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# PROPOSED SMPTE STANDARD

**SMPTE 322M**  
Revision of SMPTE 322M-1999

## for Television — Format for Transmission of DV Compressed Video, Audio and Data Over a Serial Data Transport Interface

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## 1 Scope

This standard specifies the data structure and the transmission format of DV compressed video, audio, and data over a serial data transport interface (SDTI [SMPTE 305.2M]). The standard is a combination of video, audio, subcode, and control data optimized for the connection between DV-compliant VCRs and disk systems. It ensures high-speed data stream transfer up to five times faster than real time. The video, audio, and subcode data comply with IEC 61834-2 for both 525/60 and 625/50 systems. The bit stream consists of 77-byte DIF data blocks, which are common to other DV based signals. The DIF blocks are mapped onto SDTI using a frame-bounded algorithm preserving ease of manipulating the video and audio data.

The layers of signal processing and related standards are shown in figure 1.

NOTE – For descriptions of the SDTI, refer to SMPTE 305.2M, and for descriptions of video, audio, and subcode data, refer to IEC 61834-2. The standard corresponds to data type [241<sub>n</sub>] registered as DVCAM- 1 in SMPTE 305.2M.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE 305.2M-2000, Television — Serial Data Transport Interface (SDTI)

IEC 61834-2 (1998-08), Recording — Helical-Scan Digital Video Cassette Recording System Using 6,35 mm Magnetic Tape for Consumer Use (525-60, 625-50, 1125-60 and 1250-50 Systems) — Part 2: SD Format for 525-60 and 625-50 Systems

### 3 SDTI header data

The SDTI header data as specified in SMPTE 305.2M shall contain the parameters shown in table 1, and shall be repeated on every line. The SDTI header data structure is as shown in figure 2.

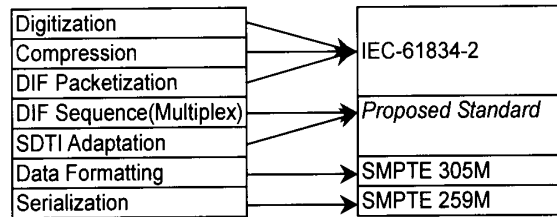


Figure 1 – Signal processing layers and related standards

Table 1 – Header data packet

Parameters	Length	Value
ADF	3 words	[000 <sub>h</sub> ] [3FF <sub>h</sub> ] [3FF <sub>h</sub> ]
DD	1 word	[140 <sub>h</sub> ]
SDID	1 word	[101 <sub>h</sub> ]
DC	1 word	[22E <sub>h</sub> ]
Line number	2 words	—
Line number CRC	2 words	—
Code	4 bits	[1 <sub>h</sub> ]
AAI	4 bits	—
Destination address	16 words	—
Source address	16 words	—
Block type	1 word	[1C1 <sub>h</sub> ]
CRC flag	1 word	[101 <sub>h</sub> ]
Data extension flag	1 word	[200 <sub>h</sub> ]
Reserved data	4 words	[200 <sub>h</sub> ] [200 <sub>h</sub> ] [200 <sub>h</sub> ] [200 <sub>h</sub> ]
Header CRC	2 words	—
CS	1 word	—

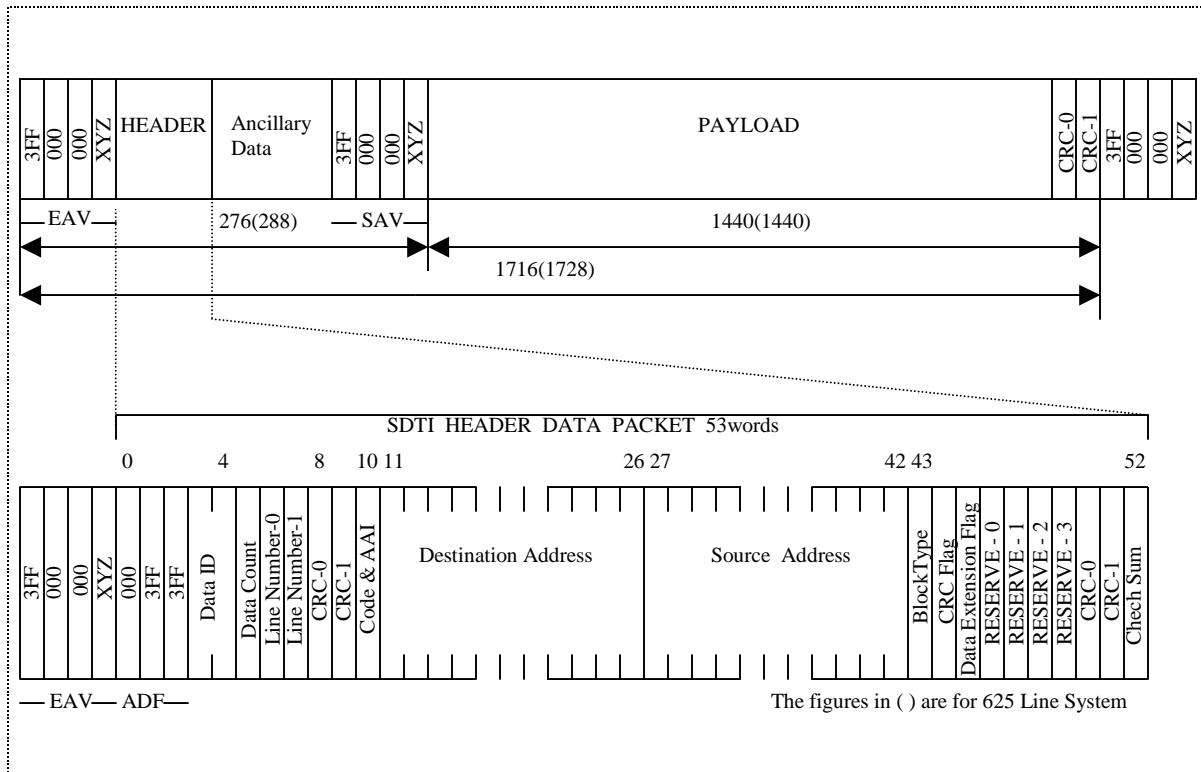


Figure 2 – SDTI header data structure

#### 4 Data structure

The following clause describes the basic data structure and the system parameters of the bit stream. The data structure of the SDTI payload is shown in figure 3. The data block consists of a control data block and five vertical data slots, in which one compressed video stream shall be contained. The empty space and reserved area shall be set to 200<sub>h</sub> as default value.

