



Recommendation ITU-R BT.1618-1
(03/2011)

**Data structure for DV-based audio, data
and compressed video at data rates
of 25 and 50 Mbit/s**

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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.1618-1

Data structure for DV-based audio, data and compressed video at data rates of 25 and 50 Mbit/s

(Question ITU-R 12/6)

(2003-2011)

Scope

This Recommendation defines the DV-based data structure for the interface of digital audio, sub-code data and compressed video with the following parameters:

- 525/60 system – 4:1:1 image sampling structure, 25 Mbit/s data rate
- 525/60 system – 4:2:2 image sampling structure, 50 Mbit/s data rate
- 625/50 system – 4:1:1 image sampling structure, 25 Mbit/s data rate
- 625/50 system – 4:2:2 image sampling structure, 50 Mbit/s data rate.

The ITU Radiocommunication Assembly,

considering

- a) that applications within professional television production and post-production have been identified where DV-based video compression can offer operational and economic advantages;
- b) that three data rates have been proposed within the same compression family to serve different applications (25 Mbit/s, 50 Mbit/s and 100 Mbit/s);
- c) that the sampling rasters for each of the three applications are different;
- d) that audio, auxiliary data and metadata elements form an integral part of these applications;
- e) that these elements are multiplexed into a single data stream for transport and further processing;
- f) that the compression quality and functional characteristics must be identical and reproducible in complex production chains;
- g) that for this purpose all details of parameters used for coding and multiplexing must be defined,

recommends

1 that for applications in professional television production and post-production using DV-based compression at 25 and 50 Mbit/s, the parameters given in Annex 1 shall 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. The words “shall” or some other obligatory language such as “must” and the negative equivalents are used to express requirements. The use of such words shall in no way be construed to imply partial or total compliance with this Recommendation.

Annex 1

1 Interface

1.1 Introduction

As shown in Fig. 1, processed audio, video, and subcode data are output for different applications through a digital interface port.

1.2 Data structure

The data structure of the compressed stream at the digital interface is shown in Figs 2 and 3. Figure 2 shows the data structure for a 50 Mb/s structure, and Fig. 3 shows the data structure for a 25 Mb/s structure.

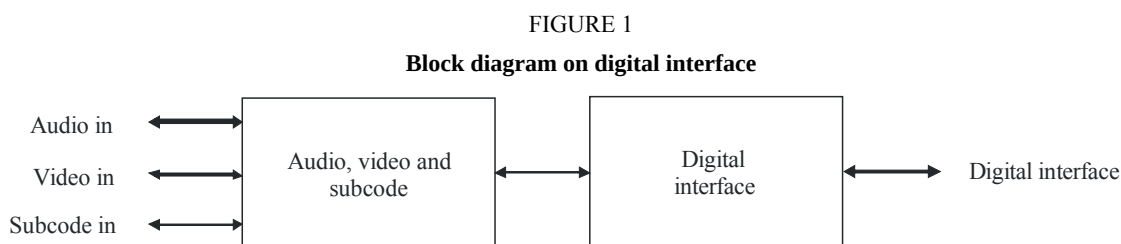
In the 50 Mb/s structure, the data of one video frame are divided into two channels. Each channel is divided into 10 DIF sequences for the 525/60 system and 12 DIF sequences for the 625/50 system.

In the 25 Mb/s structure, the data of one video frame are divided into 10 DIF sequences for the 525/60 system and 12 DIF sequences for the 625/50 system.

Each DIF sequence consists of a header section, subcode section, VAUX section, audio section, and video section with the following DIF blocks respectively:

