream.

4. The bitstream transmission device according to Claim 3,
wherein when the sampling frequency resulting from the analysis by the analysis unit is a predetermined second frequency, the preamble generation unit is further configured to specify, as the information included in the preamble signal and indicating the coding format, that the elementary audio stream is coded in a coding format not including the SBR information.

5. The bitstream transmission device according to Claim 3,
wherein when the sampling frequency resulting from the analysis by the analysis unit is a predetermined third frequency, the preamble generation unit is configured to generate the preamble signal indicating that the elementary audio stream is coded in a coding format including the SBR information, even when the elementary audio stream is not coded in a coding format including the SBR information.

6. The bitstream transmission device according to Claim 3,
wherein when the sampling frequency resulting from the analysis by the analysis unit is a predetermined fourth frequency, the preamble generation unit is configured to generate the preamble signal indicating that the elementary audio stream is coded in a coding format not including the SBR information, even when the elementary audio stream is coded in a coding format including the SBR information.

7. A bitstream reception and transmission system comprising the bitstream transmission device according to any one of Claims 1 to 6 and a bitstream reception device that receives the audio bitstream transmitted from the bitstream transmission device and decodes the received audio bitstream,
wherein the bitstream reception device includes:

a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal included in the received audio bitstream; and
an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decode the elementary audio stream according to the coding format indicated by the information specified in the preamble signal.

8. A bitstream reception and transmission system comprising the bitstream transmission device according to Claim 5 and a bitstream reception device that receives the audio bitstream transmitted from the bitstream transmission device and decodes the received audio bitstream,
wherein the bitstream reception device includes:

a preamble removal unit configured to extract

the elementary audio stream by removing the preamble signal included in the received audio bitstream; and

an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, perform decoding where a signal with an expanded high band is 0 and which uses the SBR information, in accordance with the information specified in the preamble signal and indicating the coding format.

9. A bitstream reception and transmission system comprising the bitstream transmission device according to Claim 6 and a bitstream reception device that receives the audio bitstream transmitted from the bitstream transmission device and decodes the received audio bitstream,
wherein the bitstream reception device includes:

a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal from the received audio bitstream; and

an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, generate a signal having a sampling frequency that is half a sampling frequency when decoding processing using the SBR information is performed, in accordance with the information specified in the preamble signal and indicating the coding format.

10. The bitstream transmission and reception system according to any one of Claims 7 to 9,
wherein the bitstream reception device includes a capability notification unit configured to notify the bitstream transmission device with information indicating a capability of the bitstream reception device,
the analysis unit is configured to analyze Fs information indicating a sampling rate of the elementary audio stream, and
when the Fs information indicates a predetermined value, the preamble generation unit is configured to switch between generating or not generating a preamble signal indicating inclusion of SBR information, based on the information from the capability notification unit.

11. A bitstream reception device comprising:

a reception unit configured to receive, from a bitstream transmission device, an audio bitstream in a given format that (i) is formed by incorporating, into an elementary audio stream which is a coded audio signal, a preamble signal including information indicating a coding format of the elementary audio stream, and (ii) specifies, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream when a sampling frequency and the coding format of the elementary audio stream do not comply with the given format of the audio bitstream;

a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal included in the received audio bitstream; and

an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decode the elementary audio stream according to the coding format indicated by the information specified in the preamble signal.

12. The bitstream reception device according to Claim 11,
wherein the bitstream reception device receives the audio bitstream including the preamble signal indicating that the elementary audio stream is coded in a coding format including SBR information when the sampling frequency of the elementary audio stream is a predetermined third frequency, even when the elementary audio stream is not coded in a coding format including the SBR information, and
the elementary decoding unit is configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, perform decoding where a signal with an expanded high band is 0 and which uses the SBR information, in accordance with the information specified in the preamble signal and indicating the coding format.

13. The bitstream reception device according to Claim 11,
wherein the bitstream reception device receives the audio bitstream including the preamble signal indicating that the elementary audio stream is coded in a coding format not including SBR information when the sampling frequency of the elementary audio stream is a predetermined fourth frequency, even

when the elementary audio stream is coded in a coding format including the SBR information, and
the elementary decoding unit is configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, generate a signal having a sampling frequency that is half a sampling frequency when decoding processing using the SBR information is performed, in accordance with the information specified in the preamble signal and indicating the coding format.

14. A bitstream transmission method of transmitting an audio bitstream in a given format, the bitstream transmission method comprising:

acquiring an elementary audio stream obtained by coding an audio signal;
analyzing a sampling frequency and a coding format of the elementary audio stream;
generating, based on a result of the analyzing, a preamble signal including information indicating a coding format of the elementary audio stream;
forming the audio bitstream in the given format by incorporating in the elementary audio stream the generates preamble signal; and
outputting the formed audio bitstream,
wherein based on the sampling frequency and the coding format resulting from the analyzing, in the generating of a preamble signal, a coding format that complies with the given format of the audio bitstream and is different from the coding format of the elementary audio stream resulting from the analyzing is specified as the information included in the preamble signal and indicating the coding format.

15. A bitstream reception method comprising:

receiving, from a bitstream transmission device, an audio bitstream in a given format that (i) is formed by incorporating, into an elementary audio stream which is a coded audio signal, a preamble signal including information indicating a coding format of the elementary audio stream, and based on a sampling rate and the coding format of the elementary audio stream, (ii) specifies, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream and is different from a coding format resulting from an analysis of the elementary bit stream;
extracting the elementary audio stream by removing the preamble signal included in the received audio bitstream; and
when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decoding the elementary audio stream according to the coding format indicated by the information specified in the preamble signal.

