RECOMMENDATION ITU-R BT.1365*

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

(Questions ITU-R 20/6 and ITU-R 42/6)

(1998)

The ITU Radiocommunication Assembly,

considering

a) that some countries are installing digital HDTV production facilities based on the use of digital video components conforming to Recommendations ITU-R BT.709 and ITU-R BT.1120;

b) that there exists the capacity within a signal conforming to Recommendation ITU-R BT.1120 for additional data signals to be multiplexed with the video data signal itself;

c) that there are operational and economic benefits to be achieved by the multiplexing of ancillary data signals with the video data signal;

d) that audio is one of the most important applications of ancillary data signals;

e) that HDTV serial interfaces have the high bit rate of more than 1 Gbit/s and therefore it is more difficult than in conventional TV serial interfaces to maintain an error-free condition;

f) 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;

g) that audio equipment with 24-bit accuracy is being implemented in production facilities;

h) that some broadcasters have the need to transmit asynchronous audio data by multiplexing into the video data signal,

recommends

1 that, for the inclusion of 24-bit digital audio format as ancillary data signals in HDTV serial interfaces, the specification described in Annex 1 to this Recommendation should be used.

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* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in 2003 in accordance with Resolution ITU-R 44.

Annex 1

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

1 Introduction

This specification 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. The audio data are derived from Recommendation ITU-R BS.647, hereafter referred to as AES audio.

Audio signal, sampled at a clock frequency of 48 kHz locked (isochronous) to video, is the preferred implementation for intra-studio applications. As an option, this specification supports AES audio at isochronous or asynchronous sampling rates from 32 kHz to 48 kHz.

The number of transmitted audio channels ranges from a minimum of two audio channels to a maximum of 16 audio channels. Audio channels are transmitted in pairs, and where appropriate, in groups of four. Each group is identified by a unique ancillary data ID.

Audio data packets are multiplexed into horizontal ancillary data space of the Cb/Cr parallel data stream, and audio control packets are multiplexed into horizontal ancillary data space of the Y parallel data stream. The multiplexed data are converted into serial form according to the HDTV serial digital interfaces defined in Recommendation ITU-R BT.1120.

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.

3 Definition of terms

3.1 **AES audio**: All the data, audio and auxiliary, associated with one AES digital stream as defined in Recommendation ITU-R BS.647.

3.2 **AES frame**: Two AES subframes, one with audio data for channel 1 followed by one with audio data for channel 2.

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

3.4 **audio control packet**: An ancillary data packet occurring once a field and containing data used in the process of decoding the audio data stream.

3.5 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.

3.6 audio data: 29 bits: 24 bits of AES audio associated with one audio sample, including AES auxiliary data, plus sample validity bit (V), channel status bit (C), user data bit (U), even parity bit (P) and Z flag which is derived from the preamble of AES audio stream. The Z bit is common to two channels of AES channel pair.

3.7 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.

3.8 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 shall contain audio data of one sample associated with each audio channel.

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

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

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

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

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

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

3.15 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:

Audio sampling rate	Samples/frame (in case of 1125/60)	Samples/frame (in case of 1125/59.94)
48.0 kHz	1 600/1	8 008/5
44.1 kHz	1 470/1	147 147/100
32.0 kHz	3 200/3	16 016/15

4 Overview

4.1 Audio data derived from two channel pairs are 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 is constant and is equal to one. The number of audio data packets in a given group is 0, 1 or 2 in a horizontal ancillary data block.

4.2 Two types of ancillary data packets carrying AES audio information are defined. Each audio data packet carries all of the information in the audio bit stream as defined in Recommendation ITU-R BS.647. The audio data packet is located in horizontal ancillary data space of the Cb/Cr parallel data stream. An audio control packet is transmitted once per field in horizontal ancillary data space of the second line after the switching point of the Y parallel data stream.

4.3 Data ID are defined for four separate packets of each packet type. This allows of up to eight channel pairs. 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 through 8 are in group 2, and so on.

5 Audio data packet

5.1 Structure of audio data packet

5.1.1 The structure of the audio data packet shall be as shown in Fig. 2. Audio data packets consist of ancillary data flag (ADF), data identification (DID), data block number (DBN), data count (DC), user data words (UDW) and checksum (CS). ADF, DBN, DC and CS are subject to Recommendation ITU-R BT.1364, “Format of Ancillary Data Signals Carried in Digital Component Studio Interfaces”. DC is always 218h.

5.1.2 DID is defined as 2E7h for audio group 1 (channel 1-4), 1E6h for audio group 2 (channel 5-8), 1E5h for audio group 3 (channel 9-12) and 2E4h for audio group 4 (channel 13-16), respectively.

5.1.3 UDW is defined in 5.2. In this specification, UDWx means the Xth user data word. There are always 24 words in the UDW of an audio data packet, i.e. UDW0, UDW1, …, UDW22, UDW23.

5.1.4 All audio channels in a given audio group shall have identical sampling rate, identical sampling phase and identical isochronous/asynchronous status.

5.1.5 For a given audio data packet, one sample of the audio data of each channel (CH1-CH4) is always transmitted. Even when only one of the four channels (CH1-CH4) is active, all audio data of the four channels shall be transmitted. In such case, the value of audio data, V, U, C and P bits of all inactive channels shall be set to zero.