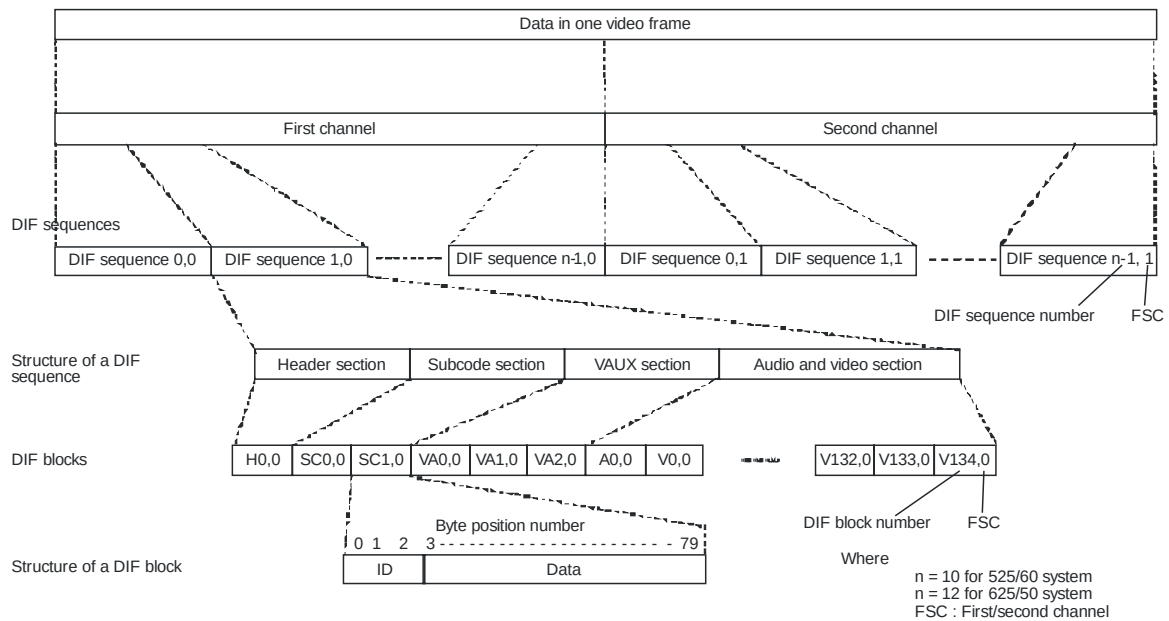
Header section: 1 DIF block
 Subcode section: 2 DIF blocks
 VAUX section: 3 DIF blocks
 Audio section: 9 DIF blocks
 Video section: 135 DIF blocks.

As shown in Figs 2 and 3, each DIF block consists of a 3-byte ID and 77 bytes of data. DIF data bytes are numbered 0 to 79. Figure 4 shows the data structure of a DIF sequence for a 50 or 25 Mb/s structure.



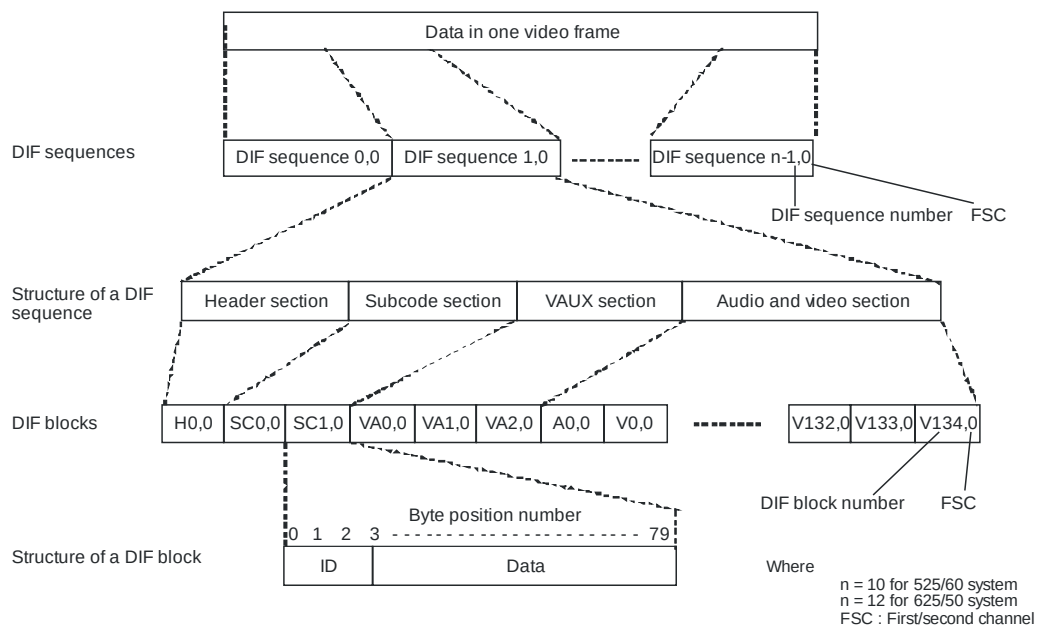
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FIGURE 2