16. An integrated circuit comprising:

an input unit configured to acquire an elementary audio stream obtained by coding an audio signal;
an analysis unit configured to analyze a sampling frequency and a coding format of the elementary audio stream;
a preamble generation unit configured to generate, based on a result of the analysis by the analysis unit, a preamble signal including information indicating a coding format of the elementary audio stream;
a forming unit configured to form the audio bitstream in the given format by incorporating in the elementary audio stream the preamble signal generated by the preamble generation unit; and
an output unit configured to output the audio bitstream formed by the forming unit,
wherein based on the sampling frequency and the coding format resulting from the analysis by the analysis unit, the preamble generation unit is configured to specify, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream and is different from the coding format of the elementary audio stream resulting from the analysis by the analysis unit.

17. An integrated circuit comprising:

a reception unit configured to receive, from a bitstream transmission device, an audio bitstream in a given format that (i) is formed by incorporating, into an elementary audio stream which is a coded audio signal, a preamble signal including information indicating a coding format of the elementary audio stream, and based on a sampling rate and the coding format of the elementary audio stream, (ii) specifies, as the information included in the preamble signal and indicating the coding format, a coding format that complies with the given format of the audio bitstream and is different from a coding format resulting from an analysis of the elementary bit

stream,
a preamble removal unit configured to extract the elementary audio stream by removing the preamble signal included in the received audio bitstream; and
an elementary decoding unit configured to, when the information specified in the preamble signal and indicating the coding format of the elementary audio stream and the information included in the elementary audio stream and indicating the coding format of the elementary audio stream are inconsistent, decode the elementary audio stream according to the coding format indicated by the information specified in the preamble signal.

18. An audio bitstream described having a given format, wherein the audio bitstream is formed by incorporating a preamble signal in an elementary audio stream obtained by coding an audio signal, and
based on a sampling frequency and a coding format of the elementary audio stream that are specified in the elementary audio stream, a coding format that complies with the given format of the audio bitstream and is different from the coding format specified in the elementary audio stream is specified in the audio bitstream as information included in the preamble signal and indicating the coding format.

19. The audio bitstream according to Claim 18, wherein the information indicating the coding format of the elementary audio stream specifies a coding format different from the coding format specified in the elementary audio stream in terms of presence or absence of spectral band replication (SBR) information in the elementary audio stream.

FIG. 1

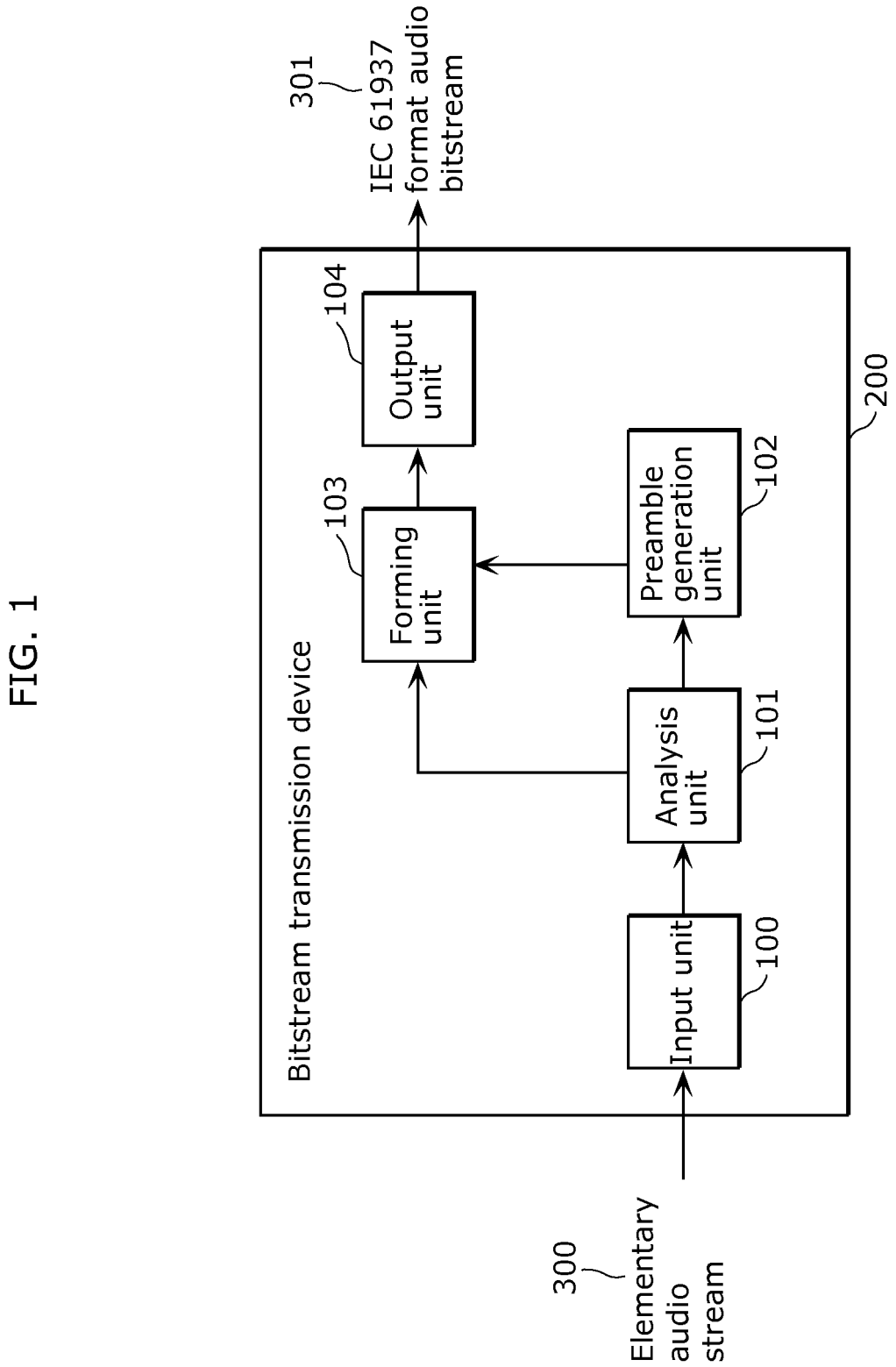

301
IEC 61937 format audio bitstream
104
Output unit
103
Forming unit
102
Preamble generation unit
200
Bitstream transmission device
101
Analysis unit
100
Input unit
300
Elementary audio stream