FIGURE 1

The relationship between AES/EBU audio and Audio data packet

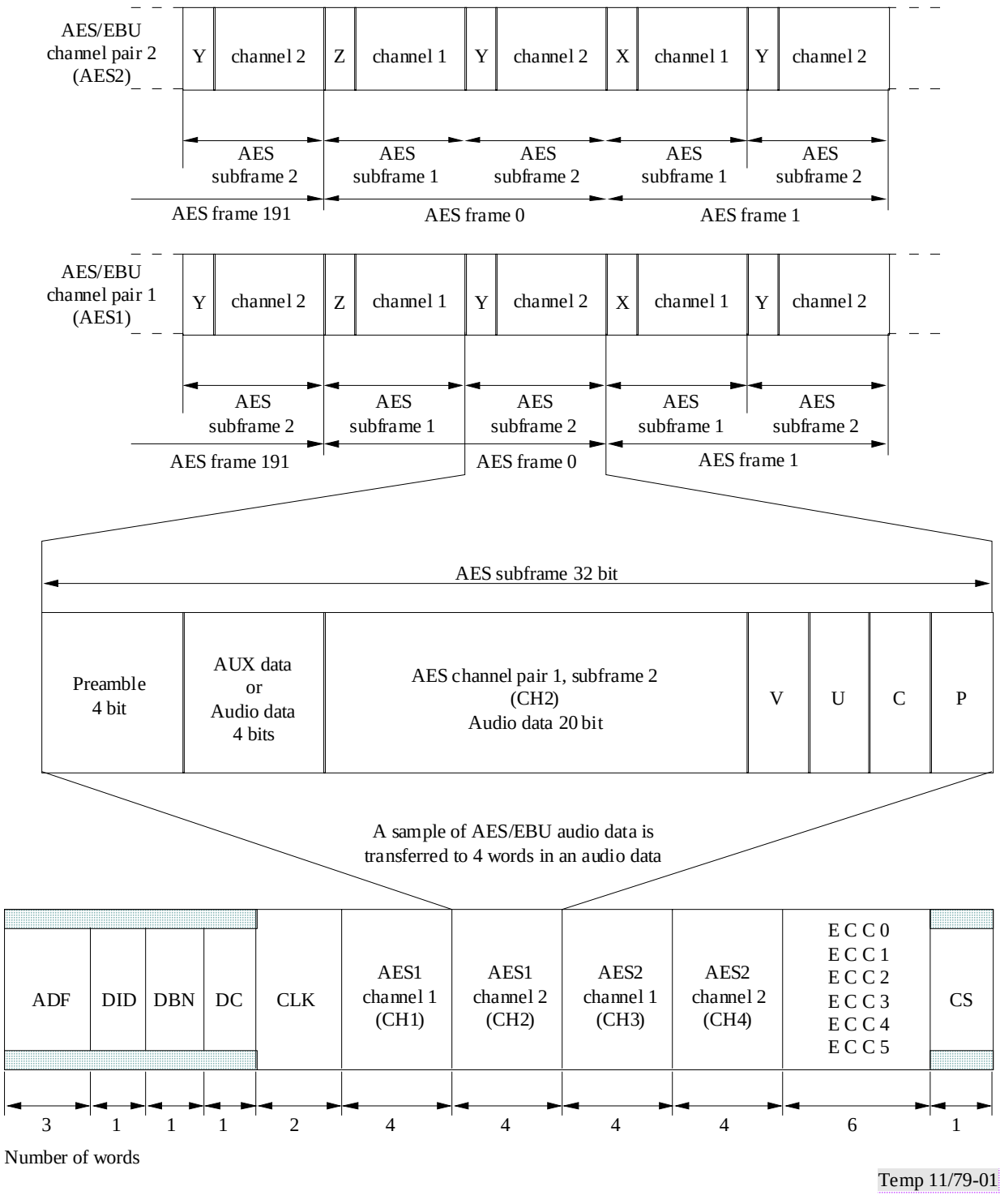
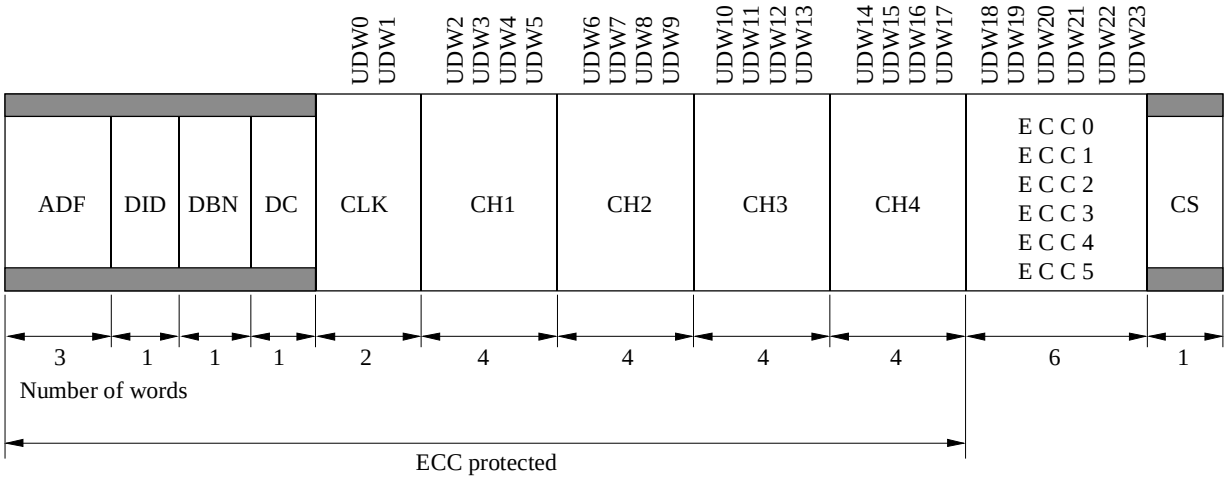


FIGURE 2

Structure of audio data packet



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5.2 Structure of user data words (UDW)

UDW consists of three types of data defined in 5.2.1-5.2.3. The description in this clause covers only audio group 1. The description for audio groups 2, 3 and 4 is similar to that for audio group 1 where channels 5, 9 and 13 correspond to channel 1, channels 6, 10 and 14 correspond to channel 2, channels 7, 11 and 15 correspond to channel 3, channels 8, 12 and 16 correspond to channel 4, respectively.

5.2.1 CLK (audio clock phase data)

5.2.1.1 CLK is used to regenerate audio sampling clock at the receiving side, especially for asynchronous audio. Bit-assignment of CLK shall be as shown in Table 1.

5.2.1.2 Bits of ck0 to ck11 indicate the number of video clocks between the first word of EAV and the video sample at the same time that audio sample appears at the input of the formatter. The relationship among “video”, “sampling instants of digital audio” and “audio clock phase data” is shown in Fig. 3A (30 Hz frame rate) and Fig. 3B (30/1.001 Hz frame rate), as an example.

5.2.1.3 The formatter places the audio data packet in the horizontal ancillary space following the video line during which the audio sample occurred. Following a switching point, the audio data packet is delayed one additional line to prevent data corruption.

Flag bit ck12 defines the audio data packet position in the multiplexed output stream relative to the associated video data.

When bit ck12 = 0, it indicates the audio data packet is located immediately after the video line during which the audio sample occurred.

When bit ck12 = 1, it indicates the audio data packet is located in the second line following the video line during which the audio sample occurred.

The relationship between “multiplex position flag (ck12)” and “the multiplex position of audio data packet” is shown in Fig. 4.