Data structure of one video frame for 50 Mb/s structure

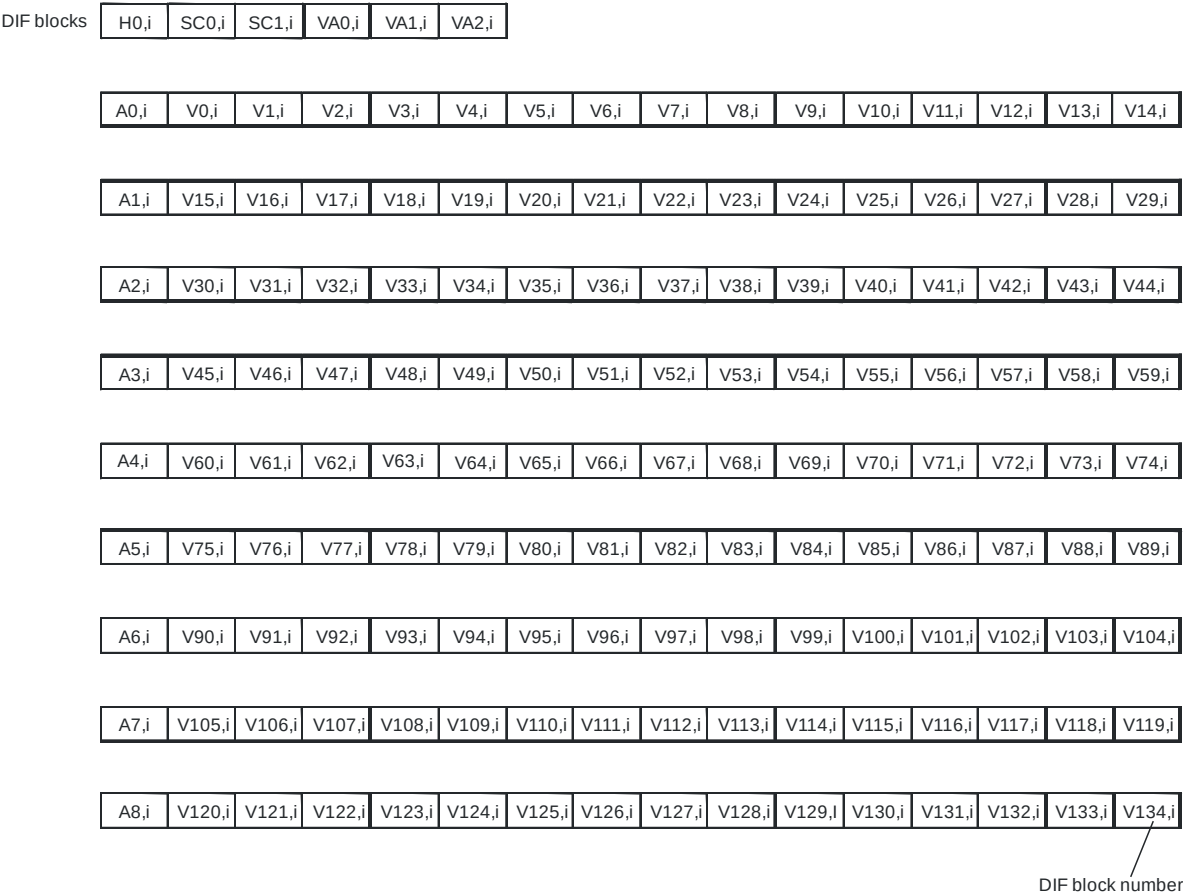
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FIGURE 3

Data structure of one video frame for 25 Mb/s structure

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FIGURE 4
Data structure of a DIF sequence



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where:
i: FSC
i = 0 for 25 Mb/s structure
i = 0,1 for 50 Mb/s structure
H0,i: DIF block in header section
SC0,i to SC1,i: DIF blocks in subcode section
VA0,i to VA2,i: DIF blocks in VAUX section
A0,i to A8,i: DIF blocks in audio section
V0,i to V134,i: DIF blocks in video section.

1.3 Header section

1.3.1 ID

The ID part of each DIF block in the header section, shown in Figs 2 and 3, consists of 3 bytes (ID0, ID1, ID2). Table 1 shows the ID content of a DIF block.