FIG. 2

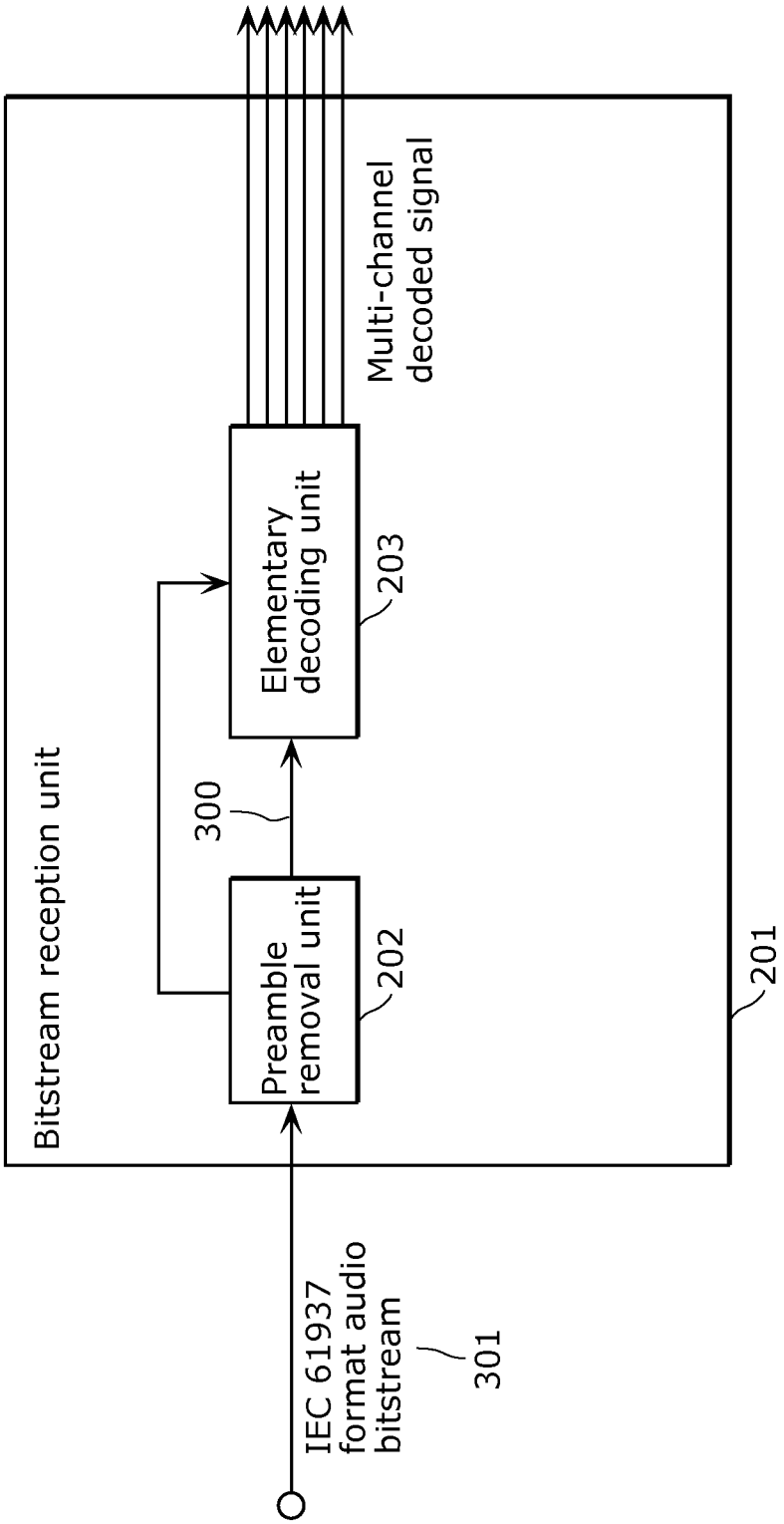

Bitstream reception unit
Preamble removal unit
202
300
Elementary decoding unit
203
Multi-channel decoded signal
201
IEC 61937 format audio bitstream
301