TABLE 1

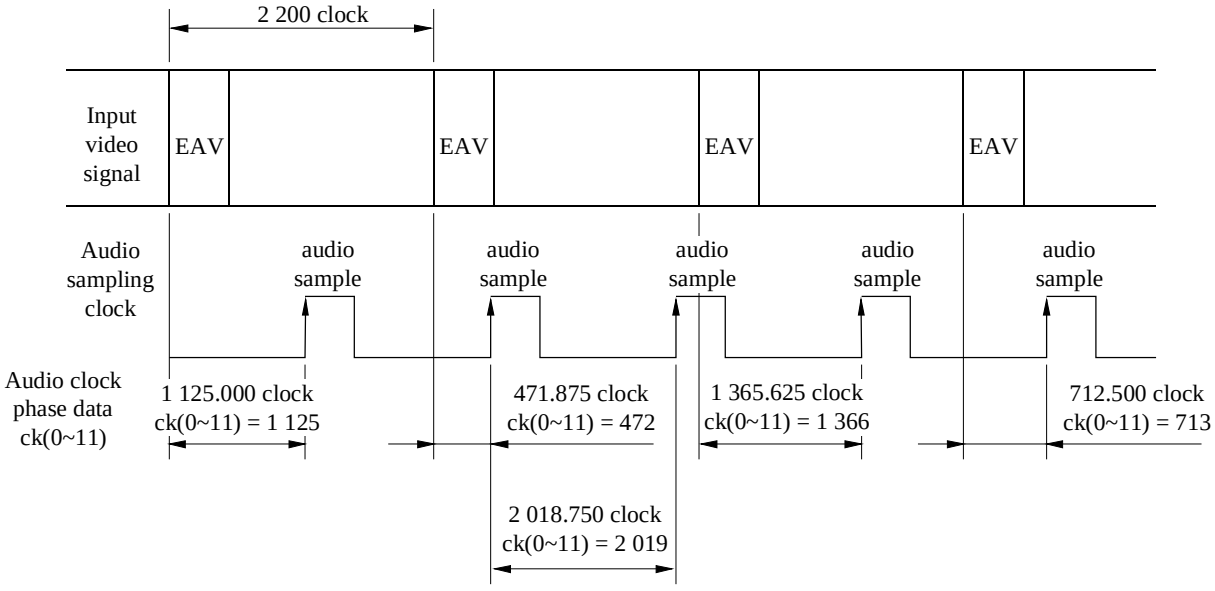
Bit-assignment of CLK

Bit number	UDW0	UDW1
b9 (MSB)	not b8	not b8
b8	even parity*	even parity*
b7	ck7 Audio clock phase data	0
b6	ck6 Audio clock phase data	0
b5	ck5 Audio clock phase data	0
b4	ck4 Audio clock phase data	ck12 Multiplex position flag
b3	ck3 Audio clock phase data	ck11 Audio clock phase data (MSB)
b2	ck2 Audio clock phase data	ck10 Audio clock phase data
b1	ck1 Audio clock phase data	ck9 Audio clock phase data
b0 (LSB)	ck0 Audio clock phase data (LSB)	ck8 Audio clock phase data

* Even parity for b0 through b7.

FIGURE 3A

The relationship among “video”, “sampling instants of digital audio” and “audio clock phase data” (48 kHz audio sampling rate and 30 Hz video frame rate)



NOTE - EAV shows the duration between the first word of EAV and the last word of SAV in Cb/Cr parallel data stream here.

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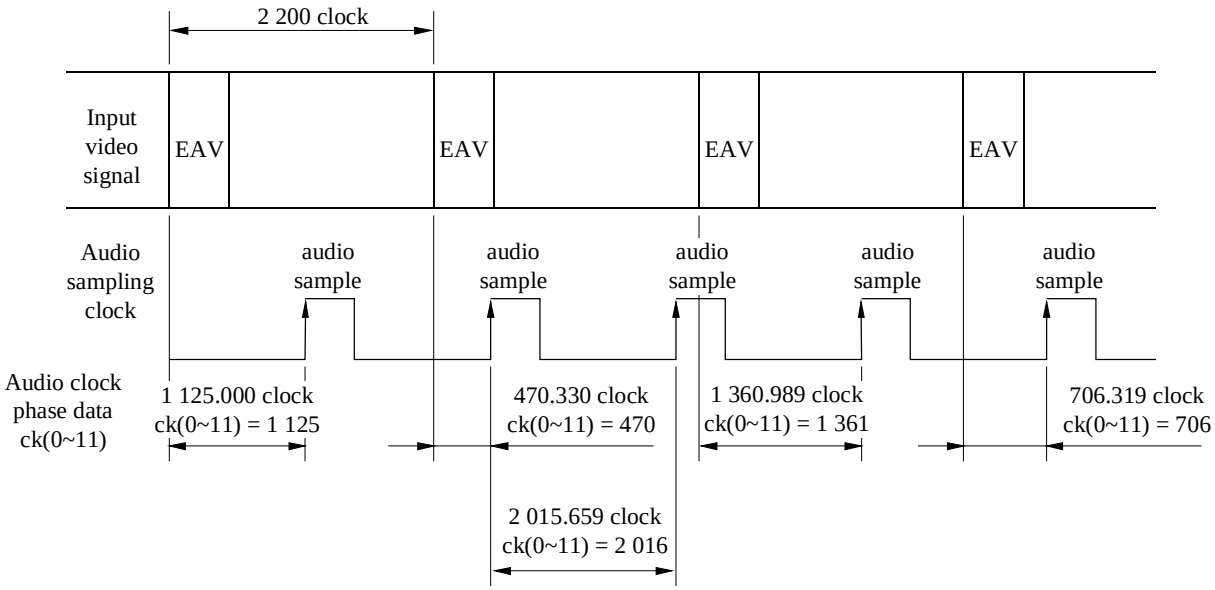
FIGURE 3B

The relationship among “video”, “sampling instants of digital audio” and “audio clock phase data” (48 kHz audio sampling rate and 30/1.001 Hz video frame rate)



NOTE - EAV shows the duration between the first word of EAV and the last word of SAV in Cb/Cr parallel data stream here.

