SMPTE 266M-2002
Revision of
ANSI/SMPTE 266M-1994

SMPTE STANDARD

for Television —
4:2:2 Digital Component Systems — Digital Vertical Interval Time Code

1 Scope

This standard describes the signal format of a digital vertical interval time code (D-VITC) suitable for use with the digital coding given in ANSI/SMPTE 125M (for 525-line, 59.94-Hz field rate, 4:2:2 component digital signals) or ITU-R 601-2 (for 625-line, 50-Hz field rate, 4:2:2 component digital signals).

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.

ANSI/SMPTE 125M-1995, Television — Component Video Signal 4:2:2 — Bit-Parallel Digital Interface

SMPTE 12M-1999, Television, Audio and Film — Time and Control Code

IEC 60461 (1986-09), Time and Control Code for Video Tape Recorders

ITU-R BT.601-5 (10/95), Studio Encoding Parameters of Digital Television for Standard 4:3 and Wide-Screen 16:9 Aspect Ratios

3 D-VITC general

3.1 Signal definition

D-VITC is an 8-bit digital data representation of the band-limited analog signal corresponding to the vertical interval time code (VITC) of SMPTE 12M and IEC 60461. The 8 bits of D-VITC shall be carried in the 8 most significant bits of the 10 bits of the ANSI/SMPTE 125M or ITU-R BT.601 coding. Since some equipment may be built using only 8 of the 10 bits, both 10- and 8-bit interpretations of the values are given in this standard, with 10 bits the preferred expression.

3.2 Data assignment

The 90 bits of information in the VITC defined in SMPTE 12M and IEC 60461 are carried by 675 consecutive luminance samples (see figure 1) of the data stream defined in ANSI/SMPTE 125M and ITU-R BT.601. Each D-VITC bit is therefore represented by 7.5 luminance samples.

3.3 Transitions

The shape of transitions between D-VITC bits is defined by the values assigned to luminance samples in the transition region. Because the number of luminance samples chosen is an odd integer multiple (15) of one-half the total number of bits, it is necessary to define two distinct transition data sets (see figure 2). When viewed in the analog domain, the resulting transitions are a close approximation to a raised cosine shape.

3.4 Digital data

In the following clauses, 10-bit expressions are given and preferred. Equivalent values for 8-bit representations used in earlier documentation of ANSI/SMPTE 125M are given in parentheses.

3.4.1 The data value associated with a binary state of 1 in the D-VITC shall be 300_h ($C0_h$).

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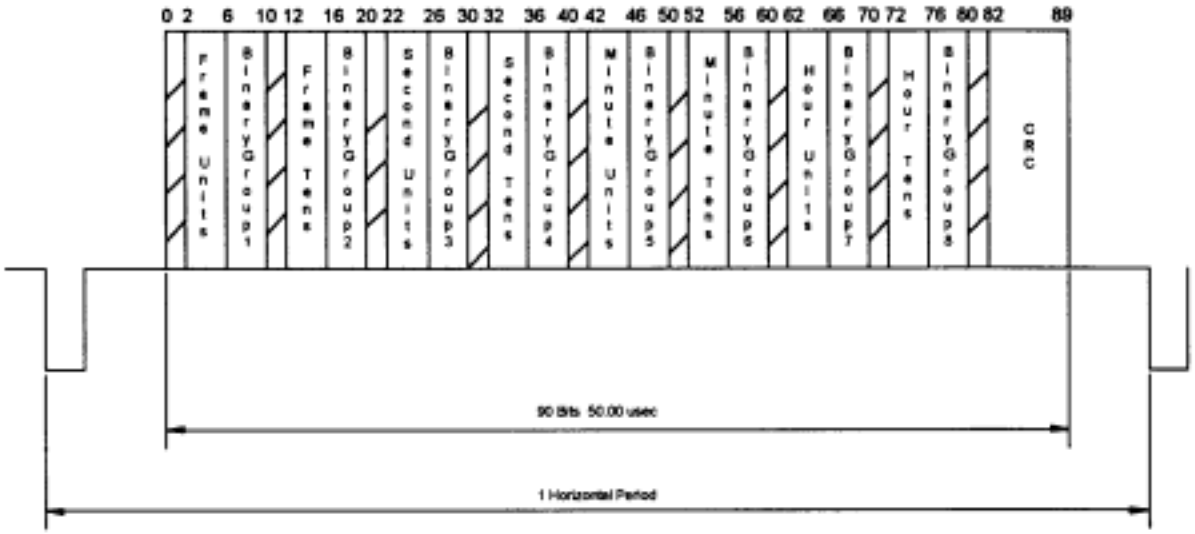

