RECOMMENDATION ITU-R BT.1366*

Transmission of time code and control code in the ancillary data space of a digital television stream according to Recommendations ITU-R BT.656, ITU-R BT.799 and ITU-R BT.1120

(Question ITU-R 42/6)

(1998)

The ITU Radiocommunication Assembly,

considering

a) that the use of time-code signals is well-established in the area of post-production;

b) that many countries are installing digital television production facilities based on the use of digital video components conforming to Recommendations ITU-R BT.601, ITU-R BT.656 or ITU-R BT.1120;

c) that there exists the capacity within a signal conforming to Recommendations ITU-R BT.656, ITU-R BT.799 and ITU-R BT.1120 for additional data signals to be multiplexed with the video data signal itself;

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

e) that the operational benefits are increased if a minimum of different formats are used for ancillary data signals;

f) that the exchange of programme material between and within organizations is facilitated if a common format of time-code signal is used;

g) that extension of the capacity of the time-code signal to carry additional information is desirable,

recommends

1 that the time-code ancillary data signal format described in this Recommendation be used for the interfaces defined in ITU-R BT.656, ITU-R BT.799 and ITU-R BT.1120.

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

1 Introduction

This Recommendation defines a transmission format for conveyance of linear (LTC) or vertical interval (VITC) time code data formatted according to ANSI/SMPTE 12M in 8- or 10-bit digital television data interfaces according to ITU-R BT.656, ITU-R BT.799 and ITU-R BT.1120.

Time code information is transmitted in the ancillary data space as defined in Recommendation ITU-R BT.1364. Multiple codes can be transmitted within a single digital video data stream. Other time information, such as real time clock, DTTR tape timer information, and other user-defined information, may also be carried in the ancillary time code packet instead of time code. The actual information transmitted through the interface is identified by the coding of a distributed binary bit.

2 Normative references

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

ANSI/SMPTE 12M-1995, Television, Audio and Film – Time and Control Code.

Recommendation ITU-R BR.780 – Time and control code for the international exchange of television programmes on magnetic tapes.

Recommendation ITU-R BT.1364 – Format of Ancillary Data Signals Carried In Digital Component Studio Interfaces.

3 Ancillary time code format

3.1 One ancillary data packet of constant length excluding ancillary data flag shall fully represent an ancillary time code (ATC) word.

3.2 The ancillary time code packet shall be type 2, having a data identification (DID) and a secondary data identification (SDID). The DID and SDID shall be set to:

DID = 60h

SDID = 60h

3.3 The data count value for ancillary time code shall be set to:

DC = 10h

4 Format of user data words in ancillary time code packet

4.1 All user data words in the ancillary time code packets are formatted as shown in Table 1.

NOTE – References to user data word (UDW) bits in this Recommendation are for a 10-bit UDW word. Correspondence between an 8-bit word and a 10-bit word is shown in Table 1.

TABLE 1

User data words format

UDW_{10} bit (10-bit words)	UDW_8 bit (8-bit words)	Assignment
b0 (LSB)	N/A	Set to "0" in 10-bit words. N/A in 8-bit words
b1	N/A	Set to "0" in 10-bit words. N/A in 8-bit words
b2	b0	Set to "0" in 10-bit and 8-bit words
b3	b1	Distributed binary bit (DBB)
b4	b2	ANC binary group LSB
b5	b3	ANC binary group
b6	b4	ANC binary group
b7	b5	ANC binary group MSB
b8	b6	Even parity for data contained in UDW bit 7 through bit 0
b9 (MSB)	b7	Not bit 8

4.1.1 Bit b7 through bit b3 of the UDW_{10}-1 through UDW_{10}-16 shall contain the time code information and additional information as per ANSI/SMPTE 12M.

4.2 Bit b3 of the UDW_{10}-1 through UDW_{10}-16 form two groups of distributed binary bits DBB 1 and DBB 2 (see Table 3).

4.2.1 The first group of distributed binary bits (DBB 1) is formed by bit 3 of UDW_{10}-1 through UDW_{10}-8, where UDW_{10}-1 (b3) represents the LSB and UDW_{10}-8 (b3) represents the MSB.