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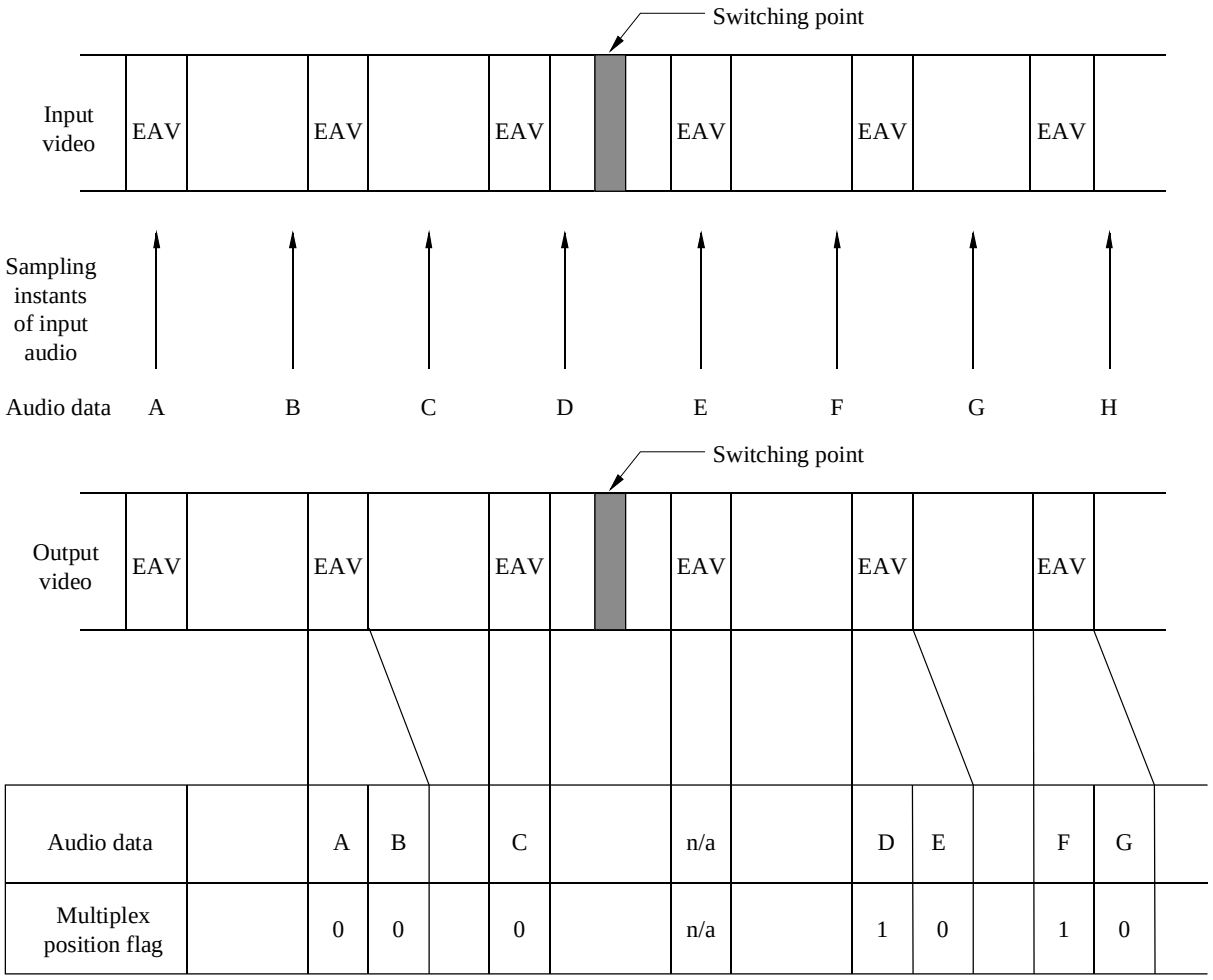
FIGURE 4

Relationship between "multiplex position flag (ck12)" and "multiplex position of audio data packet"



Audio data		A	B		C		n/a		D	E		F	G	
Multiplex position flag		0	0		0		n/a		1	0		1	0	

NOTE 1 - For example sample A, B, C, E and G, ck 12 = 0 because the ancillary data packet is multiplexed in the horizontal ancillary data space of the next line relative to input timing of the audio sample.

NOTE 2 - N/A shows that the line subsequent to switching point precludes the insertion of ancillary data packets.

NOTE 3 - For example sample D and F, ck 12 = 1 because the ancillary data packet is multiplexed in the horizontal ancillary data space of the second line relative to input timing of the audio sample.

NOTE 4 - EAV shows the duration between the first word of EAV and the last word of SAV in Cb/Cr parallel data stream here.

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5.2.2 CHn (audio data)

5.2.2.1 Bit assignment of CHn (n = 1-4) shall be as shown in Table 2. All bits of an AES subframe are transparently transferred to four consecutive UDW words (UDW4n-2, UDW4n-1, UDW4n, UDW4n + 1). UDW2 through UDW17 are always used for CHn in audio data packets.

5.2.2.2 Bit 3 of UDW2 and UDW10 indicates the status of the Z flag which corresponds to the AES block sync. Z bit in UDW2 is for CH1 and CH2, and in UDW10 for CH3 and CH4, respectively.

5.2.2.3 Bits b0 through b2 in UDW2, UDW6, UDW10 and UDW14, and bit b3 in UDW6 and UDW14 are set to zero.

TABLE 2

Bit-assignment of audio data (CHn)

	Bit number	UDW2	UDW3	UDW4	UDW5
CH1	b9 (MSB)	not b8	not b8	not b8	not b8
	b8	even parity*	even parity*	even parity*	even parity*
	b7	aud_1 3	aud_1 11	aud_1 19	P_1
	b6	aud_1 2	aud_1 10	aud_1 18	C_1
	b5	aud_1 1	aud_1 9	aud_1 17	U_1
	b4	aud_1 0 (LSB)	aud_1 8	aud_1 16	V_1
	b3	Z	aud_1 7	aud_1 15	aud_1 23(MSB)
	b2	0	aud_1 6	aud_1 14	aud_1 22
	b1	0	aud_1 5	aud_1 13	aud_1 21
	b0 (LSB)	0	aud_1 4	aud_1 12	aud_1 20
	Bit number	UDW6	UDW7	UDW8	UDW9
CH2	b9 (MSB)	not b8	not b8	not b8	not b8
	b8	even parity*	even parity*	even parity*	even parity*
	b7	aud_2 3	aud_2 11	aud_2 19	P_2
	b6	aud_2 2	aud_2 10	aud_2 18	C_2
	b5	aud_2 1	aud_2 9	aud_2 17	U_2
	b4	aud_2 0 (LSB)	aud_2 8	aud_2 16	V_2
	b3	0	aud_2 7	aud_2 15	aud_2 23(MSB)
	b2	0	aud_2 6	aud_2 14	aud_2 22
	b1	0	aud_2 5	aud_2 13	aud_2 21
	b0 (LSB)	0	aud_2 4	aud_2 12	aud_2 20
	Bit number	UDW10	UDW11	UDW12	UDW13
CH3	b9 (MSB)	not b8	not b8	not b8	not b8
	b8	even parity*	even parity*	even parity*	even parity*
	b7	aud_3 3	aud_3 11	aud_3 19	P_3
	b6	aud_3 2	aud_3 10	aud_3 18	C_3
	b5	aud_3 1	aud_3 9	aud_3 17	U_3
	b4	aud_3 0 (LSB)	aud_3 8	aud_3 16	V_3
	b3	Z	aud_3 7	aud_3 15	aud_3 23(MSB)
	b2	0	aud_3 6	aud_3 14	aud_3 22
	b1	0	aud_3 5	aud_3 13	aud_3 21
	b0 (LSB)	0	aud_3 4	aud_3 12	aud_3 20
	Bit number	UDW14	UDW15	UDW16	UDW17
CH4	b9 (MSB)	not b8	not b8	not b8	not b8
	b8	even parity*	even parity*	even parity*	even parity*
	b7	aud_4 3	aud_4 11	aud_4 19	P_4
	b6	aud_4 2	aud_4 10	aud_4 18	C_4
	b5	aud_4 1	aud_4 9	aud_4 17	U_4
	b4	aud_4 0 (LSB)	aud_4 8	aud_4 16	V_4
	b3	0	aud_4 7	aud_4 15	aud_4 23(MSB)
	b2	0	aud_4 6	aud_4 14	aud_4 22
	b1	0	aud_4 5	aud_4 13	aud_4 21
	b0 (LSB)	0	aud_4 4	aud_4 12	aud_4 20