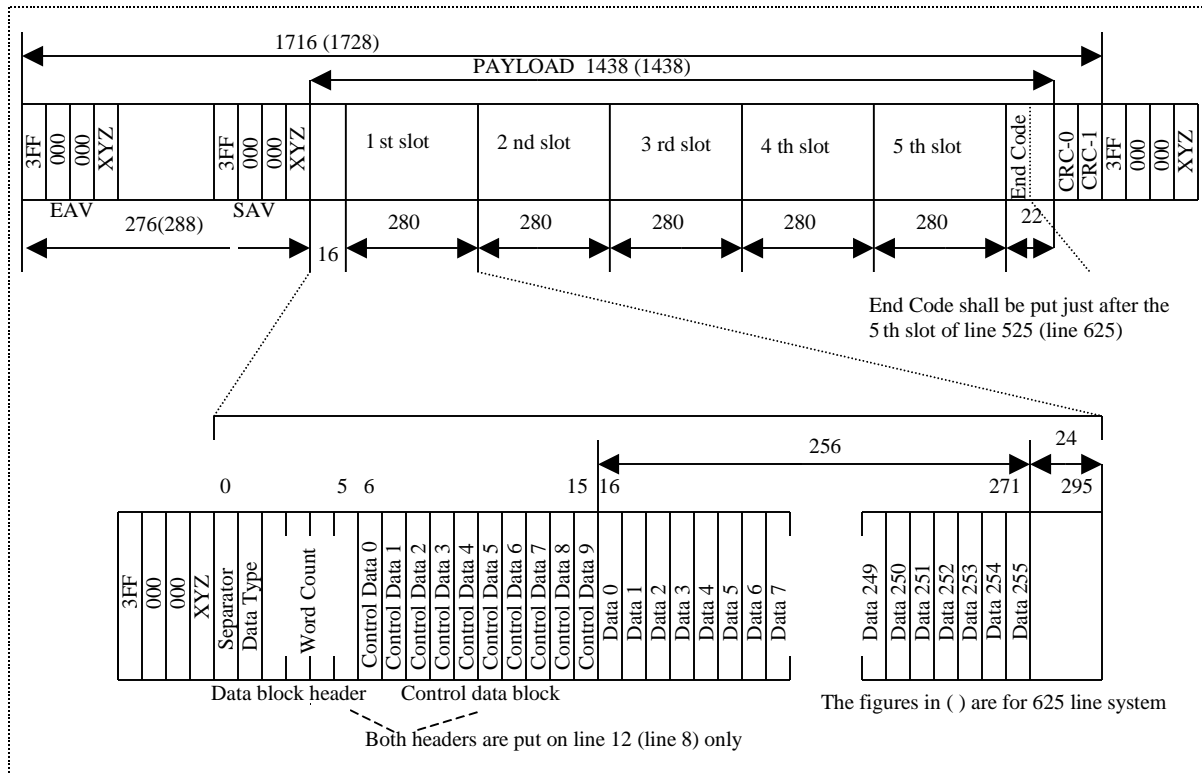


Figure 3 – Data structure

#### 4.1 Data block

The control data block and the DIF data shall be contained in B0 (LSB) through B7 (8 bits). B8 shall be a reserved data bit for future expansion, which is normally set to zero. B9 shall be the complement of B8.

#### 4.2 Data block header

The data block header, as specified in SMPTE 305.2M, shall contain the parameters shown in table 2. The data block header shall exist on line 12 for the 525/60 system or line 8 for the 625/50 system (refer to figures 7 and 10). The empty space for the Data block header and control data block on lines other than line 12 (line 8) shall be set to 200<sub>h</sub>.

Table 2 – Data block header

Parameters	Length	Value
Separator	1 word	[309 <sub>h</sub> ]
Data type	1 word	[241 <sub>h</sub> ]
Wordcount	4 words	[B4720 <sub>h</sub> ] (525/60 system) [D8F50 <sub>h</sub> ] (625/50 system)

### 4.3 Control data block

A control data block shall be inserted immediately after the data block header. The control data block shall consist of 10 words (see figure 3), and the bits are allocated as shown in table 3. The control data block has some areas of commonality with the header section specified in IEC 61834-2, and also provides specific data required for data transfer between storage devices.

Byte 1: Indicates the data type (secondary).

Byte 2: Indicates the transfer conditions (transfer speed, locked/unlocked, audio and video validity).

Bytes 3-10: Common information to IEC 61834-2.

**Table 3 – Control data block structure**

	MSB							LSB	
Byte 1	Secondary data type								
Byte 2	0 (RESERVE)		VIDEO INVALID	AUDIO INVALID	LOCK	TRANSFER MODE			
Byte 3	V 50/60	V STYPE	A 50/60	A STYPE	AP3	AP2	AP1	APT	
Byte 4	FF	FS	V REC MODE	BCSYS		DISP			
Byte 5	A-1 LF	A-1 CHN		A-1 PA	A-1 AUDIO MODE				
Byte 6	A-1 REC ST	A-1 REC END	A-1 REC MODE	A-1 EF	A-1 SMP			A-1 QU	
Byte 7	A-1 DRF	A-1 SPEED							
Byte 8	A-2 LF	A-2 CHN		A-2 PA	A-2 AUDIO MODE				
Byte 9	A-2 REC ST	A-2 REC END	A-2 REC MODE	A-2 EF	A-2 SMP			A-2 QU	
Byte 10	A-2 DRF	A-2 SPEED							
NOTES									
1 A-1 REC MODE: 1 when REC MODE of the AAUX source control pack is 111 (invalid recording); 0 when REC MODE of the AAUX source control pack is other than 111.									
2 A-2 REC MODE: 1 when REC MODE of the AAUX source control pack is 111 (invalid recording); 0 when REC MODE of the AAUX source control pack is other than 111.									
3 V REC MODE: 1 when REC MODE of the VAUX source control pack is 11 (invalid recording); 0 when REC MODE of the VAUX source control pack is other than 11.									
4 V STYPE, A STYPE, AP3, AP2, AP1, and APT are set to 0, which is the value for SD DV as specified in IEC 61834.									
5 A-1 QU and A-2 QU are 2-bit values and set to the values of QU (quantization) in the AAUX source packs specified in IEC 61834. Although IEC 61834 defines QU to have 3 bits, the actual specified values in IEC 61834 are within the 2 LSB bits, thus the 2 LSB bits can be used.									

