

ITU-R

Radiocommunication Sector of ITU

Recommendation ITU-R BT.1365-2 (10/2015)

24-bit digital audio format as ancillary data signals in HDTV and UHDTV serial interfaces

BT Series
Broadcasting service
(television)



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Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BT.1365-2

**24-bit digital audio format as ancillary data signals
in HDTV and UHDTV serial interfaces**

(Question ITU-R 130/6)

(1998-2010-2015)

Scope

This Recommendation defines the mapping of 24-bit digital audio data conforming with Recommendation ITU-R BS.647 and associated control information into the ancillary data space of serial digital video interfaces conforming to Recommendation ITU-R BT.1120 and Recommendation ITU-R BT.2077. The audio data are derived from Recommendation ITU-R BS.647, hereafter referred to as Audio Engineering Society (AES).

Keywords

UHDTV, Serial Interface, AES bit stream

The ITU Radiocommunication Assembly,

considering

- a) that many countries are installing digital HDTV and UHDTV production facilities based on the use of digital video components conforming to Recommendations ITU-R BT.709, ITU-R BT.2020, ITU-R BT.1120 and ITU-R BT.2077;
- b) that there exists the capacity within the serial digital interface for HDTV and UHDTV for additional data signals to be multiplexed as part of the serial data stream;
- c) that there are operational and economic benefits to be achieved by the multiplexing of ancillary data signals along with the video data signal;
- d) that audio is one of the most important uses of the ancillary data packets;
- e) that audio data may need error correction codes to keep the balance between audio quality and video quality because errors in audio data are more easily noticed than those of video data;
- f) that audio equipment with 24-bit accuracy is commonly used in production facilities;
- g) that some broadcasters have the need to transmit asynchronous audio data by multiplexing into the serial digital interface,

recommends

- 1 that, for the inclusion of 24-bit digital audio format as ancillary data signals in HDTV and UHDTV serial interfaces, the specification described in Annex 1 and or Annex 2 of this Recommendation should be used;
- 2 that compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met.

Definition of terms

Definition of these terms applies to the usage made in this Recommendation.

AES audio: All the VUCP (sample validity bit (V), user data bit (U), channel status bit (C), even parity bit (P)) data, audio data and auxiliary data, associated with one AES digital stream as defined in Recommendation ITU-R BS.647.

AES frame: Two AES subframes; in the case of the 32 kHz to 48 kHz sampling subframes one and two carry AES audio channel 1 and 2 respectively. In the case of 96 kHz sampling subframes one and two carry successive samples of the same AES audio signal which is mandatory for 96 kHz application.

AES subframe: All data associated with one AES audio sample for one channel in a channel pair.

audio control packet: An ancillary data packet occurring once a field in an interlaced system and once a frame in a progressive system and containing data used in the process of decoding the audio data stream.

audio clock phase data: Audio clock phase is indicated by the number of video clocks between the first word of EAV and the video sample at the same timing when audio sample appeared at the input to the formatter.

audio data: 29 bits: 24 bits of AES audio associated with one audio sample, including AES auxiliary data, plus VUCP bits and the Z flag which is derived from the preamble of AES3 stream. The Z bit is common to the two channels of an AES channel pair.

error correction code: BCH (31, 25) code (an error correction method) in each bit sequence of b0-b7. Errors between the first word of ancillary data flag (ADF) through the last word of audio data of channel 4 (CH4) in user data words (UDW) will be corrected or detected within the capability of this code.

audio data packet: An ancillary data packet containing audio clock phase data, audio data for two channel pairs (4 channels) and error correction code. An audio data packet should contain audio data of one sample associated with each audio channel.

audio frame number: A number, starting at 1, for each frame within the audio frame sequence.

audio frame sequence: The number of video frames required for an integer number of audio samples in isochronous operation.

audio group: Consists of two channel pairs that are contained in one ancillary data packet. Each audio group has a unique ID. Audio groups are numbered 1 through 4.

channel pair: Two digital audio channels, derived from the same AES audio source.

data ID: A word in the ancillary data packet which identifies the use of the data therein.

Extended audio group: an audio group as defined in Annex 1 of this Recommendation, but numbered from 5 to 8.

Extended audio data packet: an audio data packet as defined in Annex 1 of this Recommendation, but with identity corresponding to Extended audio group numbers 5 to 8.