FIG. 3

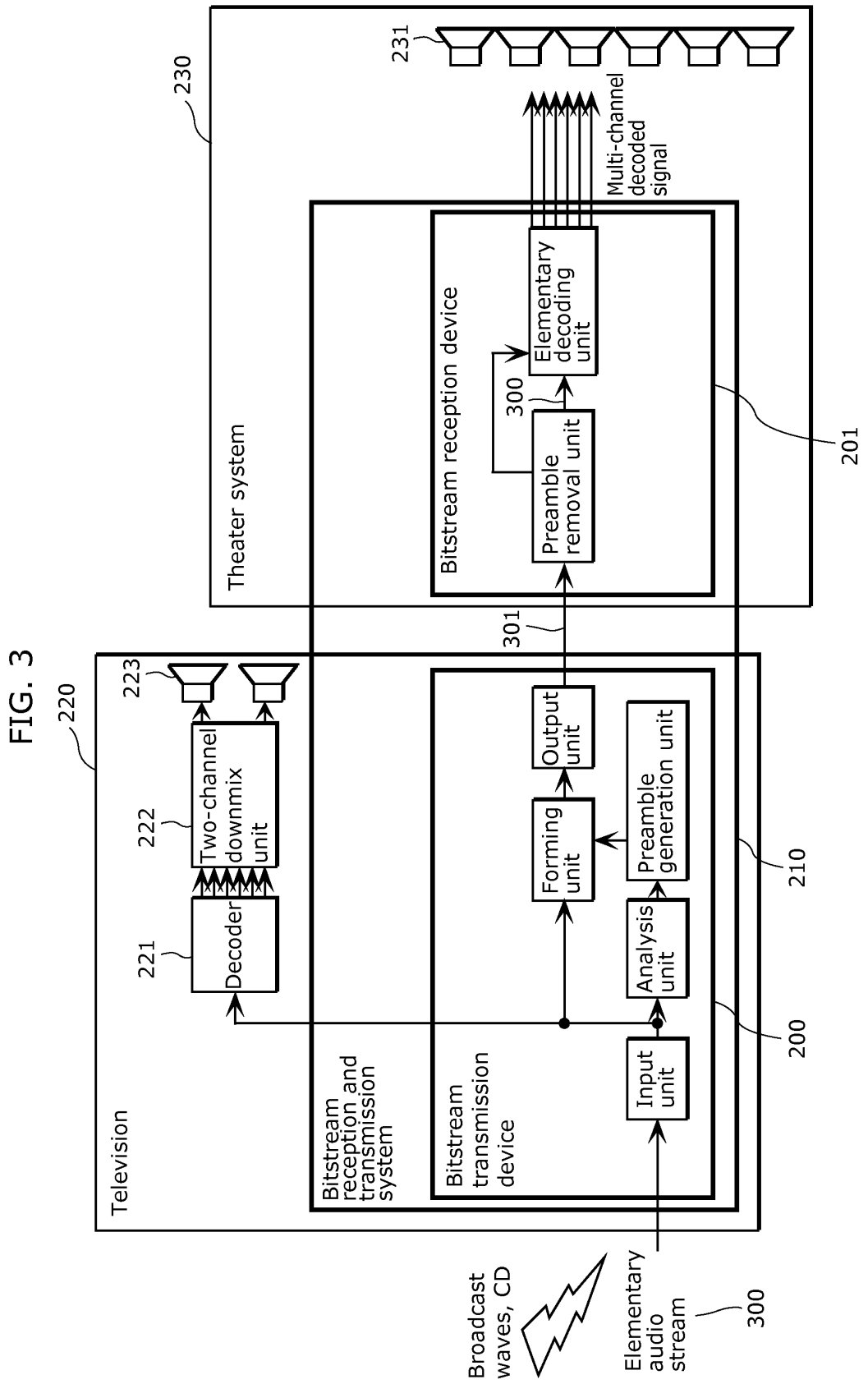

Broadcast waves, CD
Elementary audio stream
300
Television
220
Bitstream reception and transmission system
Bitstream transmission device
200
Input unit
Analysis unit
Preamble generation unit
210
Forming unit
Output unit
301
223
221
Decoder
222
Two-channel downmix unit
Theater system
230
Bitstream reception device
201
Preamble removal unit
300
Elementary decoding unit
231
Multi-channel decoded signal