### 4.3.1 Secondary data type

The control data block and the data slots are preceded with a secondary data type (1 word), with which the entire data block is defined. The initial code shall be set to all zero, and the receiver shall attempt to decode the data as soon as the desired secondary data type (i.e., "0000 0001") is detected.

<u>Value</u>	<u>Description</u>
0000 0000	Initial code
0000 0001	Data block as defined
0000 0010	Reserved
1111 1111	

### 4.3.2 Transfer mode

The transfer mode specifies the desired transfer speed of the compressed video stream. The following transfer speed can be selected:

<u>Value</u>	<u>Description</u>
000	Reserved
001	Normal speed (1X)
010	2X speed
011	3X speed
100	4X speed
101	5X speed
110	Reserved
111	Reserved

### 4.3.3 LOCK

LOCK indicates whether the VCR is being servo locked or not during the data transfer.

<u>Value</u>	<u>Description</u>
0	VCR servo unlocked
1	VCR servo locked

### 4.3.4 AUDIO INVALID

AUDIO INVALID indicates the validity of the audio data. When the AUDIO INVALID flag is active (1), the receiver shall not attempt to decode the audio data.

<u>Value</u>	<u>Description</u>
0	Audio data valid
1	Audio data invalid

### 4.3.5 VIDEO INVALID

VIDEO INVALID indicates the validity of the video data. When the VIDEO INVALID flag is active (1), the receiver shall not attempt to decode the video data.

<u>Value</u>	<u>Description</u>
0	Video data valid
1	Video data invalid

### 4.3.6 Common parameters

Other parameters contained in bytes 3 to 10 are common information to the international standard (IEC 61834).

### 4.4 Data slot

Each data slot consists of 280 words, and shall start from the word number address shown below. The data shall be contained in the first 256 bytes, and the last 24 bytes are reserved for future extensions. At normal speed (1X), only slot 1 shall be used. As the speed is increased (2X, 3X, 4X and 5X), the other slots shall be progressively filled with data.

<u>Word address</u>	<u>Number</u>
Slot 1	16
Slot 2	296
Slot 3	576
Slot 4	856
Slot 5	1136

### 4.5 Endcode

The endcode as specified in SMPTE 305.2M shall be present at the word number address 1416 on line 525 for the 525/60 system, or line 625 for the 625/50 system.

<u>Parameters</u>	<u>Length</u>	<u>Value</u>
Endcode	1 word	[30A <sub>h</sub> ]

## 5 Transmission Format

The following clause describes the overall transmission format and the detailed data structure of the compressed video stream.

### 5.1 Digital interface format (DIF)

The data structure of the video, audio, and subcode in the DIF blocks shall be as specified in IEC 61834-2. However, the 3-byte ID shall not be carried over the interface (see figures 4, 5, and 6). The DIF blocks shall be mapped onto the data slots using a frame-bounded algorithm, which is different in sequence from the one specified in IEC 61834-2.