Extended audio control packet: an audio control packet defined in Annex 1 of this Recommendation, but with identity corresponding to Extended audio group numbers 5 to 8.

horizontal ancillary data block: An ancillary data space located in the digital line blanking interval of one television line.

isochronous audio: Audio is defined as being clock isochronous with video if the sampling rate of audio is such that the number of audio samples occurring within an integer number of video frames is itself a constant integer number, as shown in the following example:

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TABLE 1
Examples of samples per frame for synchronous audio

Audio sampling rate	Samples-frame/s										
	120	120/1.001	100	60	60/1.001	50	30.00	30.00/1.001	25.00	24.00	24.00/1.001
96.0 kHz	800/1	4004/5	960	1600/1	8008/5	1920	3 200/1	16 016/5	3 840/1	4 000/1	4 004/1
48.0 kHz	400/1	2002/5	480	800/1	4004/5	960	1 600/1	8 008/5	1 920/1	2 000/1	2 002/1

Annex 1

24-bit digital audio format as ancillary data signals in HDTV and UHDTV serial interfaces

1 Introduction

Audio sampled at a clock frequency of 48 kHz locked (synchronous) to video is the preferred implementation for intrastudio applications. As an option, this Recommendation supports Audio Engineering Society (AES) audio at synchronous or asynchronous sampling rates from 32 kHz to 48 kHz and 96 kHz. Audio channels are transmitted in groups of four, up to a maximum of 16 audio channels in the case of 32 kHz, 44.1 kHz or 48 kHz sampling, and up to a maximum of 8 audio channels in case of 96 kHz sampling. Each group is identified by a unique ancillary data ID.

Audio data packets are multiplexed (embedded) into the horizontal ancillary data space of the C'_B/C'_R data stream, and audio control packets are multiplexed into the horizontal ancillary data space of the Y data stream. The multiplexed data are converted into serial form according to the HDTV serial digital interfaces defined in Recommendation ITU-R BT.1120.

For UHDTV interfaces conforming to Recommendation ITU-R BT. 2077 Parts 1 and 3, this Recommendation applies to Y data stream and C'_B/C'_R data stream, making up the overall multiplex.

For UHDTV interfaces conforming to Recommendation ITU-R BT.2077 Part 2, this Recommendation applies to basic stream 1 and basic stream 2 of the interface according to §§ 3.5 and 3.6 in Part 2 of Recommendation ITU-R BT.2077.