0-1	Synchronizing Bits	0 Fixed one 1 Fixed zero	
2-5	Units of Frames		
6-9	First Binary Group (BG1)		
10-11	Synchronizing Bits	10 Fixed one 11 Fixed zero	
12-13	Tens of Frames		
14	Flag Bit (Note 1.)		
15	Flag Bit (Note 1.)		
16-19	Second Binary Group (BG2)		
20-21	Synchronizing Bits	20 Fixed one 21 Fixed zero	
22-25	Units of Seconds		
26-29	Third Binary Group (BG3)		
30-31	Synchronizing Bits	30 Fixed one 31 Fixed zero	
32-34	Tens of Seconds		
35	Flag Bit (Note 1.)		
36-39	Forth Binary Group (BG4)		
40-41	Synchronizing Bits	40 Fixed one 41 Fixed zero	
42-45	Flag Bit (Note 1.)		
46-49	Fifth Binary Group (BG5)		
50-51	Synchronizing Bits	50 Fixed one 51 Fixed zero	
52-54	Tens of Minutes		
55	Flag Bit (Note 1.)		
58-59	Sixth Binary Group (BG6)		
60-61	Synchronizing Bits	60 Fixed one 61 Fixed zero	
62-65	Units of Hours		
66-69	Seventh Binary Group (BG7)		
70-71	Synchronizing Bits	70 Fixed one 71 Fixed zero	
72-73	Tens of Hours		
74	Flag Bit (Note 1.)		
75	Flag Bit (Note 1.)		
76-79	Eighth Binary Group (BG8)		
80-81	Synchronizing Bits	80 Fixed one 81 Fixed zero	
82-89	Cyclic Redundancy Check code		