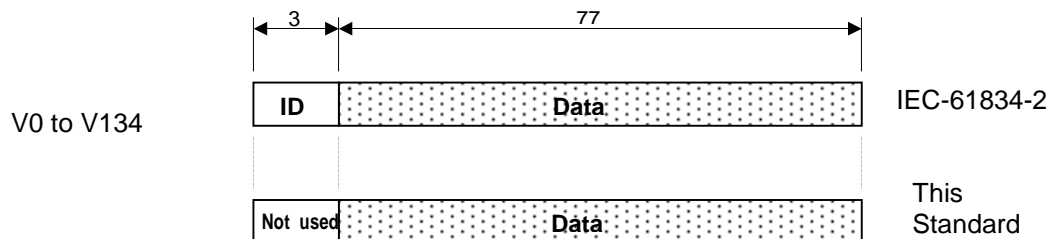


Figure 4 – Data in the video section

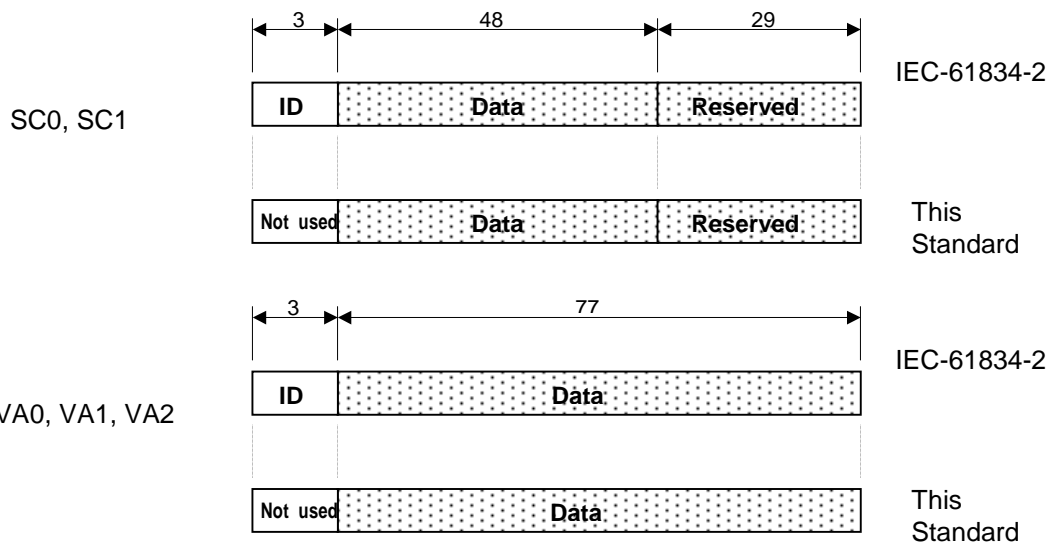


Figure 5 – Data in the SC/VAUX section

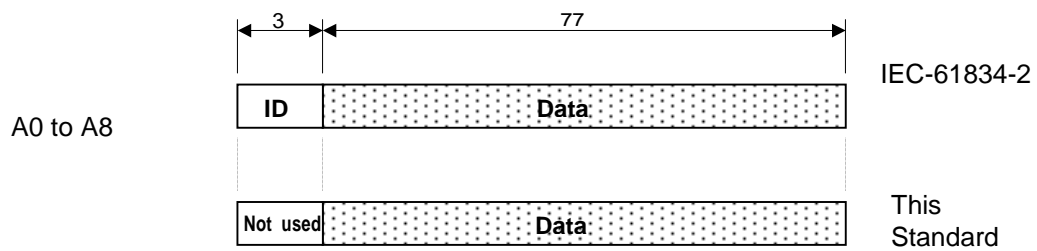


Figure 6 – Data in the Audio/AAUX section



## 5.2 525/60 system

The data block shall be transmitted from line 12 through line 525, provided that valid data shall not exist on lines 9–11 and 272–274 for the 525/60 system as shown in figure 7. The areas in lines 247–271 and 510–8 are reserved for future extensions.

### 5.2.1 Video sections

The video sections are contained in lines 12–223 and 275–486 (see figure 8):

$$(n, V0) - (n, V134); n = 0 \text{ to } 9$$

### 5.2.2 SC/VAUX sections

The SC/VAUX sections are contained in lines 224–231 and 487–494 (see figure 9):

$$(n, SC0), (n, SC1), n, VA0), (n, VA1), (n, VA2); n = 0 \text{ to } 9$$

### 5.2.3 Audio/AAUX sections

The audio/AAUX sections are contained in lines 232–246 and 495–509 (see figure 9):

$$(n, A0) - (n, A8); n = 0 \text{ to } 9$$

## 5.3 625/50 system

The data block shall be transmitted from line 8 through line 625, provided that valid data shall not exist on lines 5–7 and 318–320 for the 625/50 system as shown in figure 10. The areas in lines 289–317 and 602–4 are reserved for future extensions.

### 5.3.1 Video sections

The video sections are contained in lines 8–261 and 321–574 (see figure 11):

$$(n, V0) - (n, V134); n = 0 \text{ to } 11$$

### 5.3.2 SC/VAUX sections

The SC/VAUX sections are contained in lines 262–271 and 575–584 (see figure 12):

$$(n, SC0), (n, SC1), (n, VA0), (n, VA1), (n, VA2); n = 0 \text{ to } 11$$

### 5.3.3 Audio/AAUX sections

The audio/AAUX sections are contained in lines 272–288 and 585–601 (see figure 12):

