IEC 62071-3

Edition 1.0 2005-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Helical-scan compressed digital video cassette system using 6,35 mm magnetic tape – Format D-7 –
Part 3: Data stream format

Système de magnétoscope numérique à cassette à balayage hélicoïdal à signal compressé utilisant la bande magnétique de 6,35 mm – Format D-7 –
Partie 3: Format de suites de données

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HELICAL-SCAN COMPRESSED DIGITAL VIDEO CASSETTE SYSTEM USING 6,35 mm MAGNETIC TAPE – FORMAT D-7 –

Part 3: Data stream format

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International Standard IEC 62071-3 has been prepared by technical area 6: Higher data rate storage media, data structures and equipment of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This bilingual version (2013-07) corresponds to the monolingual English version, published in 2005-10.

The text of this standard is based on the following documents:

CDV	Report on voting
100/902/CDV	100/986/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 62071 consists of the following parts, under the general title *Helical-scan compressed digital video cassette system using 6,35 mm magnetic tape – Format D-7:*

Part 1: VTR specifications

Part 2: Compression format

Part 3: Data stream format

This part 3 describes the specifications for transmission of DV-based compressed video and audio data stream over 270Mb/s and 360 Mb/s serial digital interface.

Part 1 describes the VTR specifications which are tape, magnetization, helical recording, modulation method and basic system data for video compressed data.

Part 2 describes the specifications for encoding process and data format for 525i and 625i systems.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

HELICAL-SCAN COMPRESSED DIGITAL VIDEO CASSETTE SYSTEM USING 6,35 mm MAGNETIC TAPE – FORMAT D-7 –

Part 3: Data stream format

1 Scope

This part of IEC 62071 defines the format of the data stream for the synchronous exchange of DV-based audio, data, and compressed video (whose data structure is defined in SMPTE 314M) over the interface defined in SMPTE 305M. It covers the transmission of audio, subcode data and compressed video packets associated with DV-based 25 and 50 Mb/s data structures including faster-than-real-time transmission for 525/60 SDTI and 625/50 SDTI systems.

This standard does not include the data stream of a DV-compressed structure as defined in SMPTE 322M.

Space within SMPTE 305M not used by a data stream conforming to this standard may be used for the transmission of data other than those representing DV-based audio, data and compressed video.

In this standard, the 60 Hz system refers to the field frequency 59,94 Hz system and the 50 Hz system refers to the field frequency 50,0 Hz system.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

SMPTE 305M: 2005, *Television – Serial Data Transport Interface*

SMPTE 314M: 1999, *Television – Data Structure for DV-Based Audio, Data and Compressed Video – 25 and 50 Mb/s*

SMPTE 322M: 2004, *Television – Format for Transmission of DV Compressed Video, Audio and Data Over a Serial Data Transport Interface*

3 Abbreviations and acronyms

DIF:	Digital interface
DVF:	DIF valid flag
ECC:	Error correction code
FF:	Field/frame frequency flag
FSNF:	Frame sequence number flag
SDI:	Serial digital interface
SDTI:	Serial data transport interface
ST:	Signal type
STVF:	Signal type of video frame
TRF:	Transmission rate flag
TT:	Transmission type

4 Identification within the serial data transport interface (SDTI)

4.1 SDTI header packet data

The header packet data words of the serial data transport interface (SDTI) associated with this data stream format shall conform to SMPTE 305M. When the SDTI interface is transporting a data stream conforming to this standard, the block type word within the SDTI header packet shall have the value 173_h for transported data contained in fixed-size blocks when ECC (error correction code) is used and the value

233_h when ECC is not used.

4.2 Payload

The payload is composed of consecutive fixed-size blocks (see Figure 1). The SDTI data type word shall identify the data type of this payload with the value 221_h.

5 Stream block format

The stream block format is shown in Figure 1. The length of each stream block is 170 words, including a secondary header, two DIF (digital interface) block IDs, two DIF block data (of stream data) and an ECC block. The secondary header contains reserved data words, signal type words, and a transmission type word. The complete word structure of the stream block for a compressed video data stream is defined below:

Reserved data	:	3 words
Signal type	:	2 words
Transmission type	:	1 word
DIF block ID	:	3 words
DIF block data	:	77 words
DIF block ID	:	3 words
DIF block data	:	77 words
ECC	:	4 words