FIG. 4A

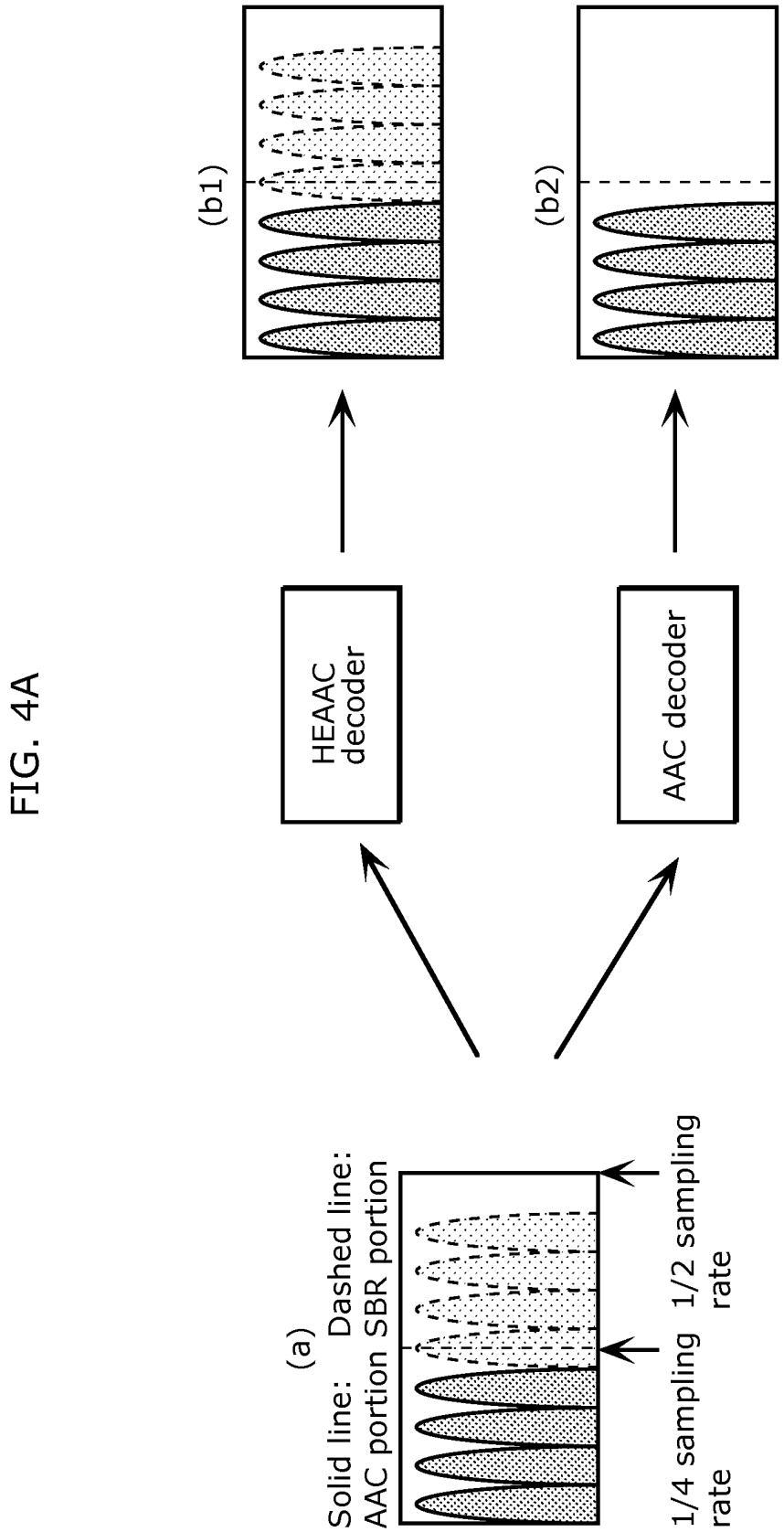

(a)
Solid line: Dashed line:
AAC portion SBR portion
1/4 sampling rate
1/2 sampling rate
HEAAC decoder
AAC decoder
(b1)
(b2)

FIG. 4B

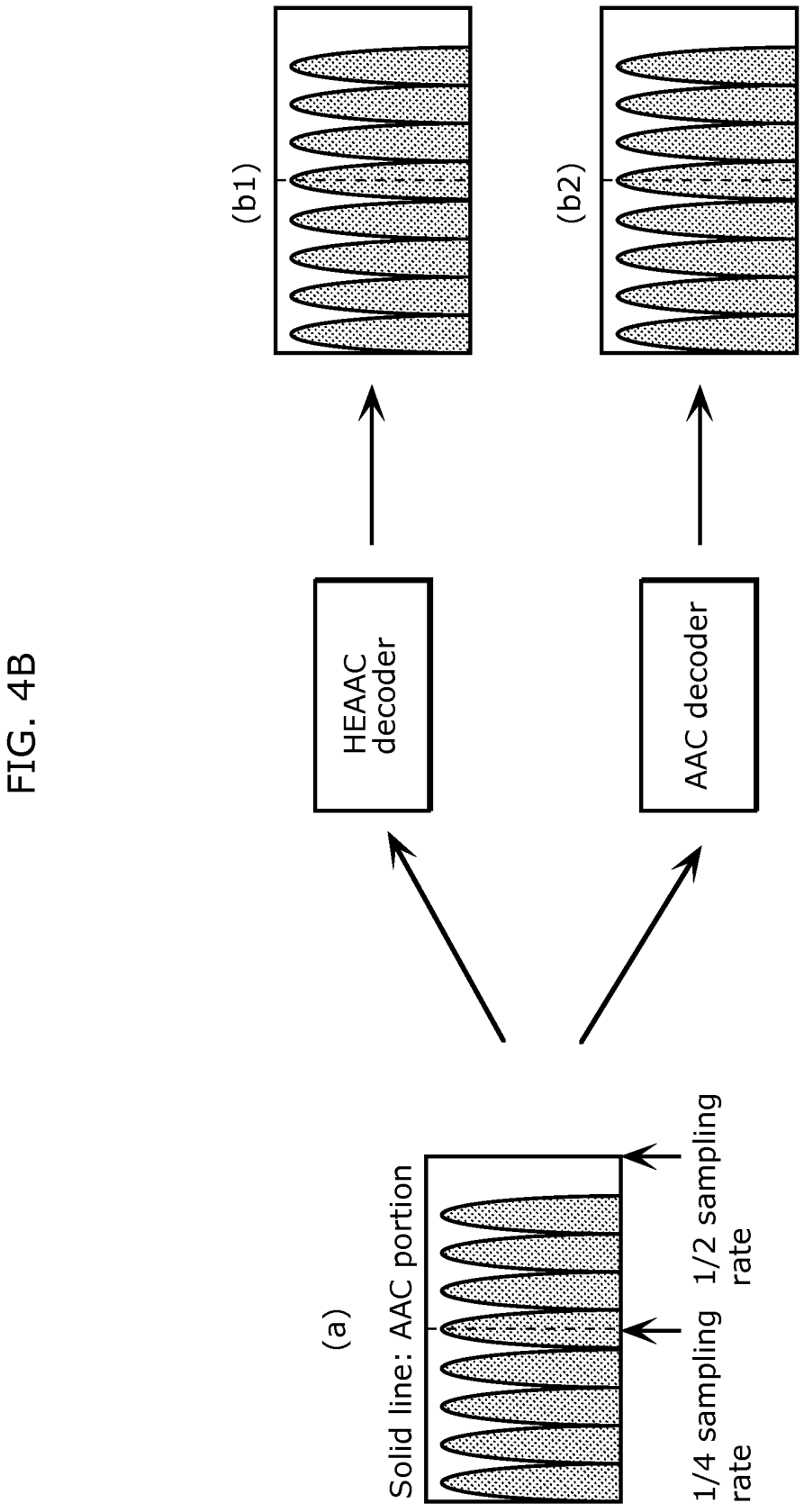

(a)
Solid line: AAC portion
1/4 sampling rate
1/2 sampling rate
HEAAC decoder
AAC decoder
(b1)
(b2)