$$(n, A0) - (n, A8); n = 0 \text{ to } 11$$

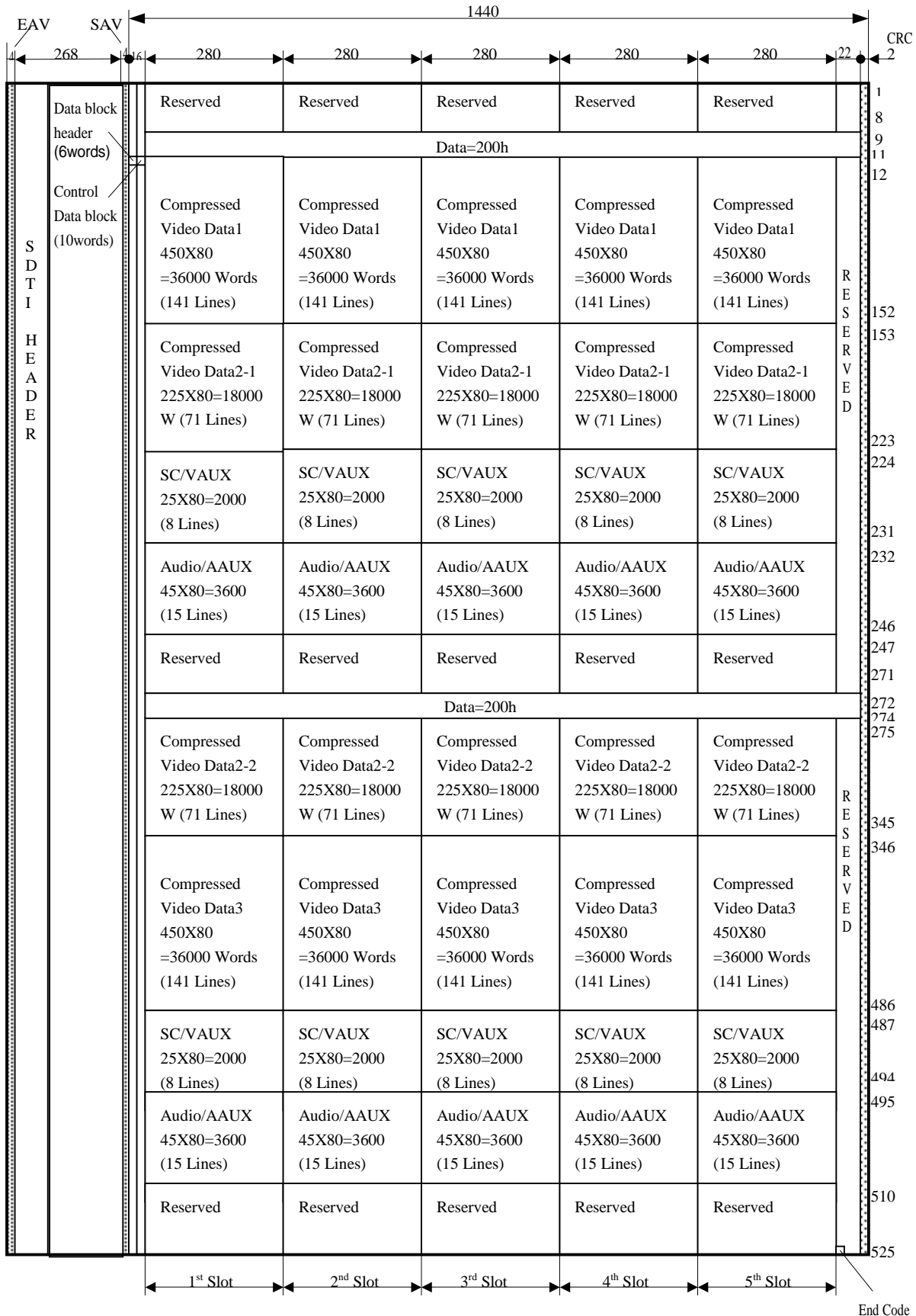


Figure 7 – Transmission format for 525/60 system