TABLE 1
ID data of a DIF block

Byte position number			
	Byte 0 (ID0)	Byte 1 (ID1)	Byte 2 (ID2)
MSB	SCT ₂	Dseq ₃	DBN ₇
	SCT ₁	Dseq ₂	DBN ₆
	SCT ₀	Dseq ₁	DBN ₅
	Res	Dseq ₀	DBN ₄
LSB	Arb	FSC	DBN ₃
	Arb	Res	DBN ₂
	Arb	Res	DBN ₁
	Arb	Res	DBN ₀

ID contains the following:

SCT: Section type (see Table 2)

Dseq: DIF sequence number (see Tables 3 and 4)

FSC: Identification of a DIF block in each channel 50 Mb/s structure

FSC = 0: first channel

FSC = 1: second channel 25 Mb/s structure

FSC = 0

DBN: DIF block number (see Table 5)

Arb: Arbitrary bit

Res: Reserved bit for future use

Default value shall be set to 1.

TABLE 2
Section type

SCT ₂	SCT ₁	SCT ₀	Section type
0	0	0	Header
0	0	1	Subcode
0	1	0	VAUX
0	1	1	Audio
1	0	0	Audio
1	0	1	Reserved
1	1	0	
1	1	1	

TABLE 3
DIF sequence number for 525/60 system

Dseq ₃	Dseq ₂	Dseq ₁	Dseq ₀	Meaning
0	0	0	0	DIF sequence number 0
0	0	0	1	DIF sequence number 1
0	0	1	0	DIF sequence number 2
0	0	1	1	DIF sequence number 3
0	1	0	0	DIF sequence number 4
0	1	0	1	DIF sequence number 5
0	1	1	0	DIF sequence number 6
0	1	1	1	DIF sequence number 7
1	0	0	0	DIF sequence number 8
1	0	0	1	DIF sequence number 9
1	0	1	0	Not used
1	0	1	1	Not used
1	1	0	0	Not used
1	1	0	1	Not used
1	1	1	0	Not used
1	1	1	1	Not used

TABLE 4
DIF sequence number for 625/50 system

Dseq ₃	Dseq ₂	Dseq ₁	Dseq ₀	Meaning
0	0	0	0	DIF sequence number 0
0	0	0	1	DIF sequence number 1
0	0	1	0	DIF sequence number 2
0	0	1	1	DIF sequence number 3
0	1	0	0	DIF sequence number 4
0	1	0	1	DIF sequence number 5
0	1	1	0	DIF sequence number 6
0	1	1	1	DIF sequence number 7
1	0	0	0	DIF sequence number 8
1	0	0	1	DIF sequence number 9
1	0	1	0	DIF sequence number 10
1	0	1	1	DIF sequence number 11
1	1	0	0	Not used
1	1	0	1	Not used
1	1	1	0	Not used
1	1	1	1	Not used

TABLE 5
DIF block number

Dseq ₇	Dseq ₆	Dseq ₅	Dseq ₄	Dseq ₃	Dseq ₂	Dseq ₁	Dseq ₀	Meaning
0	0	0	0	0	0	0	0	DIF sequence number 0
0	0	0	0	0	0	0	1	DIF sequence number 1
0	0	0	0	0	0	1	0	DIF sequence number 2
0	0	0	0	0	0	1	1	DIF sequence number 3
:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:
1	0	0	0	0	1	1	0	DIF block number 134
1	0	0	0	0	1	1	1	Not used
:	:	:	:	:	:	:	:	:
1	1	1	1	1	1	1	1	Not used

1.3.2 Data

The data part (payload) of each DIF block in the header section is shown in Table 6. Bytes 3 to 7 are active and bytes 8 to 79 are reserved.

TABLE 6
Data (payload) in the header DIF block

Byte position number of header DIF block								
	3	4	5	6	7	8	–	79
MSB	DSF	Res	TF1	TF2	TF3	Res	Res	Res
	0	Res	Res	Res	Res	Res	Res	Res
	Res	Res	Res	Res	Res	Res	Res	Res
	Res	Res	Res	Res	Res	Res	Res	Res
	Res	Res	Res	Res	Res	Res	Res	Res
	Res	APT2	AP12	AP22	AP32	Res	Res	Res
LSB	Res	APT1	AP11	AP21	AP31	Res	Res	Res
	Res	APT0	AP10	AP20	AP30	Res	Res	Res

DSF: DIF sequence flag

DSF = 0: 10 DIF sequences included in a channel (525/60 system)

DSF = 1: 12 DIF sequences included in a channel (625/50 system)

APT_n, AP1_n, AP2_n, AP3_n: These data shall be identical as track application IDs (APT_n = 001, AP1_n = 001, AP2_n = 001, AP3_n = 001), if the source signal comes from a digital VCR. If the signal source is unknown, all bits for these data shall be set to 1.