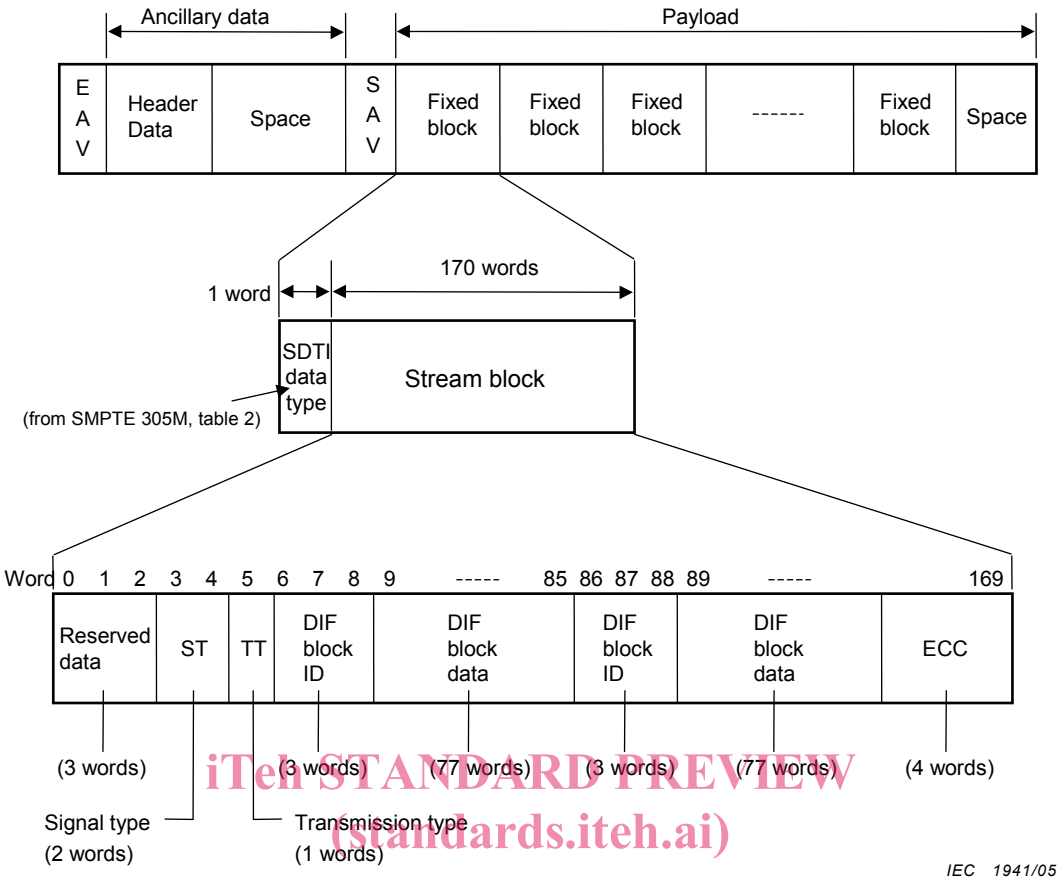


Figure 1 – Stream block format

5.1 Reserved data words

The reserved data words shall consist of 3 words and be positioned at the start of the stream block. The default value for the reserved data is 200_h.

5.2 Signal type words

The signal type word (ST) mapping is shown in Figure 2. The signal type words shall consist of two words. The first word of ST (word 3) includes the specific type of video frame ID (STVF ID). The second word of ST (word 4) includes the field/frame frequency flag (FF), the DIF structure format, the DIF valid flag (DVF), the frame sequence number flag (FSNF), the transmission rate flag (TRF) and reserved bits.

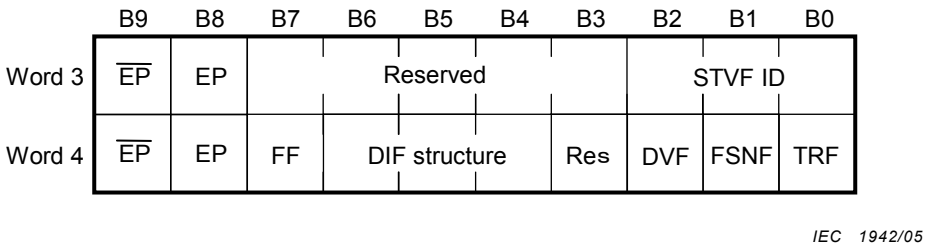


Figure 2 – Signal type (ST) word mapping

Word 3 of ST

The STVF ID shows information mainly related to pictures that have been 3:2 pull-down converted from 480 line/ 29,98 frame rate progressive pictures.