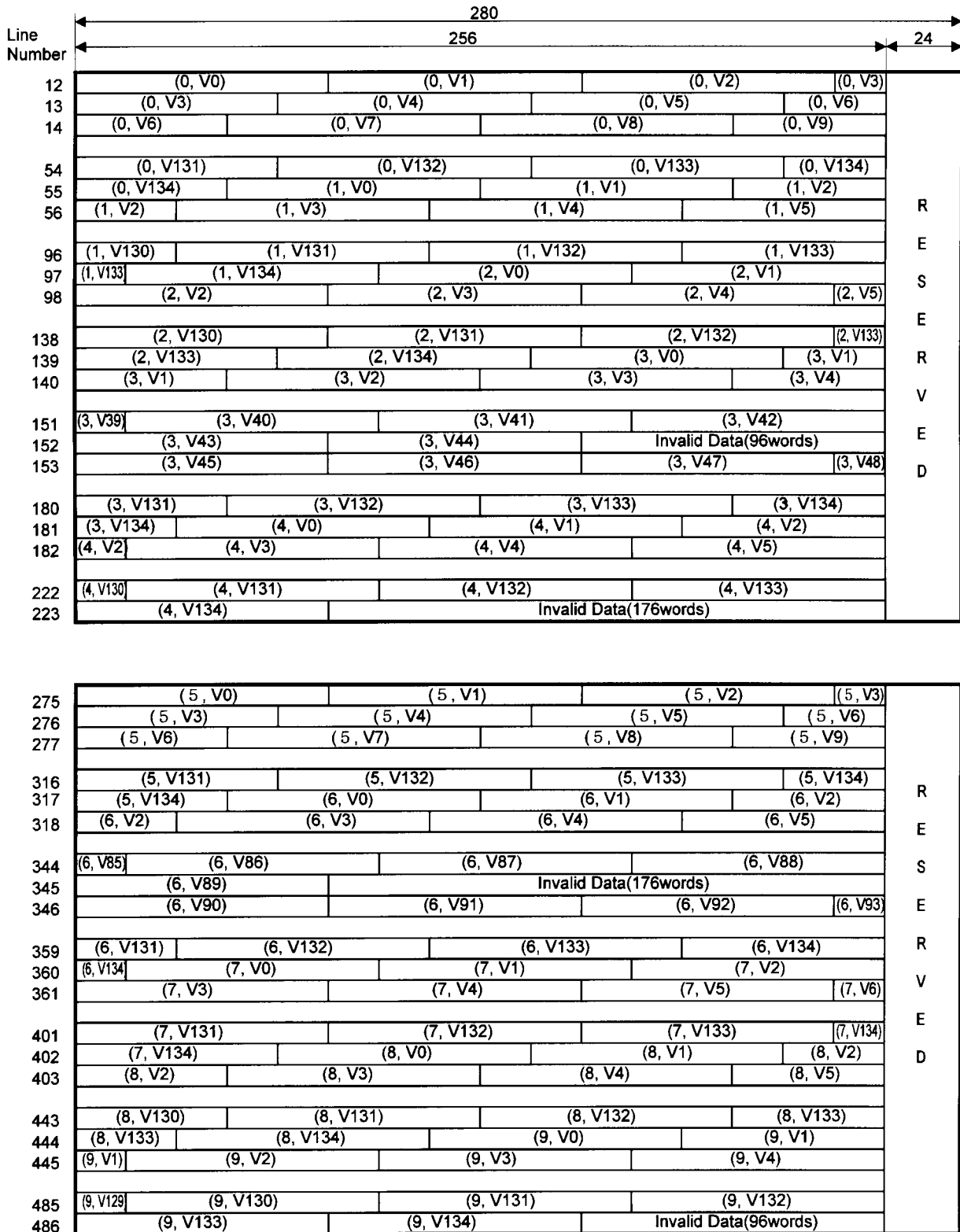


Figure 8 – Video sections for 525/60 system

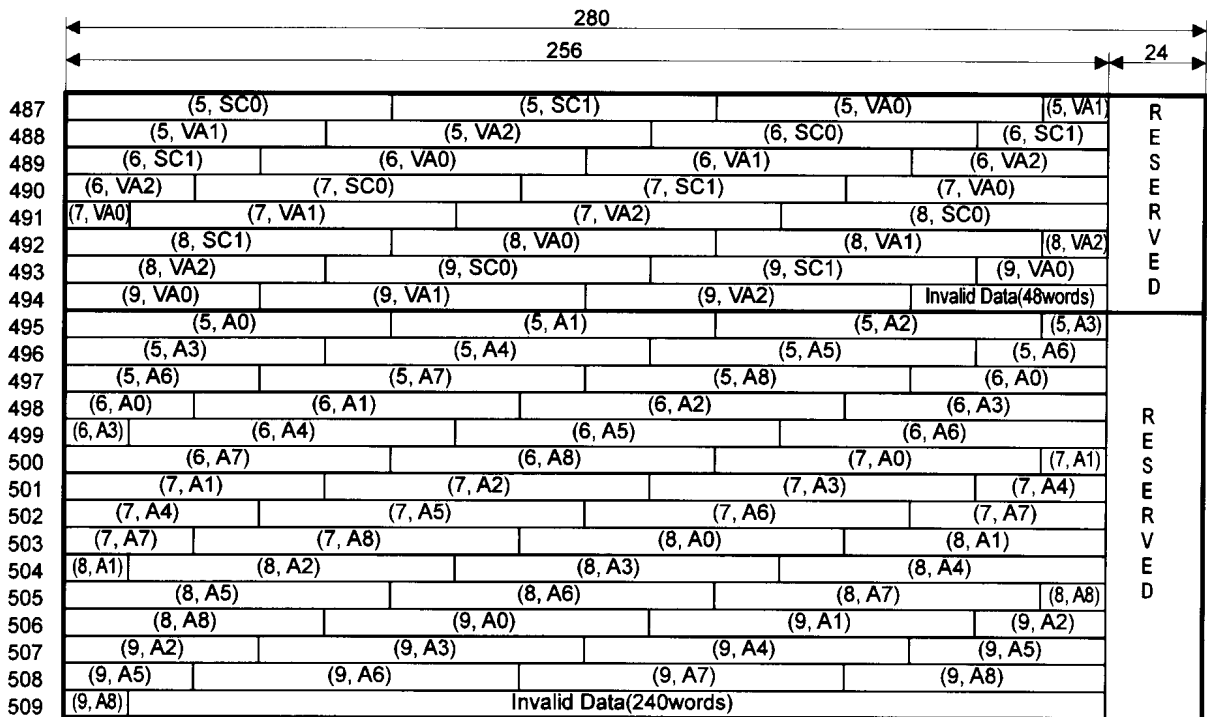
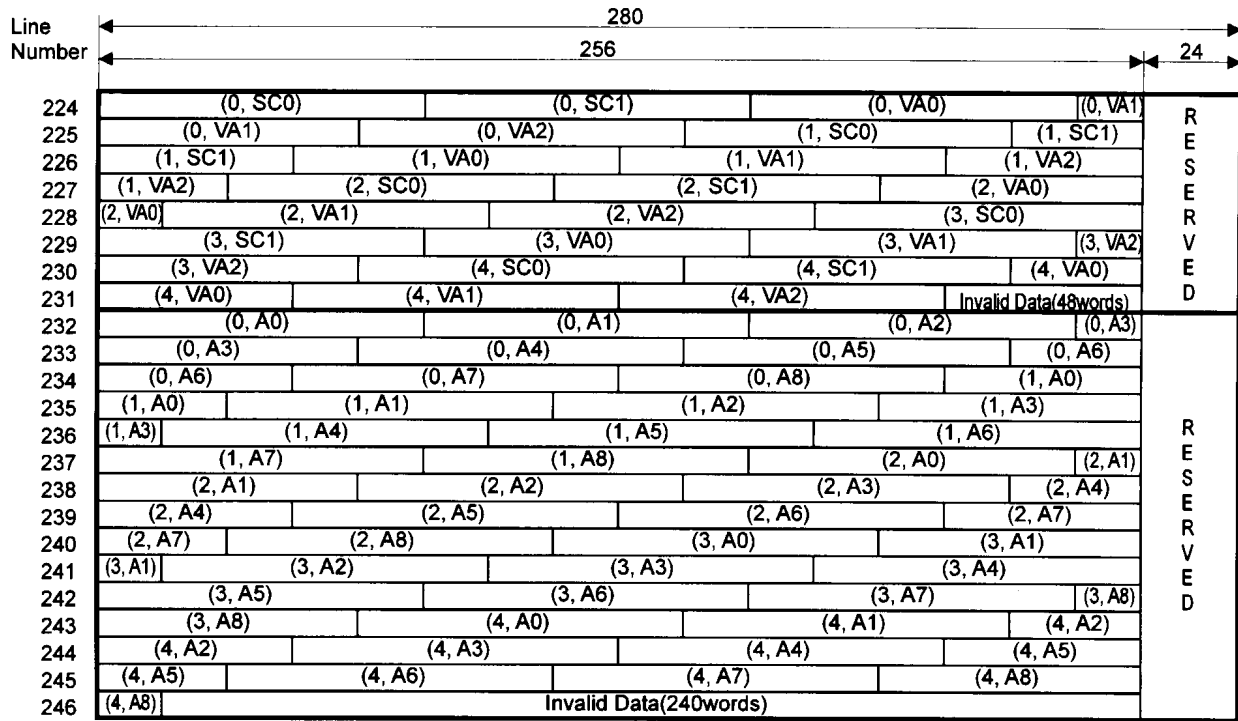