Note 1. Flag Bits as specified by SMPTE 12M

Figure 1 – Time code bit assignment

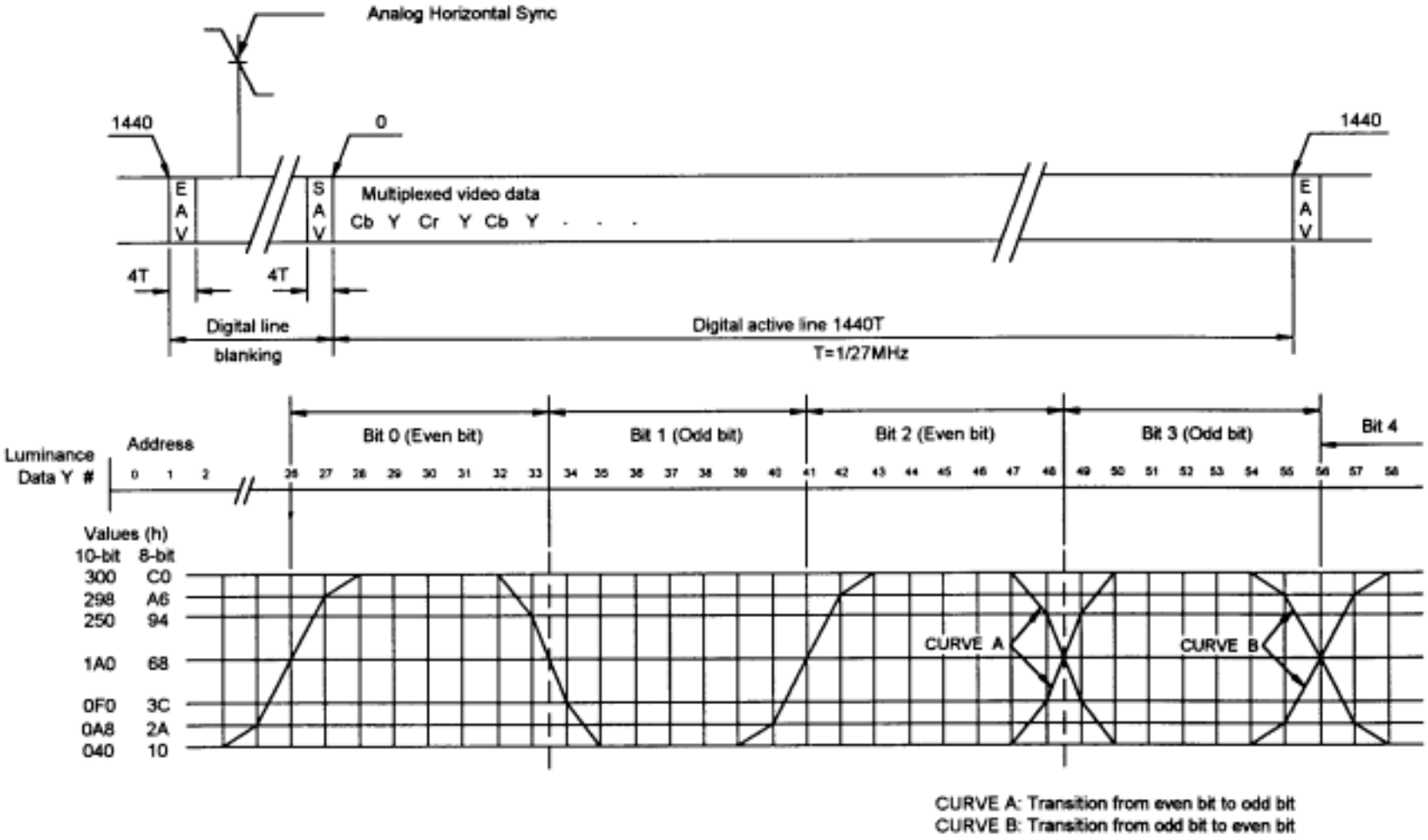

Figure 2 – D-VITC waveform representation and position in digital video samples

3.4.2 The data value associated with a binary state of 0 in the D-VITC shall be 040_h (10_h).

3.4.3 The data values of samples associated with transitions between D-VITC binary states are defined in figure 2.

3.4.4 The data values of all luminance samples of the active line period which are not used in forming the D-VITC shall be set to 040_h (10_h).

3.4.5 The data values of all unused chrominance samples of the active line period shall be set to 200_h (80_h).

3.5 Insertion lines

For 525-line/60-field systems, the D-VITC shall be inserted on lines 14 and 277. Insertion on lines 16 and 279 is optional.

For 625-line/50-field systems, the D-VITC shall be inserted on lines 19 and 332. Insertion on lines 21 and 334 is optional.

Annex A (informative)
525-line signals

The timing relationship between analog VITC and D-VITC for 525-line, 59.94-Hz field rate signals is given in figure A.1.