FIG. 5A

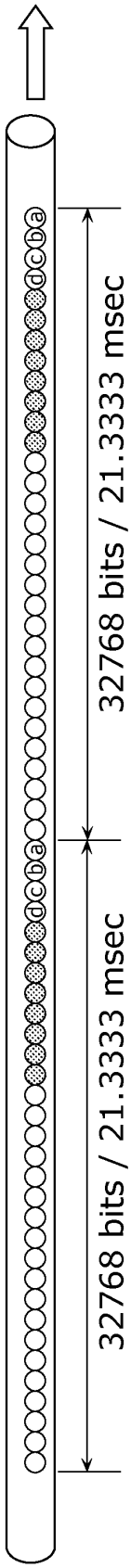


FIG. 5B

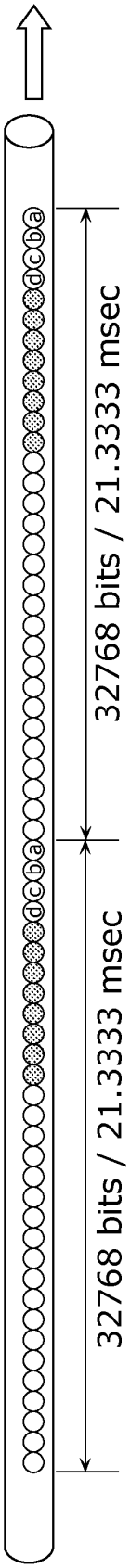


FIG. 5C

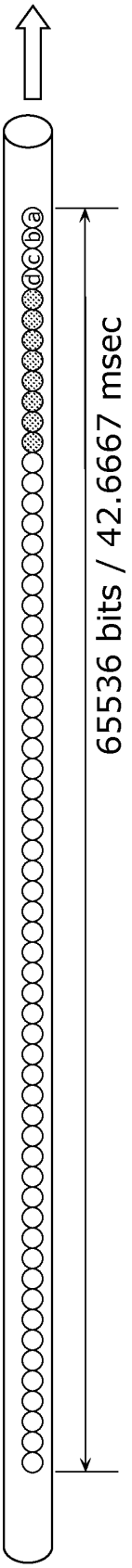


FIG. 6

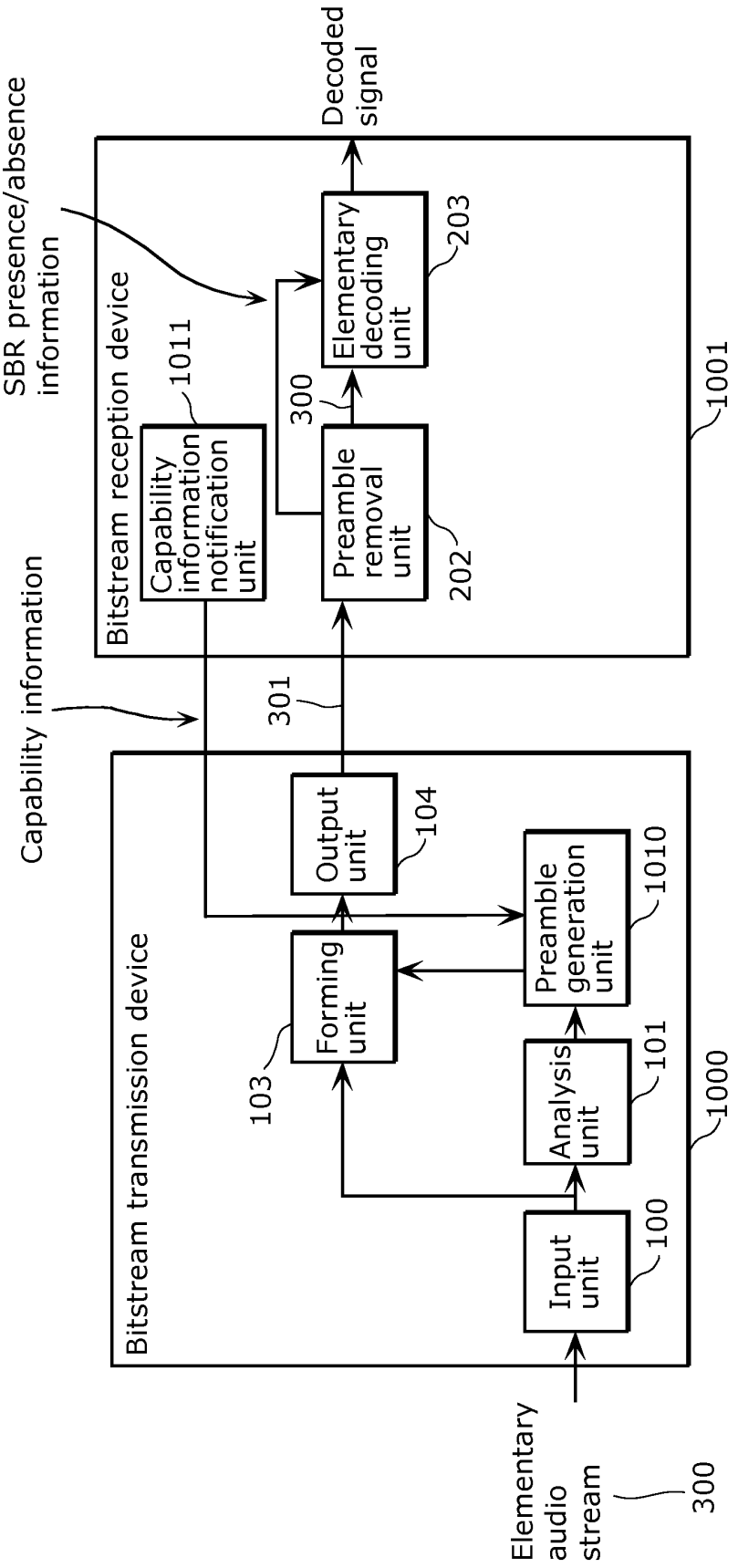

Elementary audio stream
300
Bitstream transmission device
Input unit
100
Analysis unit
101
Preamble generation unit
1010
Forming unit
103
Output unit
104
1000
Capability information
301
Bitstream reception device
Capability information notification unit
1011
Preamble removal unit
202
300
Elementary decoding unit
203
1001
SBR presence/absence information
Decoded signal