Figure 9 – SC/VAUX and audio/AAUX sections for 525/60 system

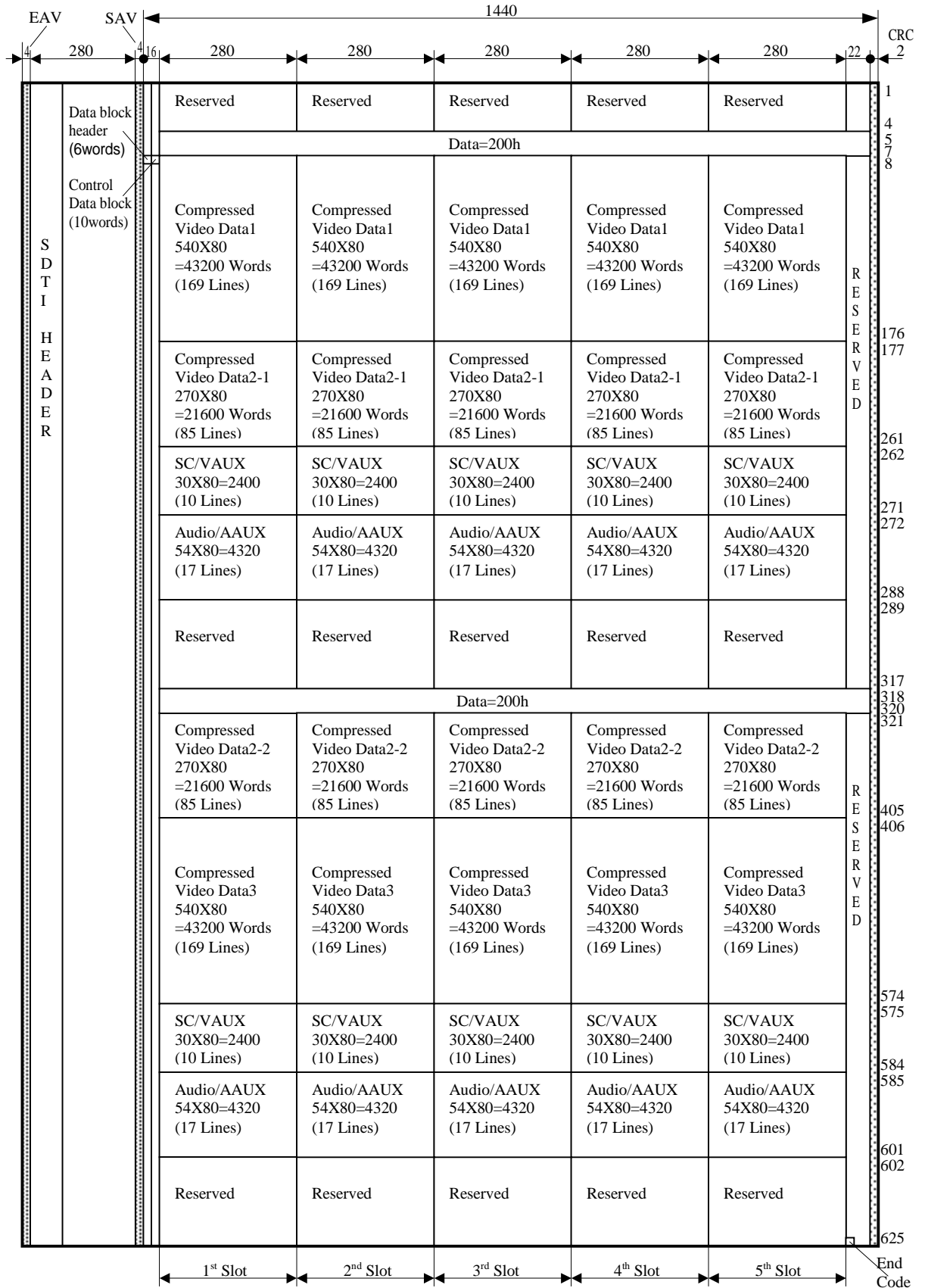


Figure 10 – Transmission format for 625/50system

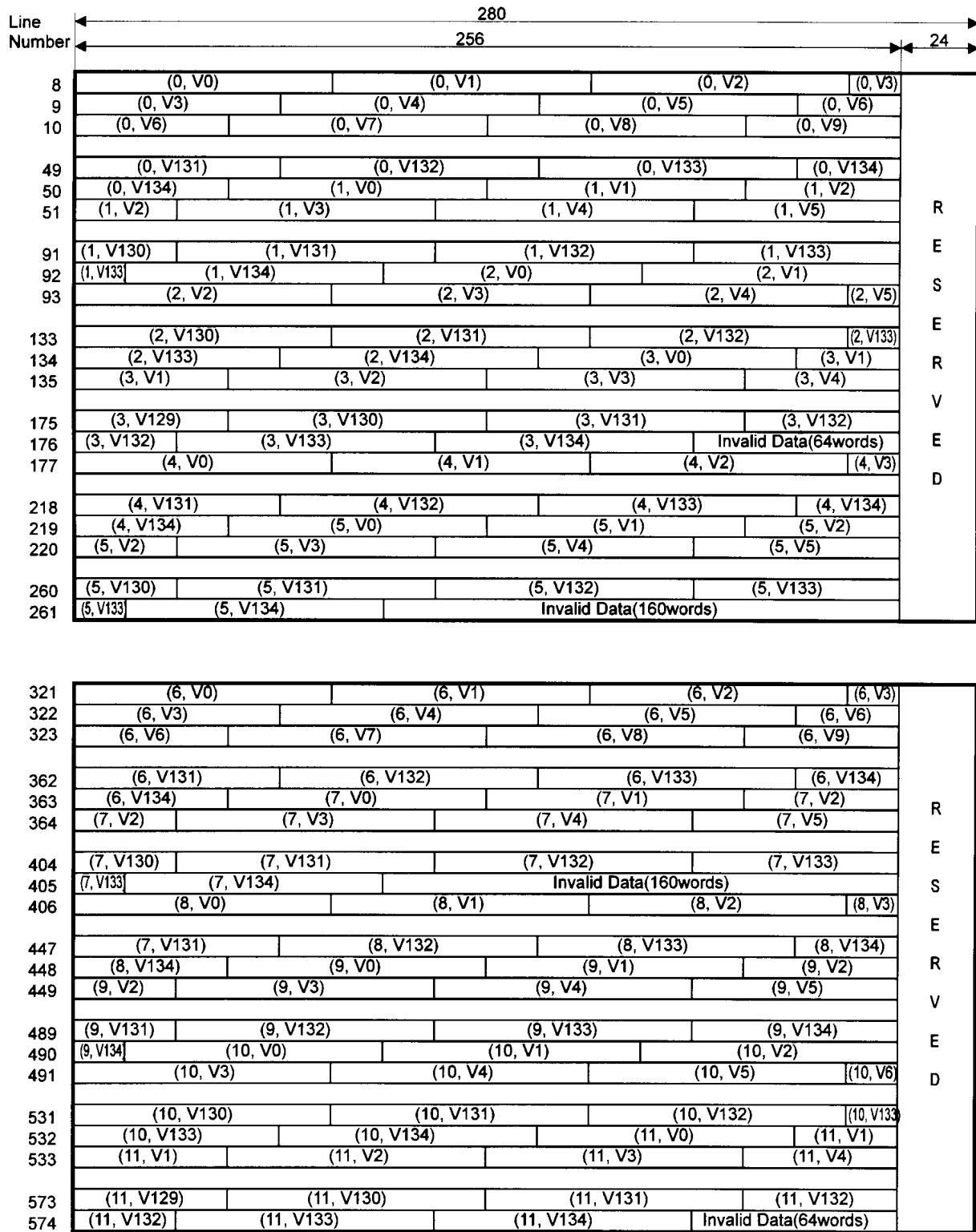


Figure 11 – Video sections for 625/50 system

Line Number	280			
	256			24
262	(0, SC0)	(0, SC1)	(0, VA0)	(0, VA1)
263	(0, VA1)	(0, VA2)	(1, SC0)	(1, SC1)
264	(1, SC1)	(1, VA0)	(1, VA1)	(1, VA2)
265	(1, VA2)	(2, SC0)	(2, SC1)	(2, VA0)
266	(2, VA0)	(2, VA1)	(2, VA2)	(3, SC0)
267	(3, SC1)	(3, VA0)	(3, VA1)	(3, VA2)
268	(3, VA2)	(4, SC0)	(4, SC1)	(4, VA0)
269	(4, VA0)	(4, VA1)	(4, VA2)	(5, SC0)
270	(5, SC0)	(5, SC1)	(5, VA0)	(5, VA1)
271	(5, VA1)	(5, VA2)	Invalid Data(160words)	
272	(0, A0)	(0, A1)	(0, A2)	(0, A3)
273	(0, A3)	(0, A4)	(0, A5)	(0, A6)
274	(0, A6)	(0, A7)	(0, A8)	(1, A0)
275	(1, A0)	(1, A1)	(1, A2)	(1, A3)
276	(1, A3)	(1, A4)	(1, A5)	(1, A6)
277	(1, A7)	(1, A8)	(2, A0)	(2, A1)
278	(2, A1)	(2, A2)	(2, A3)	(2, A4)
279	(2, A4)	(2, A5)	(2, A6)	(2, A7)
280	(2, A7)	(2, A8)	(3, A0)	(3, A1)
281	(3, A1)	(3, A2)	(3, A3)	(3, A4)
282	(3, A5)	(3, A6)	(3, A7)	(3, A8)
283	(3, A8)	(4, A0)	(4, A1)	(4, A2)
284	(4, A2)	(4, A3)	(4, A4)	(4, A5)
285	(4, A5)	(4, A6)	(4, A7)	(4, A8)
286	(4, A8)	(5, A0)	(5, A1)	(5, A2)
287	(5, A3)	(5, A4)	(5, A5)	(5, A6)
288	(5, A6)	(5, A7)	(5, A8)	Invalid(32words)
RESERVED				
575	(6, SC0)	(6, SC1)	(6, VA0)	(6, VA1)
576	(6, VA1)	(6, VA2)	(7, SC0)	(7, SC1)
577	(7, SC1)	(7, VA0)	(7, VA1)	(7, VA2)