NOTES

Z:	AES block sync.	aud (0-23):	24 bit AES audio data of CHn
Un:	AES user bit of CHn	Vn:	AES sample validity bit of CHn
Pn:	AES parity bit of CHn	Cn:	AES channel status bit of CHn

Value of Vn, Un, Cn and Pn is equal to that of AES subframe, respectively.

* Even parity for b0 through b7.

5.2.3 ECC (error correction codes)

5.2.3.1 ECC are used to correct or detect errors in 24 words from the first word of ADF through UDW17. The error correction code is BCH (31, 25) code. BCH code is formed for each bit sequence of b0-b7, respectively. ECC consists of 6 words determined by the polynomial generator equation:

$$ECC(X) = (X+1)(X^5+X^2+1) = X^6+X^5+X^3+X^2+X+1.$$

Initial value of all FFn is set to zero. The calculation starts at the first word of ADF and ends at the final word of CH4 (UDW17) for each bit of b0 to b7, respectively. The remaining data in the FFn is ECCn. (n = 0-5) (FFn stands for "Flip Flop number". For example, the data of FF0 is ECC0, the data of FF5 is ECC5.)

5.2.3.2 Bit-assignment of ECC shall be as shown in Table 3. An example of the block diagram of the BCH-code formation circuit is shown in Fig. 5.

TABLE 3

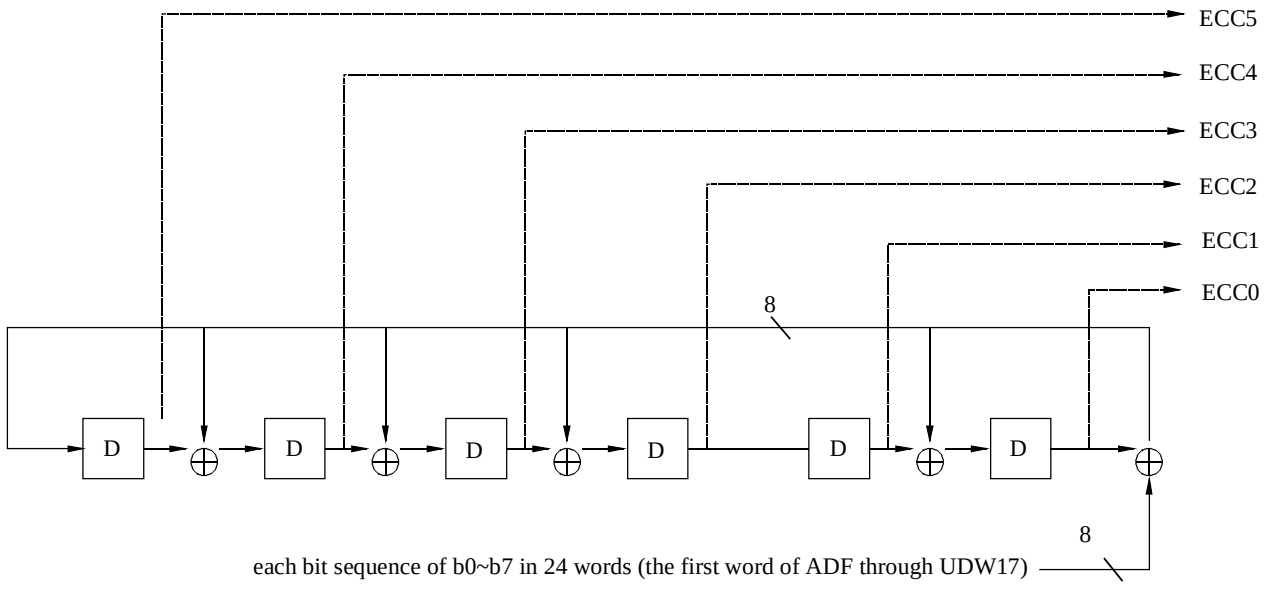
Bit-assignment of ECC

	UDW18	UDW19	UDW20	UDW21	UDW22	UDW23
Bit number	ECC0	ECC1	ECC2	ECC3	ECC4	ECC5
b9 (MSB)	not b8	not b8	not b8	not b8	not b8	not b8
b8	even parity*	even parity*	even parity*	even parity*	even parity*	even parity*
b7	ecc0 7	ecc1 7	ecc2 7	ecc3 7	ecc4 7	ecc5 7
b6	ecc0 6	ecc1 6	ecc2 6	ecc3 6	ecc4 6	ecc5 6
b5	ecc0 5	ecc1 5	ecc2 5	ecc3 5	ecc4 5	ecc5 5
b4	ecc0 4	ecc1 4	ecc2 4	ecc3 4	ecc4 4	ecc5 4
b3	ecc0 3	ecc1 3	ecc2 3	ecc3 3	ecc4 3	ecc5 3
b2	ecc0 2	ecc1 2	ecc2 2	ecc3 2	ecc4 2	ecc5 2
b1	ecc0 1	ecc1 1	ecc2 1	ecc3 1	ecc4 1	ecc5 1
b0 (LSB)	ecc0 0	ecc1 0	ecc2 0	ecc3 0	ecc4 0	ecc5 0

* Even parity for b0 through b7.