2 References

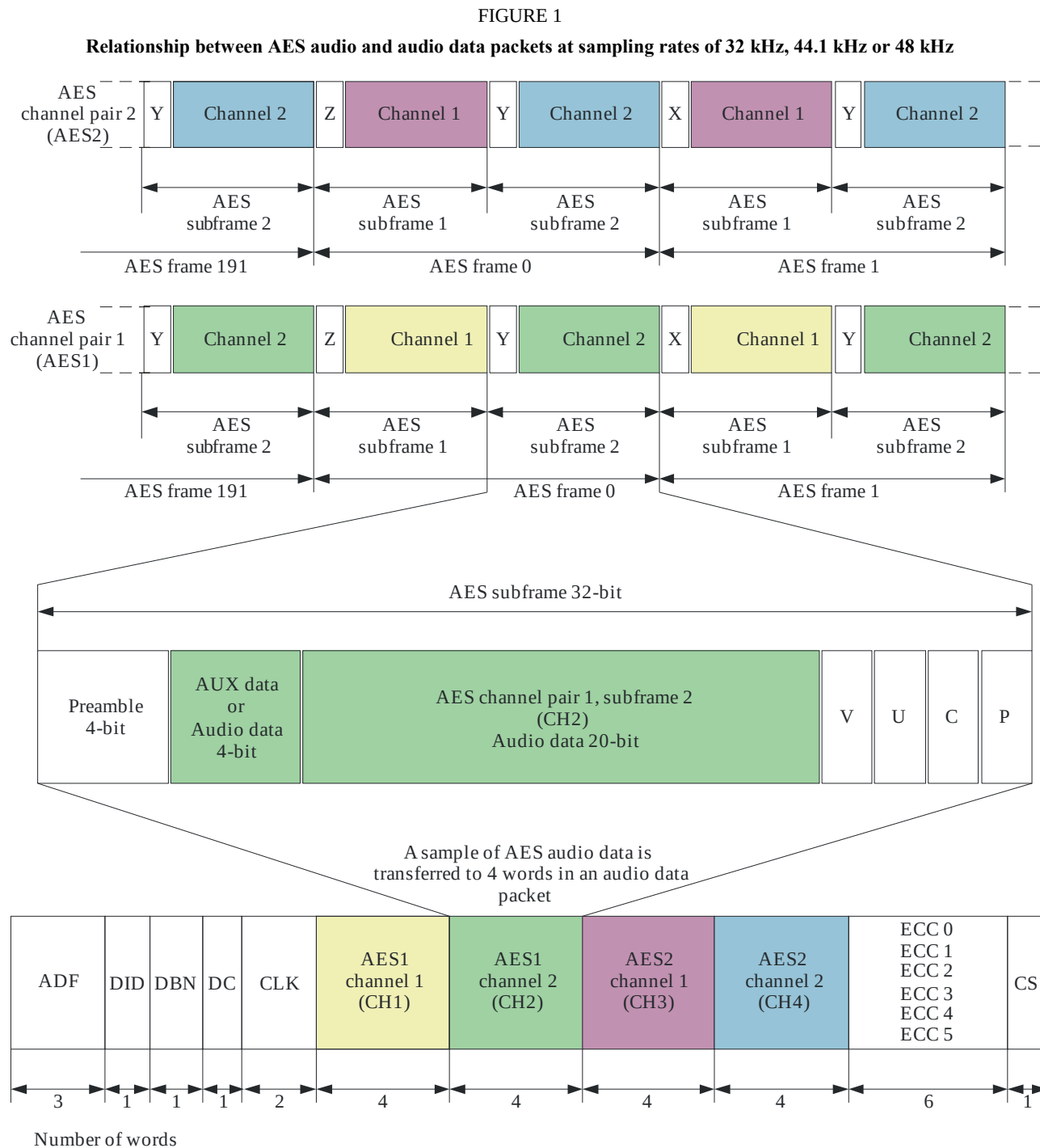
- Recommendation ITU-R BT.709 – Parameter Values for the HDTV standards for production and international programme exchange.
- Recommendation ITU-R BT.1120 – Digital interfaces for HDTV studio signals.
- Recommendation ITU-R BS.647 – A Digital audio interface for broadcasting studios.
- Recommendation ITU-R BT.2020- Parameter values for ultra-high definition television systems for production and international programme exchange.
- Recommendation ITU-R BT.2077– Real-time serial digital interfaces for UHDTV signals.
- Recommendation ITU-R BT.1364 – Format of Ancillary Data signals carried in digital component studios.

3 Overview

3.1 The modes of transmission carried in an audio data packet should be the two channel mode at all sampling frequencies from 32 kHz to 48 kHz and the single channel double sampling frequency mode at the sampling frequency of 96 kHz. Audio data channels 1~4 (CH1~CH4) carry two AES audio channel pairs (AES1 channel 1 & 2 and AES2 channel 1 & 2) in the case of 32 kHz to 48 kHz sampling. For 96 kHz sampling two successive samples of two AES audio channels (AES1 channel 1 1st & 2nd sample and AES2 channel 1 1st & 2nd sample) should be carried.

3.2 The 32 kHz, 44.1 kHz or 48 kHz sampling audio data derived from two channel pairs should be configured in an audio data packet as shown in Fig. 1. Both channels of a channel pair are derived from the same AES audio source. The number of samples per channel used for one audio data packet

should be constant and is equal to one. The number of audio data packets in a given group should be less than or equal to N_a in a horizontal ancillary data block. See § 4.3.3.