TF: Transmitting flag:

TF1: Transmitting flag of audio DIF blocks

TF2: Transmitting flag of VAUX and video DIF blocks

TF3: Transmitting flag of subcode DIF blocks

TF_n = 0: Data shall be valid

TF_n = 1: Data shall be invalid

Res: Reserved bit for future use

Default value shall be set to 1.

1.4 Subcode section

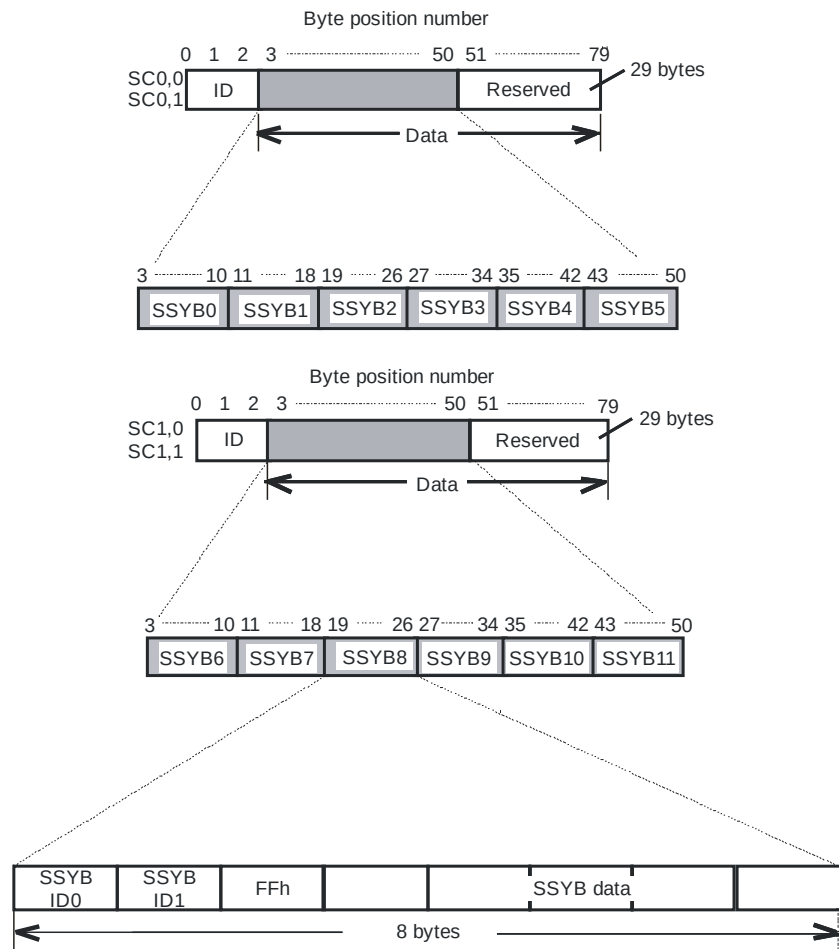
1.4.1 ID

The ID part of each DIF block in the subcode section is described in § 1.3.1. The section type shall be 001.

1.4.2 Data

The data part (payload) of each DIF block in the subcode section is shown in Fig. 5. The subcode data consists of 6 SSYBs, each 8 bytes long, and a reserved area of 29 bytes in each relevant DIF block. SSYBs in a DIF sequence are numbered 0 to 11. Each SSYB is composed of SSYB ID equal to 2 bytes, FF_h, and an SSYB data payload of 5 bytes.

FIGURE 5

Data in the subcode section

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1.4.2.1 SSYB ID

Table 7 shows SSYB ID (ID0, ID1). These data contain FR ID, application ID ($AP3_2$, $AP3_1$, $AP3_0$), and SSYB number (Syb_3 , Syb_2 , Syb_1 , Syb_0).

FR ID is an identification for the first or second half of each channel:

FR = 1: the first half of each channel

FR = 0: the second half of each channel

The first half of each channel

DIF sequence number 0, 1, 2, 3, 4 for the 525/60 system

DIF sequence number 0, 1, 2, 3, 4, 5 for the 625/50 system

The second half of each channel

DIF sequence number 5, 6, 7, 8, 9 for the 525/60 system

DIF sequence number 6, 7, 8, 9, 10, 11 for the 625/50 system

If information is not available, all bits shall be set to 1.