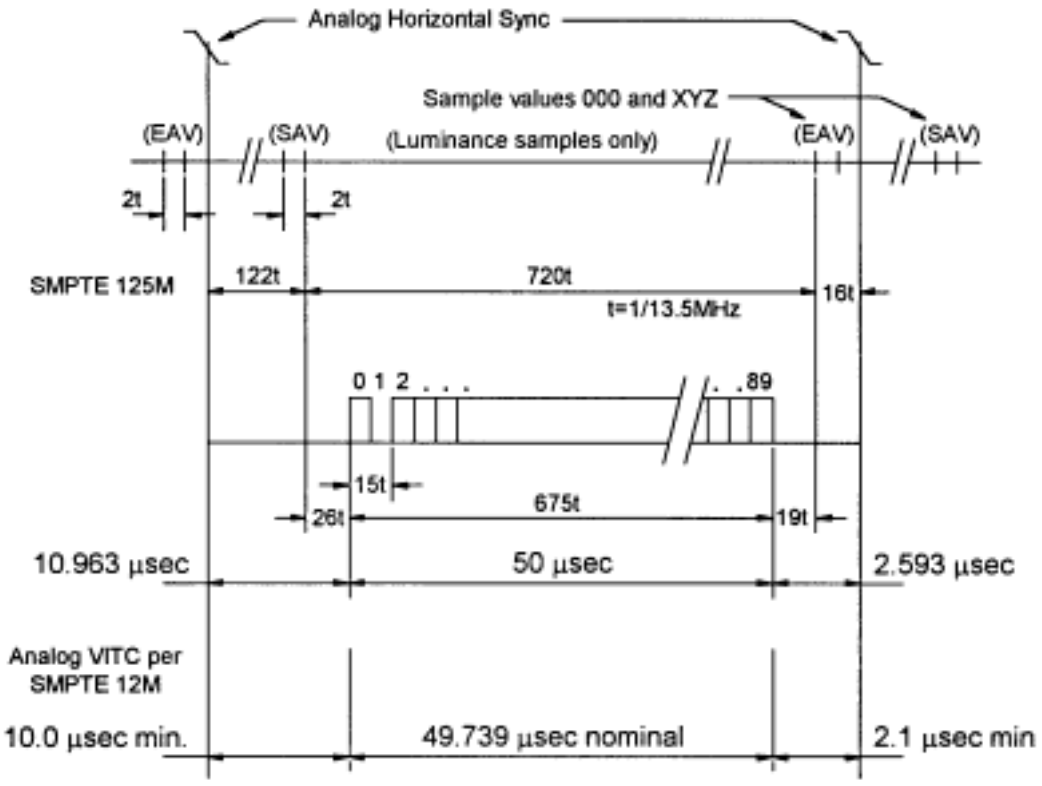

Figure A.1 – Timing relationship between analog VITC and D-VITC for 525/60 standard

Annex B (informative)
625-line signals

The timing relationship between analog VITC and D-VITC for 625-line, 50-Hz field rate signals is given in figure B.1.