FIG. 7

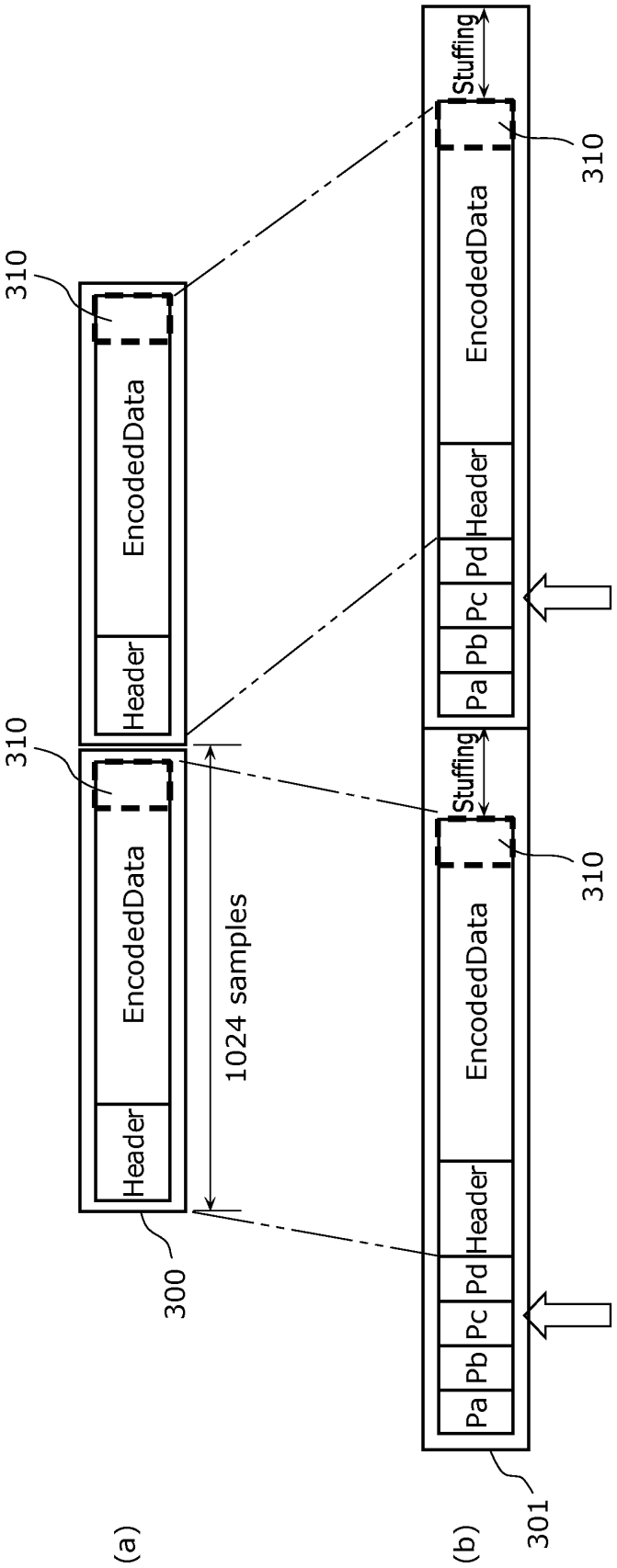
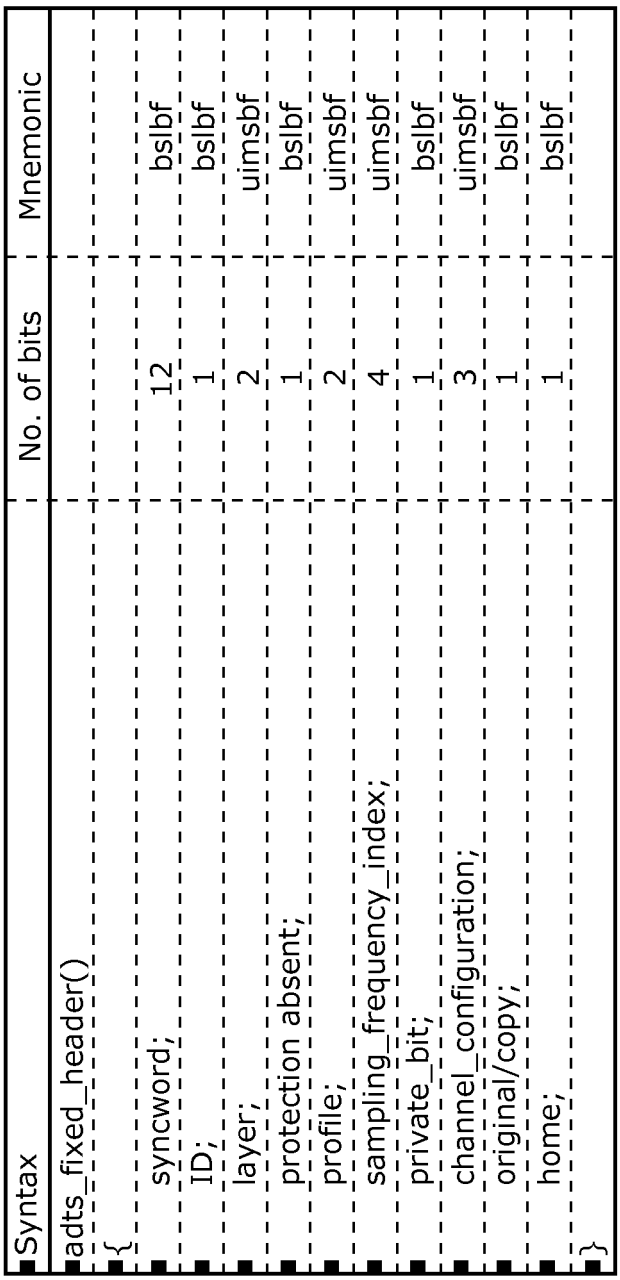