FIGURE 5

An example of block diagram of the BCH-code formation circuitry



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5.3 Multiplexing of audio data packet

5.3.1 Only the horizontal ancillary data space of the colour-difference data stream (Cb/Cr) shall be used for transmission of the audio data packet.

5.3.2 The audio data packet shall not be multiplexed into the horizontal ancillary data space of the line subsequent to the switching point defined by the source format. As an example, the ancillary data space available for audio data packet in the 1125/60 system is shown in Fig. 6.

5.3.3 The number of samples per audio channel which can be multiplexed in one horizontal ancillary data space is 0, 1 or 2. When two samples of the audio data are transmitted in one horizontal ancillary data block, the packet of the audio sample which appears earlier at the input of the formatter shall be transmitted first.

5.3.4 An audio data packet shall be multiplexed in the horizontal ancillary data space of the first or second line following the line during which the audio sample occurred at the input of the formatter.

NOTE – Audio phase must be maintained across the audio groups carrying the multiple-channel audio.

5.3.5 The audio data packet shall be multiplexed following the CRCC words defined in Recommendation ITU-R BT.1120.

5.3.6 When more than two audio data packets are transmitted in one horizontal ancillary data block, the audio data packets shall be contiguous with each other.

6 Audio control packet

6.1 Structure of audio control packet

6.1.1 The structure of audio control packet shall be as shown in Fig. 7. Audio control packets consist of ancillary data flag (ADF), data identification (DID), data block number (DBN), data count (DC), user data words (UDW) and checksum (CS). ADF, DC and CS are subject to Recommendation ITU-R BT.1364, “Format of Ancillary Data Signals Carried in Digital Component Studio Interfaces”. DC is always 10Bh and DBN is always 200h.

6.1.2 DID is defined as 1E3h for audio group 1 (channel 1-4), 2E2h for audio group 2 (channel 5-8), 2E1h for audio group 3 (channel 9-12) and 1E0h for audio group 4 (channel 13-16), respectively.

6.1.3 UDW is defined in 6.2. In this specification, UDWx means the Xth user data word. There are always 11 words in the UDW of an audio control packet, i.e. UDW0, UDW1, …, UDW9, UDW10.

FIGURE 6

Ancillary data space of Cb/Cr parallel data stream available for transmission of audio data packets (in case of 1125/60 system)