TABLE 7
SSYB ID

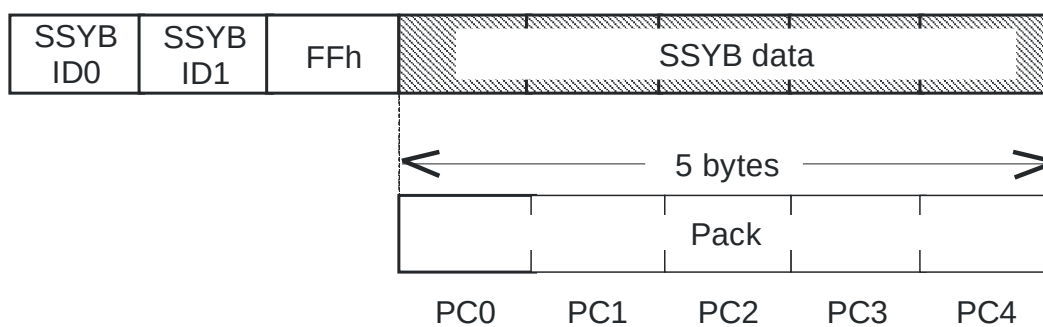
Bit position	SSYB number 0 and 6		SSYB number 1 to 5 and 7 to 10		SSYB number 11	
	ID0	ID1	ID0	ID1	ID0	ID1
b7 (MSB)	FR	Arb	FR	Arb	FR	Arb
b6	AP3 ₂	Arb	Res	Arb	APT ₂	Arb
b5	AP3 ₁	Arb	Res	Arb	APT ₁	Arb
b4	AP3 ₀	Arb	Res	Arb	APT ₀	Arb
b3	Arb	Syb ₃	Arb	Syb ₃	Arb	Syb ₃
b2	Arb	Syb ₂	Arb	Syb ₂	Arb	Syb ₂
b1	Arb	Syb ₁	Arb	Syb ₁	Arb	Syb ₁
b0 (LSB)	Arb	Syb ₀	Arb	Syb ₀	Arb	Syb ₀

NOTE 1 – Arb = arbitrary bit.

1.4.2.2 SSYB data

Each SSYB data payload consists of a pack of 5 bytes as shown in Fig. 6. Table 8 shows pack header table (PCO byte organization). Table 9 shows the pack arrangement in SSYB data for each channel.

FIGURE 6
Pack in SSYB



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TABLE 8
Pack header table

UPPER LOWER	0000	0001	0010	0011	0100	0101	0110	0111	–	1111
0000						SOURCE	SOURCE			
0001						SOURCE CONTROL	SOURCE CONTROL			
0010										
0011		TIME CODE								
0100		BINARY GROUP								
0101										
1111										NO INFO

TABLE 9
Mapping of packet in SSYB data

SSYB number	First half of each channel	Second half of each channel
0	Reserved	Reserved
1	Reserved	Reserved
2	Reserved	Reserved
3	TC	TC
4	BG	Reserved
5	TC	Reserved
6	Reserved	Reserved
7	Reserved	Reserved
8	Reserved	Reserved
9	TC	TC
10	BG	Reserved
11	TC	Reserved

NOTE 1 – TC = time code pack.

NOTE 2 – BG = binary group pack.

NOTE 3 – Reserved = default value of all bits shall be set to 1.

NOTE 4 – TC and BG data are the same within a single video frame. The time code data are an LCT type.

1.4.2.2.1 Time code pack

Table 10 shows a mapping of the time code (TC) pack. Time code data mapped to the time code packs remain the same within each video frame.

TABLE 10
Mapping of time code pack

525/60 system

MSB					LSB			
PC0	0	0	0	1	0	0	1	1
PC1	CF	DF	TENS of FRAMES		UNITS of FRAMES			
PC2	PC	TENS of SECONDS			UNITS of SECONDS			
PC3	BGF0	TENS of MINUTES			UNITS of MINUTES			
PC4	BGF2	BGF1	TENS of HOURS		UNITS of HOURS			

625/50 system

MSB					LSB			
PC0	0	0	0	1	0	0	1	1
PC1	CF	Arb	TENS of FRAMES		UNITS of FRAMES			
PC2	BGF0	TENS of SECONDS			UNITS of SECONDS			
PC3	BGF2	TENS of MINUTES			UNITS of MINUTES			
PC4	PC	BGF1	TENS of HOURS		UNITS of HOURS			

NOTE 1 – Detailed information is given in Recommendation ITU-R BR.780-2.