In the 525/60 SDTI system, the following applies:

Bits B7 through B3 are reserved bits and shall be set to 00000_b as default values.

Bits B2 through B0 indicate the specific type of video frame ID which shows the type of the converted picture with the following values:

B2	B1	B0	Original	Converted
0	0	0	: 480i / 29,97	-> No change
0	0	1	: 480p / 29,97	-> Segmented frame (see note)
0	1	0	: 480p / 23,98	-> No field sequence ID (3:2 pull down)
0	1	1	: 480p / 23,98	-> A frame (3:2 pull down)
1	0	0	: 480p / 23,98	-> B frame (3:2 pull down)
1	0	1	: 480p / 23,98	-> C frame (3:2 pull down)
1	1	0	: 480p / 23,98	-> D frame (3:2 pull down)
1	1	1	: 480p / 23,98	-> E frame (3:2 pull down)

NOTE Odd lines of 480p/29,97 are mapped to the first field and even lines of 480p/29,97 are mapped to the second field.

In the 625/50 SDTI system, the following applies:

All values of bits B7 through B0 are set to 00_h as default values.

Bit B8 of word 3 is equal to the even parity of B7 through B0.

Bit B9 of word 3 is equal to the complement of B8.

Word 4 of ST

Bit B7 indicates the field frequency of serial digital interface (SDI) with the following values:

B7	
0	: 60 Hz (59,94 Hz)
1	: 50 Hz

Bits B6 through B4 indicate the DIF structure with the following values:

B6	B5	B4	
0	0	0	: Reserved
0	0	1	: Reserved
0	1	0	: Reserved
0	1	1	: 25 Mb/s structure
1	0	0	: Reserved
1	0	1	: 50 Mb/s structure
1	1	0	: Reserved
1	1	1	: Reserved

Bit B3 is reserved bit and shall be set to 0_b as default value.

Bit B2 is the DIF valid flag (DVF) and indicates the validity of the DIF data mapped into SDTI.

B2
0 : invalid
1 : valid

Bit B1 is the frame sequence number flag (FSNF) and indicates the validity of the frame sequence number (see 5.3) with the following values:

B1
0 : valid
1 : invalid

Bit B0 is the transmission rate flag (TRF) and indicates the validity of the transmission rate (see 5.3) with the following values:

B0
0 : valid
1 : invalid

Bit B8 is equal to the even parity of B7 through B0.

Bit B9 is equal to the complement of B8.

5.3 Transmission type word

The transmission type word (TT) mapping is shown in Figure 3. The transmission type word shall consist of one word including the frame sequence number and the transmission rate.

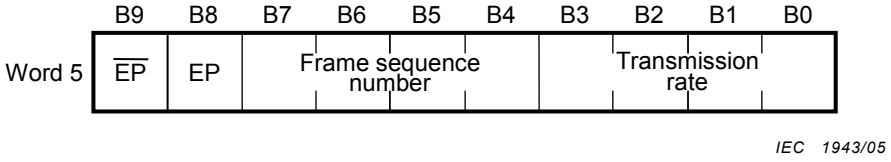


Figure 3 – Transmission type (TT) word mapping

Bits B7 through B4 indicate the frame sequence number with the following values:

0_h : 1
1_h : 2
|
Fh : 16

The frame sequence number identifies frames multiplexed within an SDTI frame.

Bits B3 through B0 indicate the transmission rate with the following values:

0_h : 1 x (normal transmission rate) (see note)
1_h : 2 x
2_h : 3 x
3_h : 4 x
4_h : 5 x
5_h : 6 x
6_h : 7 x
7_h : 8 x
8_h – E_h: reserved
F_h : 16 x

NOTE The multiple of the normal transmission rate is represented by x. The normal transmission rate corresponding to normal reproduction of the television picture is 1 x.

Bit B8 is equal to the even parity of B7 through B0;

Bit B9 is equal to the complement of B8.

5.4 DIF block ID words

The DIF block ID (ID0-2) shall consist of three words, contained in bits A23 through A0 as shown in Figure 4. The lower 8-bit portion of these three words is specified in SMPTE 314M.