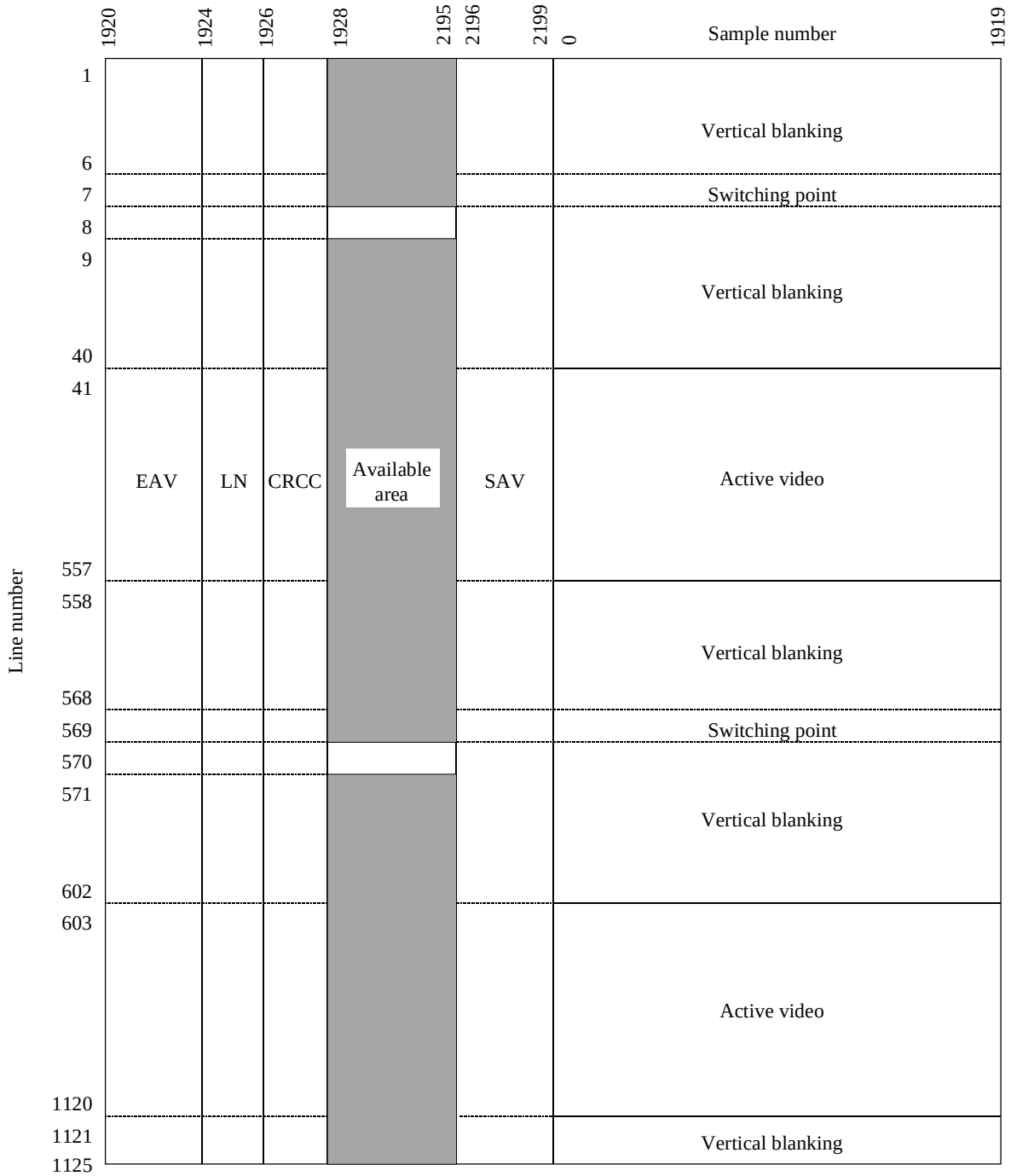

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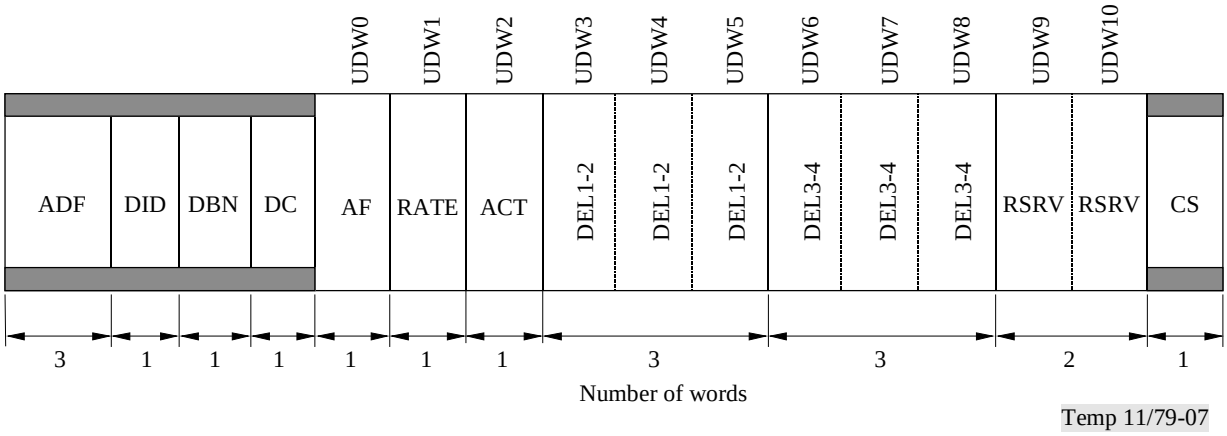
FIGURE 7

Structure of audio control packet



6.2 Structure of user data words (UDW)

UDW consists of five types of data defined in 6.2.1-6.2.5. The description in this clause covers only audio group 1. The description for audio groups 2, 3 and 4 is similar to audio group 1 where channels 5, 9 and 13 correspond to channel 1, channels 6, 10 and 14 correspond to channel 2, channels 7, 11 and 15 correspond to channel 3, channels 8, 12 and 16 correspond to channel 4, respectively.

6.2.1 AF (audio frame number data)

6.2.1.1 Audio frame number data (AF) provide a sequential numbering of video frames to indicate where they fall in the progression of non-integer number of samples per video frame (audio frame sequence). The first number of the sequence is always 1 and the final number is equal to the length of the audio frame sequence. A value of AF equal to all zeros indicates that frame numbering is not available. (See Appendix 1.)

6.2.1.2 The bit-assignment of the AF shall be as shown in Table 4. The AF is common for all channels in a given audio group.

6.2.1.3 When channel pairs in a given audio group are operating in asynchronous mode, the AF word in the audio control packet is not used and b0-b8 should be set to zero.

TABLE 4

Bit-assignment of AF

Bit number	UDW0
	AF
b9 (MSB)	not b8
b8	f8 Audio frame number MSB)
b7	f7 Audio frame number
b6	f6 Audio frame number
b5	f5 Audio frame number
b4	f4 Audio frame number
b3	f3 Audio frame number
b2	f2 Audio frame number
b1	f1 Audio frame number
b0 (LSB)	f0 Audio frame number (LSB)

6.2.2 RATE (Sampling rate)

6.2.2.1 The sampling rate for all channel pairs is defined by the word (RATE). The bit-assignment of RATE shall be as shown in Table 5.

6.2.2.2 The sync mode bit asx, when set to one, indicate that the channel pairs in a given audio group are operating asynchronously.

6.2.2.3 The rate code is currently defined as shown in Table 6.

TABLE 5

Bit-assignment of RATE

Bit number	UDW1
	RATE
b9 (MSB)	not b8
b8	0
b7	0
b6	0
b5	0
b4	0
b3	X2 (MSB)
b2	X1 Rate code
b1	X0 (LSB)
b0 (LSB)	asx isochronous audio; 0 asynchronous audio; 1

TABLE 6

Assignment of Rate code

X2	X1	X0	Sample rate
0	0	0	48.0 kHz
0	0	1	44.1 kHz
0	1	0	32.0 kHz
1	1	1	free running
0	1	1	reserved
	:		:
1	1	0	reserved

6.2.3 ACT

6.2.3.1 The word ACT indicates active channels. Bits a1 to a4 are set to one for each active channel in a given audio group otherwise they are set to zero. The bit-assignment of ACT is shown in Table 7.

TABLE 7

Bit-assignment of ACT

Bit number	UDW2
	ACT
b9 (MSB)	not b8
b8	even parity*
b7	0
b6	0
b5	0
b4	0
b3	a4 active: 1, inactive: 0 (CH4)
b2	a3 active: 1, inactive: 0 (CH3)
b1	a2 active: 1, inactive: 0 (CH2)
b0 (LSB)	a1 active: 1, inactive: 0 (CH1)

* Even parity for b0 through b7.

6.2.4 DELm-n

6.2.4.1 The words DELm-n indicate the amount of accumulated audio processing delay relative to video, measured in audio sample intervals, for each channel pair of CHm and CHn.

6.2.4.2 The bit-assignment of DELm-n shall be as shown in Table 8. The *e* bit is set to one to indicate valid audio delay data. The delay words are referenced to the point where the AES/EBU data are input to the formatter. The delay words represent the average delay value, inherent in the formatting process, over a period no less than the length of the audio frame sequence plus any pre-existing audio delay.

6.2.4.3 The audio delay data (del 0-del 25) is represented in the format of 26-bit 2's complement. Positive values indicate that the video leads the audio.

TABLE 8

Bit-assignment of DELm-n

Bit number	UDW3	UDW4	UDW5	UDW6	UDW7	UDW8
	DEL1-2			DEL3-4		
b9 (MSB)	not b8	not b8	not b8	not b8	not b8	not b8
b8	del 7	del 16	del 25 (±)	del 7	del 16	del 25 (±)
b7	del 6	del 15	del 24 (MSB)	del 6	del 15	del 24 (MSB)
b6	del 5	del 14	del 23	del 5	del 14	del 23
b5	del 4	del 13	del 22	del 4	del 13	del 22
b4	del 3	del 12	del 21	del 3	del 12	del 21
b3	del 2	del 11	del 20	del 2	del 11	del 20
b2	del 1	del 10	del 19	del 1	del 10	del 19
b1	del 0 (LSB)	del 9	del 18	del 0 (LSB)	del 9	del 18
b0 (LSB)	*e*	del 8	del 17	*e*	del 8	del 17