CF: Colour frame

0 = unsynchronized mode

1 = synchronized mode

DF: Drop frame flag

0 = Nondrop frame time code

1 = Drop frame time code

PC: Biphase mark polarity correction

0 = even

1 = odd

BGF: Binary group flag

Arb: Arbitrary bit

1.4.2.2.2 Binary group pack

Table 11 shows the mapping of the binary group (BG) pack. Binary group data mapped to the binary group packs remain the same within each video frame.

TABLE 11
Mapping of binary group pack

	MSB				LSB			
PC0	0	0	0	1	0	1	0	0
PC1	BINARY GROUP 2				BINARY GROUP 1			
PC2	BINARY GROUP 4				BINARY GROUP 3			
PC3	BINARY GROUP 6				BINARY GROUP 5			
PC4	BINARY GROUP 8				BINARY GROUP 7			

1.5 VAUX section

1.5.1 1D

The ID part of each DIF block in the VAUX section is described in § 1.3.1. The section type shall be 010.

1.5.2 Data

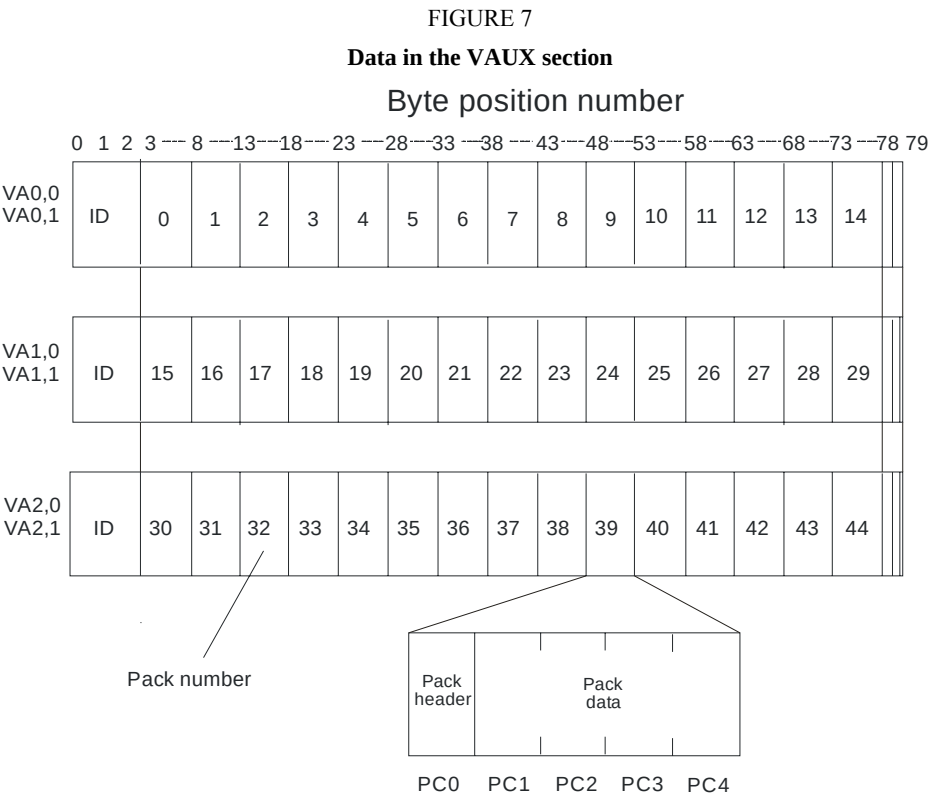
The data part (payload) of each DIF block in the VAUX section is shown in Fig. 7. This figure shows the VAUX pack arrangement for each DIF sequence.

There are 15 packs, each 5 bytes long, and two reserved bytes in each VAUX DIF block payload. A default value for the reserved byte is set to FF_h.

Therefore, there are 45 packs in a DIF sequence. VAUX packs of the DIF blocks are sequentially numbered 0 to 44. This number is called a video pack number.

Table 12 shows the mapping of the VAUX packs of the VAUX DIF blocks. A VAUX source pack (VS) and a VAUX source control pack (VSC) must be present in each of the video compressed frames. The remaining VAUX packs of the DIF blocks in a DIF sequence are reserved and the value of all reserved words is set to FF_h.