	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Word 6 and 86	$\overline{EP1}$	EP1	A7	A6	A5	A4	A3	A2	A1	A0
Word 7 and 87	$\overline{EP2}$	EP2	A15	A14	A13	A12	A11	A10	A9	A8
Word 8 and 88	$\overline{EP3}$	EP3	A23	A22	A21	A20	A19	A18	A17	A16

IEC 1944/05

Figure 4 – Mapping of DIF block ID

EP1 is equal to the even parity of bits A7 through A0;
EP2 is equal to the even parity of bits A15 through A8;
EP3 is equal to the even parity of bits A23 through A16;

and

$\overline{EP1}$ is equal to the complement of EP1;
$\overline{EP2}$ is equal to the complement of EP2;
$\overline{EP3}$ is equal to the complement of EP3.

5.5 DIF block data words

The DIF block data shall consist of 77 words. The lower 8 bits of each DIF block word represent the DIF block data, as specified in SMPTE 314M; the higher 2 bits are parity data.

Bits B7 through B0 are DIF block data; Bit B8 is equal to the even parity of B7 through B0;

Bit B9 is equal to the complement of B8.

5.6 Error correction code (ECC) words

Bits B7 through B0 of the words within a stream block (including reserved data words, the ST word, the TT word and all words of the DIF block ID and DIF block data) are optionally protected by an error correction code (ECC). The ECC shall consist of four words and be inserted at the end of the stream block.

The error correction code is a (170,166) Reed-Solomon code in GF(256), whose field generator polynomial is shown as:

$$P(x) = X^8 + X^4 + X^3 + X^2 + 1$$

where X^i are place-keeping variables in GF(2), the binary field.

The generator polynomial of the code in GF(256) is:

$$G(x) = (x+\alpha)(x+\alpha^2)(x+\alpha^3)(x+\alpha^4)$$

where α is given by 2_h in GF(256).

When the value of the block type in the SDTI header (see 4.1) is 173_h, the Reed-Solomon code shall be contained in C31 through C0 as shown in Figure 5. When the value of the block type is 233_h, the ECC shall have the fixed value 200_h.

	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Word 166	$\overline{EP1}$	EP1	C7	C6	C5	C4	C3	C2	C1	C0
Word 167	$\overline{EP2}$	EP2	C15	C14	C13	C12	C11	C10	C9	C8
Word 168	$\overline{EP3}$	EP3	C23	C22	C21	C20	C19	C18	C17	C16
Word 169	$\overline{EP4}$	EP4	C31	C30	C29	C28	C27	C26	C25	C24

IEC 1945/05

Figure 5 – Mapping of ECC

EP1 is equal to the even parity of bits C7 through C0;
EP2 is equal to the even parity of bits C15 through C8;
EP3 is equal to the even parity of bits C23 through C16;
EP4 is equal to the even parity of bits C31 through C24;

and

$\overline{EP1}$ is equal to the complement of EP1;
$\overline{EP2}$ is equal to the complement of EP2;
$\overline{EP3}$ is equal to the complement of EP3;
$\overline{EP4}$ is equal to the complement of EP4.

6 Transmission order

The transmission order within one frame for 25 and 50 Mb/s DV-based compression structures consisting of DIF blocks is shown in Figures 6, 7, and 8.

In the 50 Mb/s structure, each frame is carried in two channels, which are transmitted in sequence one after another. In the 25 Mb/s structure, only a single channel is used.

Each channel consists of 10 DIF sequences in the 60 Hz system or 12 DIF sequences in the 50 Hz system. DIF sequences within a frame are transmitted in a DIF sequence order from 0 to n-1. Each DIF sequence is composed of 150 DIF blocks. DIF blocks within a DIF sequence are transmitted sequentially from DIF block 0 to 149.