578	(7, VA2)	(8, SC0)	(8, SC1)	(8, VA0)
579	(8, VA0)	(8, VA1)	(8, VA2)	(9, SC0)
580	(9, SC1)	(9, VA0)	(9, VA1)	(9, VA2)
581	(9, VA2)	(10, SC0)	(10, SC1)	(10, VA0)
582	(10, VA0)	(10, VA1)	(10, VA2)	(11, SC0)
583	(11, SC0)	(11, SC1)	(11, VA0)	(11, VA1)
584	(11, VA1)	(11, VA2)	Invalid Data(160words)	
585	(6, A0)	(6, A1)	(6, A2)	(6, A3)
586	(6, A3)	(6, A4)	(6, A5)	(6, A6)
587	(6, A6)	(6, A7)	(6, A8)	(7, A0)
588	(7, A0)	(7, A1)	(7, A2)	(7, A3)
589	(7, A3)	(7, A4)	(7, A5)	(7, A6)
590	(7, A7)	(7, A8)	(8, A0)	(8, A1)
591	(8, A1)	(8, A2)	(8, A3)	(8, A4)
592	(8, A4)	(8, A5)	(8, A6)	(8, A7)
593	(8, A7)	(8, A8)	(9, A0)	(9, A1)
594	(9, A1)	(9, A2)	(9, A3)	(9, A4)
595	(9, A5)	(9, A6)	(9, A7)	(9, A8)
596	(9, A8)	(10, A0)	(10, A1)	(10, A2)
597	(10, A2)	(10, A3)	(10, A4)	(10, A5)
598	(10, A5)	(10, A6)	(10, A7)	(10, A8)
599	(10, A8)	(11, A0)	(11, A1)	(11, A2)
600	(11, A3)	(11, A4)	(11, A5)	(11, A6)
601	(11, A6)	(11, A7)	(11, A8)	Invalid(32words)
RESERVED				

Figure 12 – SC/VAUX and audio/AAUX sections for 625/50 system

**Annex A** (informative)

**Bibliography**

ANSI/SMPTE 259M-1997, Television — 10-Bit 4:2:2 Component and 4fsc Composite Digital Signals — Serial Digital Interface

SMPTE RP 168-2002, Definition of Vertical Interval Switching Point for Synchronous Video Switching

ITU-R BT.656-4 (02/98), Interface for Digital Component Video Signals in 525-Line and 625-Line Television Systems Operating at the 4:2:2 Level of Recommendation ITU-R BT.601 (Part A)