If VAUX data are not transmitted, a NO INFO pack, which is filled up by FF_h, shall be transmitted.



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TABLE 12
Mapping of VAUX pack in a DIF sequence

Pack number		Pack data
Even DIF sequence	Odd DIF sequence	
39	0	VS
40	1	VSC

where:

Even DIF sequence:

- DIF sequence number 0, 2, 4, 6, 8 for 525/60 system
- DIF sequence number 0, 2, 4, 6, 8, 10 for 625/50 system

Odd DIF sequence:

- DIF sequence number 1, 3, 5, 7, 9 for 525/60 system
- DIF sequence number 1, 3, 5, 7, 9, 11 for 625/50 system

1.5.2.1 VAUX source pack (VS)

Table 13 shows the mapping of a VAUX source pack.

TABLE 13
Mapping of VAUX source pack

MSB					LSB			
PC0	0	1	1	0	0	0	0	0
PC1	Res	Res	Res	Res	Res	Res	Res	Res
PC2	B/W	EN	CLF		Res	Res	Res	Res
PC3	Res	Res	50/60	STYPE				
PC4	VISC							

B/W: Black-and-white flag

0 = Black and white

1 = Colour

EN: Colour frames enable flag

0 = CLF is valid

1 = CLF is invalid

CLF: Colour frame identification code (see ITU-R BT.1700)

For 525/60 system

00b = Colour frame A

01b = Colour frame B

Others = Reserved

For 625/50 system

00b = 1st, 2nd field

01b = 3rd, 4th field

10b = 5th, 6th field

11b = 7th, 8th field

50/60:

0 = 60-field system

1 = 50-field system

STYPE: STYPE defines a signal type of video signal.

00000b = 4:1:1 compression

00001b = Reserved

| |

00011b = Reserved

00100b = 4:2:2 compression

00101b = Reserved

| |

11111b = Reserved

VISC:

10001000b = -180

00000000b = 0

01111000b = 180

01111111b = No information

Other = Reserved

Res: Reserved bit for future use

Default value shall be set to 1

1.5.2.2 VAUX source control pack (VSC)

Table 14 shows the mapping of a VAUX source control pack.

TABLE 14
Mapping of VAUX source control pack

MSB				LSB				
PC0	0	1	1	0	0	0	0	1
PC1	CGMS		Res	Res	Res	Res	Res	Res
PC2	Res	Res	0	0	Res	DISP		
PC3	FF	FS	FC	IL	Res	Res	0	0
PC4	Res	Res	Res	Res	Res	Res	Res	Res

CGMS: Copy generation management system

CGMS	Copy possible generation
0 0	Copy free
0 1	Reserved
1 0	
1 1	

DISP: Display select mode

DISP	Aspect ratio and format	Position
0 0 0	4:3 full format	Not applicable
0 0 1	Reserved	
0 1 0	16:9 full format (squeeze)	Not applicable
0 1 1 1 1 1	Reserved	

FF: Frame/field flag

FF indicates whether two consecutive fields are delivered, or one field is repeated twice during one frame period.

0 = Only one of two fields is delivered twice

1 = Both fields are delivered in order.

FS: First/second field flag

FS indicates a field which is delivered during the field one period.

0 = Field 2 is delivered

1 = Field 1 is delivered.

FF	FS	Output field
1	1	Field 1 and field 2 are output in this order (1, 2 sequence)
1	0	Field 2 and field 1 are output in this order (2, 1 sequence)
0	1	Field 1 is output twice
0	0	Field 2 is output twice

FC: Frame change flag

FC indicates whether the picture of the current frame is repeated based on the immediate previous frame.

0 = Same picture as the previous frame

1 = Different picture from the previous frame

IL: Interlace flag

0 = Noninterlaced

1 = Interlaced

Res: Reserved bit for future use

Default value shall be set to 1.

1.6 Audio section

1.6.1 ID

The ID part of each DIF block in the audio section is described in § 1.3.1. The section type shall be 011.

1.6.2 Data

The data part (payload) of each DIF block in the audio section is described in Fig. 8. The data of a DIF block in the audio DIF block are composed of 5 bytes of audio auxiliary data (AAUX) and 72 bytes of audio data which are encoded and shuffled by the process shown in §§ 1.6.2.1 and 1.6.2.2.