(a)
(b)
310
310
310
310
Header
EncodedData
Stuffing
Header
EncodedData
Stuffing
Pa
Pb
Pc
Pd
1024 samples
300
301

FIG. 8A



Syntax	No. of bits	Mnemonic
adts_fixed_header()		
{		
syncword;	12	bslbf
ID;	1	bslbf
layer;	2	uimsbf
protection absent;	1	bslbf
profile;	2	uimsbf
sampling_frequency_index;	4	uimsbf
private_bit;	1	bslbf
channel_configuration;	3	uimsbf
original/copy;	1	bslbf
home;	1	bslbf
}		

FIG. 8B

Syntax	No. of bits	Mnemonic
AudioSpecificConfig ()		
{		
audioObjectType = GetAudioObjectType();		
samplingFrequencyIndex;	4	bslbf
if (samplingFrequencyIndex == 0xf) {		
samplingFrequency;	24	uimsbf
}		
channelConfiguration;	4	bslbf
sbrPresentFlag = -1;		
if {AudioObjectType == 5) {		
extensionAudioObjectType = audioObjectType ;		
sbrPresentFlage = 1;		
extensionSamplingFrequencyIndex;	4	uimsbf
if (extensionSamplingFrequencyIndex == 0xf)		
extensionSamplingFrequency;	24	uimsbf
audioObjectType = GetAudioObjectType();		
}		
else {		
extensionAudioObjectType = 0;		
}		
switch (audioObjectType) {		

FIG. 9

Data-type According to IEC 61937-2 Value of Pc bits 0-4	Sub-data-type Value of Pc bits 5-6	Contents	Reference point R	Repetition period of data-bursts in IEC 60958 frames
0-22	0-3	According to IEC 61937		
23	0	According to IEC 61937-10		Definition specific to IEC 61937-10
	1	AAC LC	Bit 0 of Pa	960 / 1 024
	2	HE AAC	Bit 0 of Pa	1 920 / 2 048
	3	Reserved for future definition of other applications	reserved	Reserved for future definition of other applications
24-31	0-3	According to IEC 61937		

FIG. 10

Sampling rate	Audio data coding format	
	AAC (SBR absent)	HEAAC (SBR present)
16 kHz	×	○
22.05 kHz	×	○
24 kHz	×	○
32 kHz	○	×
44.1 kHz	○	×
48 kHz	○	○

FIG. 11A

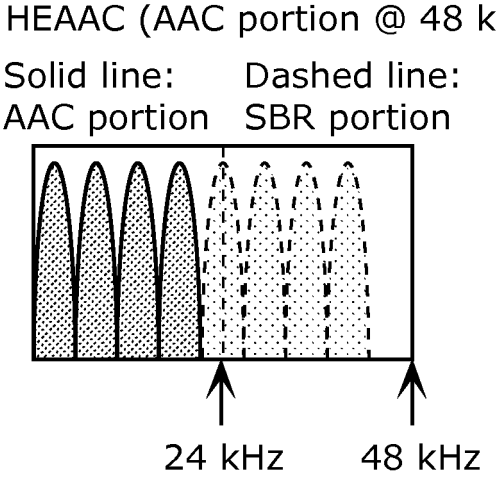
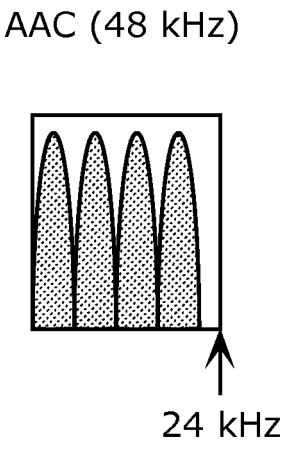


FIG. 11B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/003205

A. CLASSIFICATION OF SUBJECT MATTER
G10L19/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G10L19/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2012
Kokai Jitsuyo Shinan Koho	1971-2012	Toroku Jitsuyo Shinan Koho	1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-50387 A (Matsushita Electric Industrial Co., Ltd.), 16 February 2006 (16.02.2006), entire text; fig. 1 to 12 (Family: none)	1-19
A	JP 2004-7359 A (Matsushita Electric Industrial Co., Ltd.), 08 January 2004 (08.01.2004), entire text; fig. 1 to 5 & US 2003/0191630 A1 & EP 1353512 A1 & CN 1450738 A	1-19

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August, 2012 (21.08.12)	04 September, 2012 (04.09.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/003205

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-202353 A (Matsushita Electric Industrial Co., Ltd.), 03 August 2006 (03.08.2006), entire text; fig. 1 to 5 (Family: none)	1-19
A	WO 2006/090852 A1 (Matsushita Electric Industrial Co., Ltd.), 31 August 2006 (31.08.2006), entire text; fig. 1 to 17 & US 2009/0228283 A1 & EP 1860649 A1 & DE 602006021402 D & KR 10-2007-0111954 A	1-19
A	JP 2007-17628 A (Matsushita Electric Industrial Co., Ltd.), 25 January 2007 (25.01.2007), entire text; fig. 1 to 10 (Family: none)	1-19

Form PCT/ISA/210 (continuation of second sheet) (July 2009)