6.2.5 RSRV

6.2.5.1 The words marked RSRV are reserved for future use.

6.2.5.2 The bit-assignment of RSRV word shall be as shown in Table 9.

TABLE 9

Bit-assignment of RSRV

Bit number	UDW9	UDW10
	RSRV	RSRV
b9 (MSB)	not b8	not b8
b8	reserved (set to 0)	reserved (set to 0)
b7	reserved (set to 0)	reserved (set to 0)
b6	reserved (set to 0)	reserved (set to 0)
b5	reserved (set to 0)	reserved (set to 0)
b4	reserved (set to 0)	reserved (set to 0)
b3	reserved (set to 0)	reserved (set to 0)
b2	reserved (set to 0)	reserved (set to 0)
b1	reserved (set to 0)	reserved (set to 0)
b0 (LSB)	reserved (set to 0)	reserved (set to 0)

6.3 Multiplexing of the audio control packet

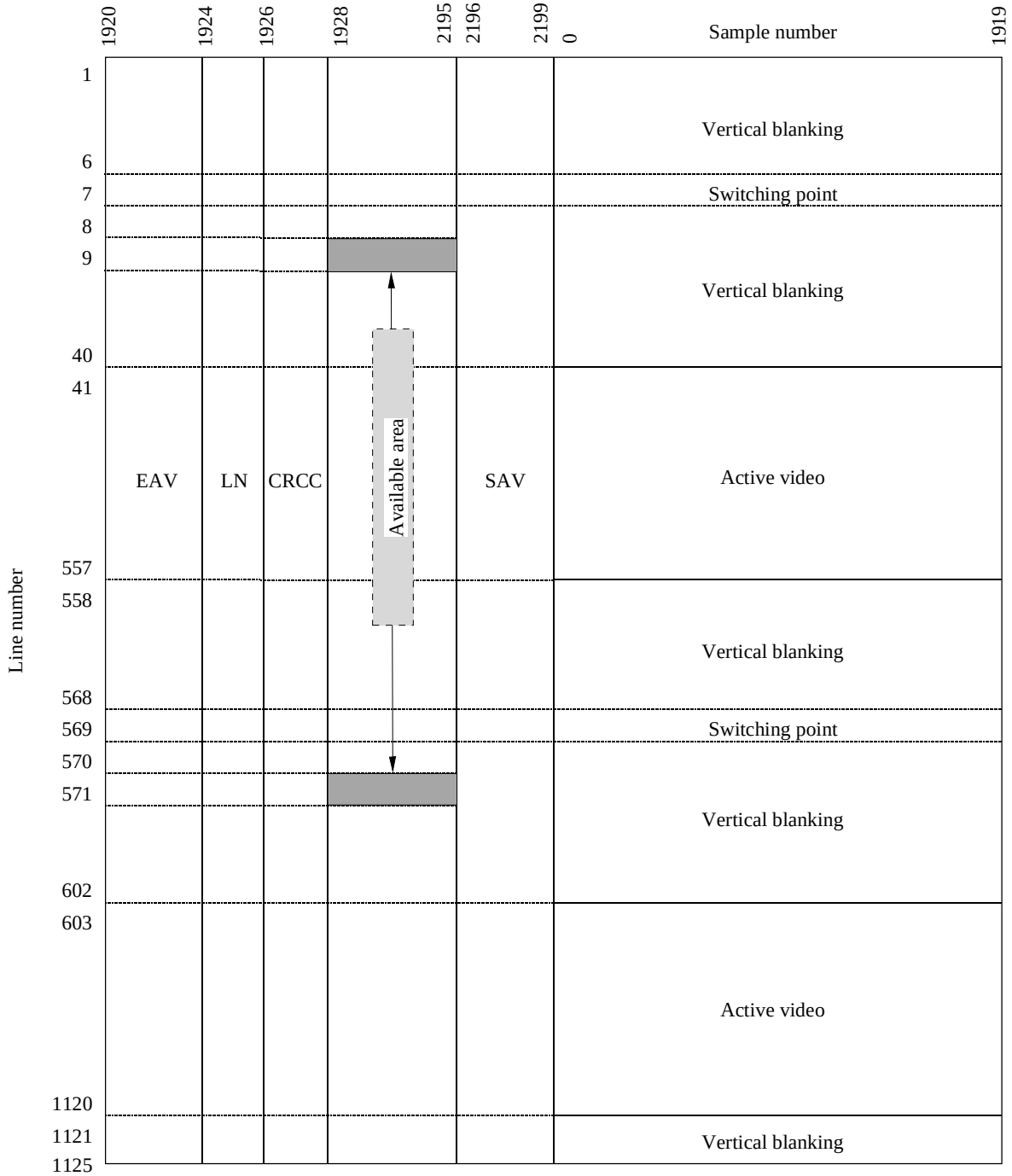
6.3.1 The audio control packets shall be transmitted once every field.

6.3.2 The audio control packet shall be transmitted in the horizontal ancillary data space of the second line after the switching point of Y parallel data stream.

For example, since the switching point for 1125/60 system exists in Line 7 and 569, the audio control packets are transmitted in the horizontal ancillary data space of Line 9 and Line 571 of the Y parallel data stream. Ancillary data space available for the transmission of audio control packets is shown in Fig. 8.

FIGURE 8

Ancillary data space of Y parallel data stream available for transmission of audio control packets (in case of 1125/60 system)



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Appendix 1

Alignment of audio samples for each audio frame

For alignment of AF (audio frame number data) and sample distribution, the following number of audio samples for each audio frame may be a preferred example.

All audio frame sequences are based on two integer numbers of samples per frame (m and m + 1) with audio frame numbers starting at 1 and proceeding to the end of the sequence. Odd-numbered audio frames (1, 3, 5, etc.) have the larger integer number of samples and even-numbered audio frames (2, 4, 6, etc.) have the smaller integer number of samples with the exception tabulated in Table 10. Receivers should have the ability to receive correctly audio data sequence even when this sequence restriction is not implemented.

TABLE 10

Alignment of audio samples for each audio frame

Television system	Sampling rate (kHz)	Frame sequence	Basic numbering		Exceptions	
			Samples per odd audio frame (m)	Samples per even audio frame (m+1)	Frame number	Number of samples
30 frame/s	48.0	1	1 600		none	
	44.1	1	1 470		none	
	32.0	3	1 067	1 066	none	
29.97 frame/s	48.0	5	1 602	1 601	none	
	44.1	100	1 472	1 471	23, 47, 71	1 471
	32.0	15	1 068	1 067	4, 8, 12	1 068
25 frame/s	48.0	1	1 920		none	
	44.1	1	1 764		none	
	32.0	1	1 280		none	