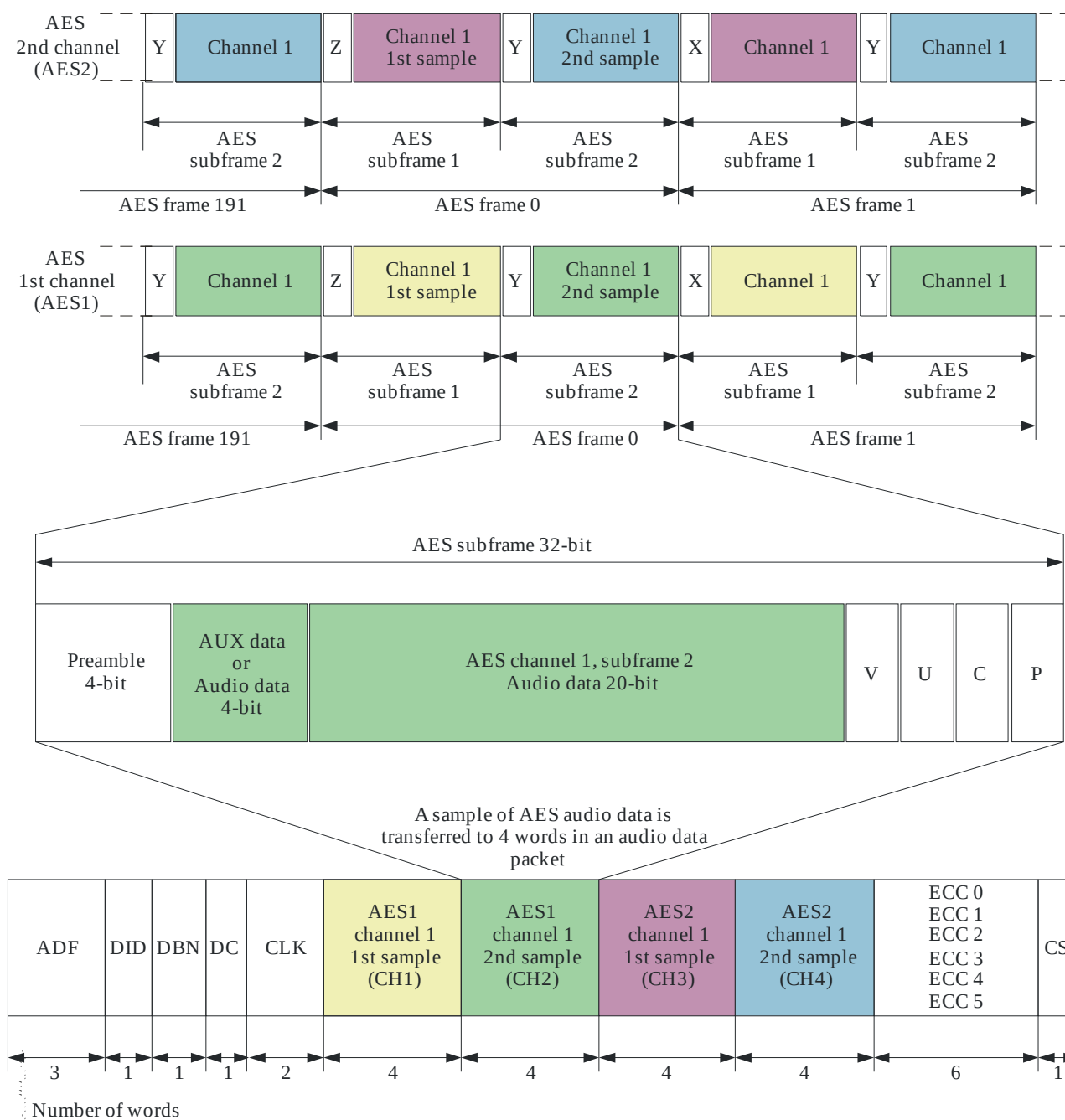


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3.3 Figure 2 shows the audio data packet at the sampling rate of 96 kHz. AES subframes 1 and 2 carry successive samples of the same AES audio signal. Both channels should be derived from the same AES audio source. The number of samples per channel used for one audio data packet should be constant and equal to two. The number of audio data packets in a given group is less than or equal to $N_a/2$ in a horizontal ancillary data block.

FIGURE 2

Relationship between AES audio and audio data packets at a sampling rate of 96 kHz



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3.4 Two types of ancillary data packets carrying AES audio information are defined in this Recommendation. Each audio data packet should carry all of the information in the AES bit stream. The audio data packet should be located in the horizontal ancillary data space of the C_B/C_R data stream. An audio control packet should be transmitted once per field in an interlaced system and once per frame in a progressive system in the horizontal ancillary data space of the second line after the switching point of the Y data stream.

3.5 Data ID should be defined for four separate packets of each packet type. This allows for up to eight channel pairs. In Annex 1 of this Recommendation, the audio groups are numbered 1 through 4 and the channels are numbered 1 through 16. Channels 1 through 4 are in group 1, channels 5