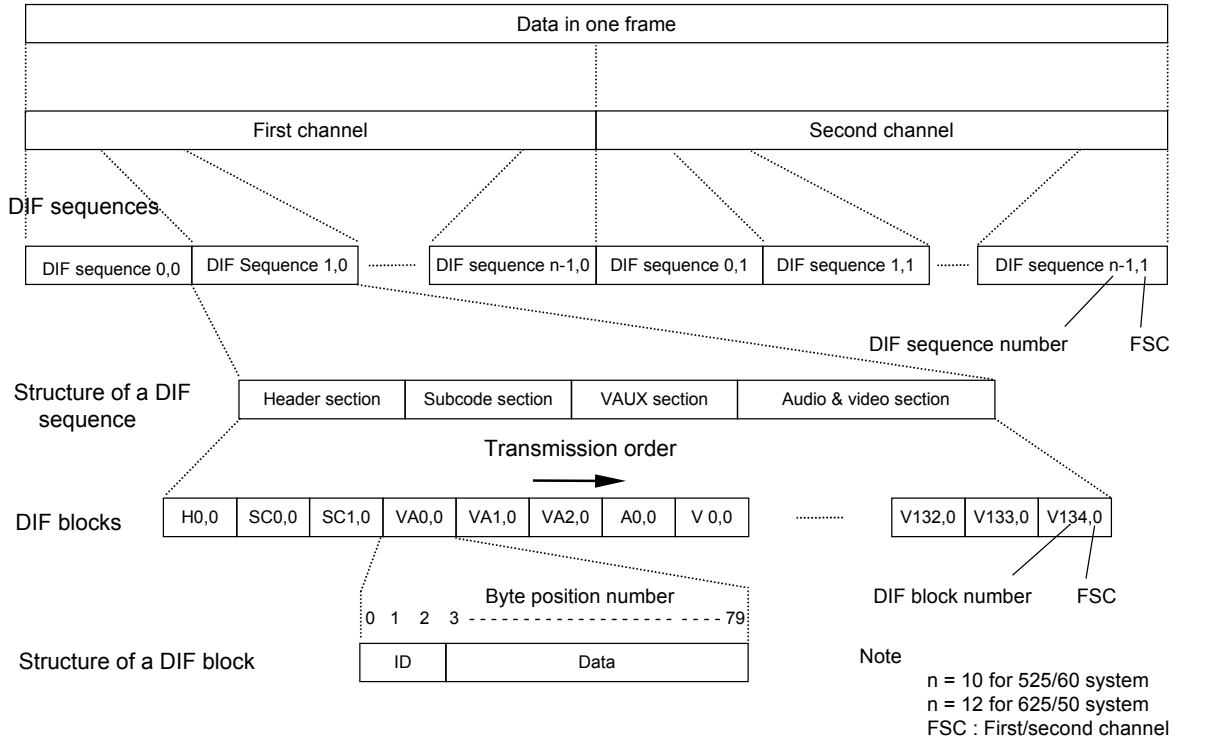


Figure 6 – Transmission order in one frame for the 50 Mb/s structure

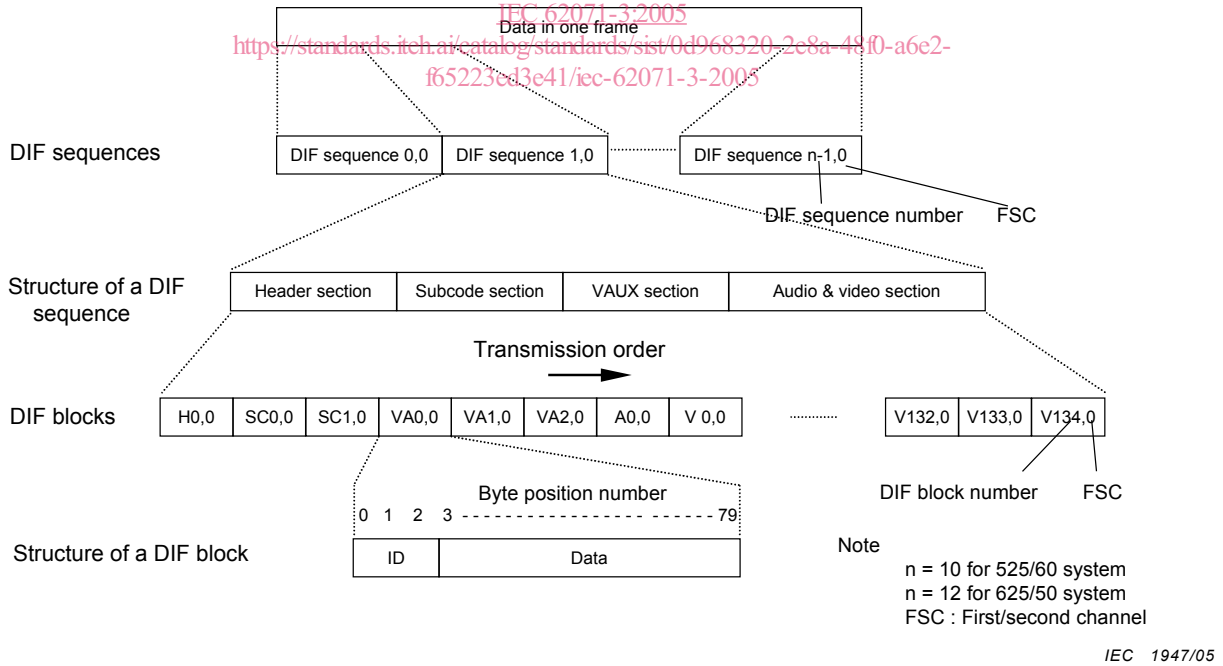
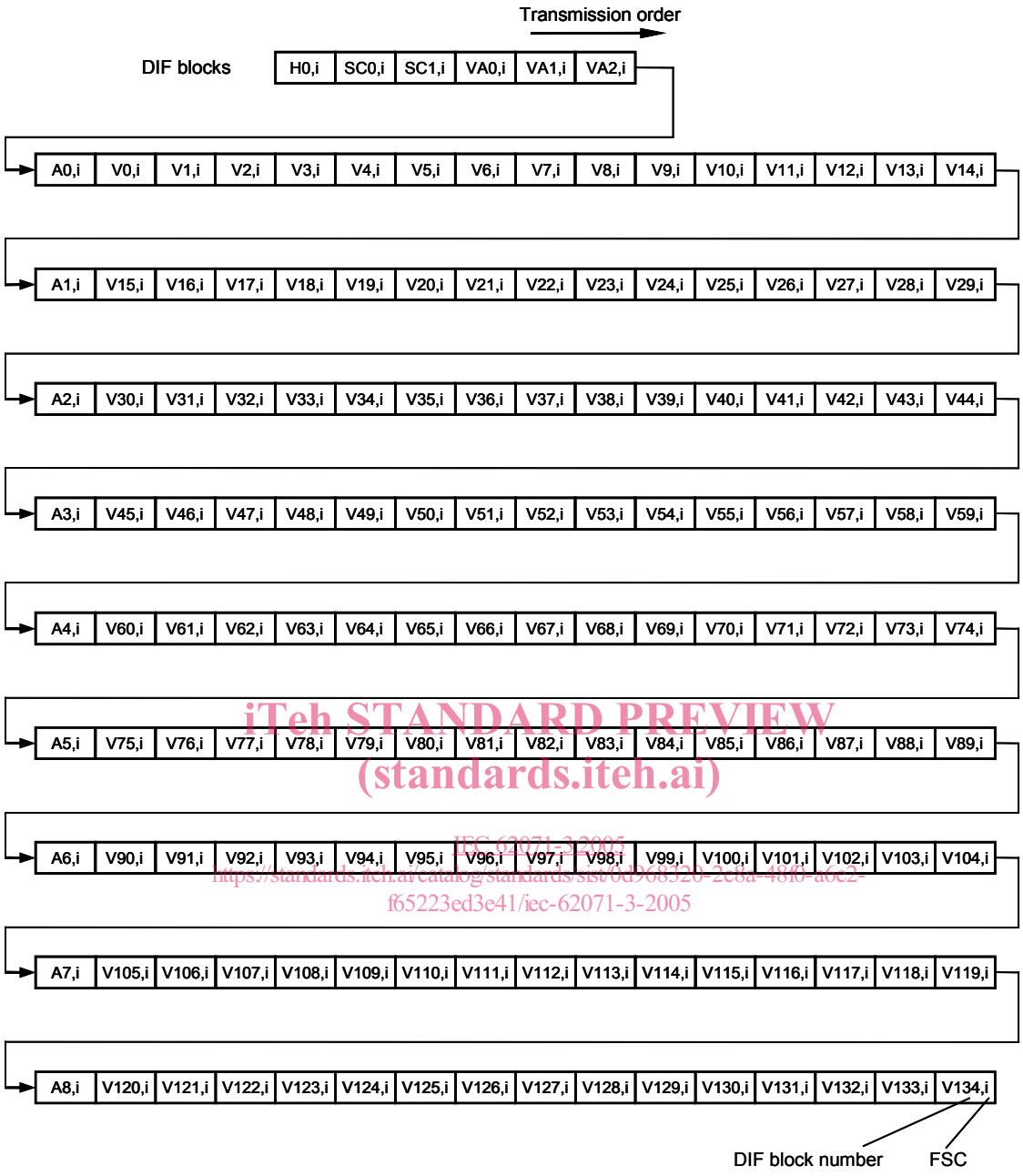


Figure 7 – Transmission order in one frame for the 25 Mb/s structure



IEC 1948/05

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

Figure 8 – Transmission order in a DIF sequence