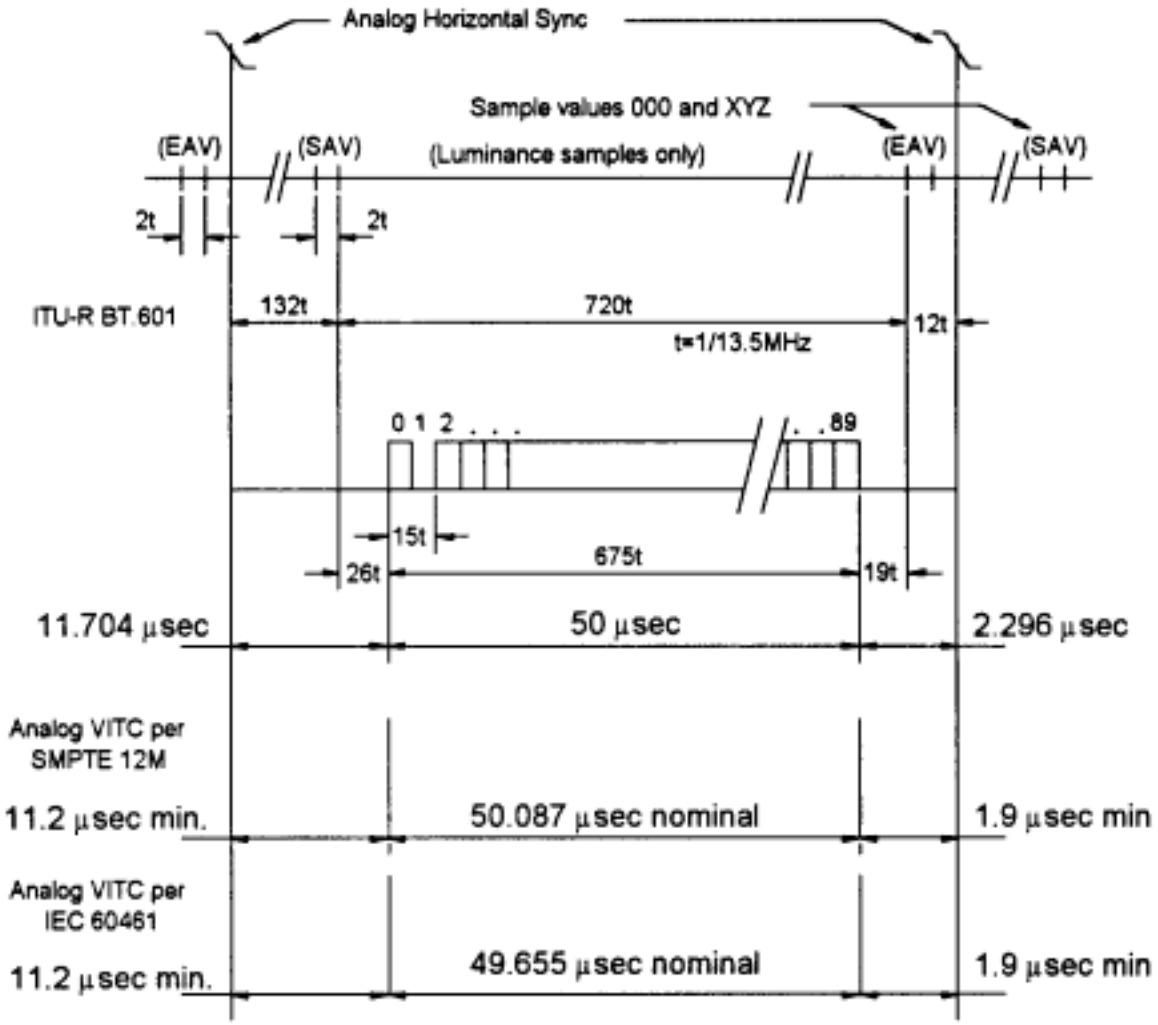

Figure B.1 – Timing relationship between analog VITC and D-VITC for 625/50 standard

Annex C (informative)
D to A conversion

When D-VITC is decoded and D to A converted, the resulting analog signal could deviate from the nominal values given in SMPTE 12M or IEC 60461. Table C.1 gives possible deviations. The deviations are a consequence of the use of the 13.5-MHz sampling frequency defined by the 4:2:2 digital data specification of ANSI/SMPTE 125M and ITU-R BT.601.

NOTE – Designers should be aware that due to the schedule of revisions to SMPTE 12M and IEC 60461, there may also be differences in the nominal values of VITC bit rates specified in these documents.

Table C.1 – Tolerance deviations

	VITC		D-VITC	
	SMPTE 12M IEC 60461	IEC 60461[1)]	SMPTE 266M	DEVIATION
525-line 60-field systems				
Bit rate [Hz]	1,809,400 ± 2%		1,800,000.0	– 9,400
90-bit duration [µs]	49.739 ± 1		50.0	+ 0.261
625-line 50-field systems				
Bit rate [Hz]	1,796,875 ± 2%		1,800,000.0	+ 3,125
90-bit duration [µs]	50.087 ± 1		50.0	+ 0.067
Bit rate [Hz]		1,812,500 ± 200	1,800,000.0	– 12,500
90-bit duration [µs]		49.655 ± 0.005	50.0	+ 0.345

[1)] The values in this column represent the status of the 1986 version of IEC 60461.

Annex D (informative)
A to D conversion

Design engineers should be aware of a potential difference in defined digital values when an analog signal (VITC) is A to D converted.

Annex E (informative)
Bibliography

EBU N12, TIme-and-Control Codes for Television Recording