4.2.2 The second group of distributed binary bits (DBB 2) is formed by bit 3 of UDW_{10}-9 through UDW_{10}-16, where UDW_{10}-9 (b3) represents the LSB and UDW_{10}-16 (b3) represents the MSB.

4.3 Bits b7 through b4 form an ancillary binary group into which the time code is mapped. Bits b4 of the UDW_{10} represents the LSB of this group.

4.4 Information coded in the distributed binary bit group is defined in Table 3.

4.4.1 Bits b4 through b0 of the distributed binary bit group DBB 2 convey VITC line number location indicating the position of VITC data on the output digital video signal interface within the vertical blanking interval. The line select number depends on the television system and shall be constrained to a range as shown in Table 2.

TABLE 2

Line select number

					VITC line select			
					525/60		625/50	
					bit b5 = x	bit b5 = 1	bit b5 = x	bit b5 = 1
DBB 2 bits b4 through b0					VITC on line N	Repeated VITC on line (N+2)	VITC on line N	Repeated VITC on line (N+2)
b4	b3	b2	b1	b0	field 1/field 2	field 1/field 2	field 1/field 2	field 1/field 2
0	0	1	1	0	-	-	6/319	8/321
0	0	1	1	1	-	-	7/320	9/322
0	1	0	0	0	-	-	8/321	10/323
0	1	0	0	1	-	-	9/322	11/324
0	1	0	1	0	10/273	12/275	10/323	12/325
0	1	0	1	1	11/274	13/276	11/324	13/326
0	1	1	0	0	12/275	14/277	12/325	14/327
0	1	1	0	1	13/276	15/278	13/326	15/328
0	1	1	1	0	14/277	16/279	14/327	16/329
0	1	1	1	1	15/278	17/280	15/328	17/330
1	0	0	0	0	16/279	18/281	16/329	18/331
1	0	0	0	1	17/280	19/282	17/330	19/332
1	0	0	1	0	18/281	20/283	18/331	20/333
1	0	0	1	1	19/282	-	19/332	21/334
1	0	1	0	0	20/283	-	20/333	22/335
1	0	1	0	1	-	-	21/334	-
1	0	1	1	0	-	-	22/335	-

NOTE – x = irrelevant.

4.4.2 Bit b5 of DBB 2 when set to "1" shall signify that the VITC word carried in the ancillary time code word, when converted to an analogue video output signal, shall be inserted on the selected line number and shall be repeated again on the selected line number +2 (see Table 2, bit b5 = 1).

4.4.3 Bits b7 and b6 of the DBB 2 word represent different time code condition bits (see Table 3). Data errors indicated by the error detection system of the received time code signal at the input receiving interface to the ancillary time code formatter and the type of processing of receiving user bits shall be signalled by these bits in the transmitted ATC word. The coding of these two bits is shown in Table 4.

4.5 Mapping of the time code data into the UDW 1 through UDW 16 of the ancillary time code data packet is shown in Table 5.

TABLE 3

Distributed binary bit group coding

DBB group	Bit 3 of UDW	Distributed binary bit (DBB) MSB LSB	Definition
DBB 1	UDW_{10}-1 through UDW_{10}-8	0 0 0 0 0 0 0 0	Longitudinal time code
		0 0 0 0 0 0 0 1	Vertical interval time code #1
		0 0 0 0 0 0 1 0	Vertical interval time code #2
		0 0 0 0 0 0 1 1 through 0 0 0 0 0 1 1 1	User defined
		0 0 0 0 1 0 0 0 through 0 1 1 1 1 1 1 1	Locally generated time address and user data (user defined)
		1 0 0 0 0 0 0 0 through 1 1 1 1 1 1 1 1	Reserved
DBB 2	UDW_{10}-9	b0	VITC line select (LSB) (Note)
	UDW_{10}-10	b1	VITC line select (Note)
	UDW_{10}-11	b2	VITC line select (Note)
	UDW_{10}-12	b3	VITC line select (Note)
	UDW_{10}-13	b4	VITC line select (MSB) (Note)
	UDW_{10}-14	b5	VITC line duplication (Note)
	UDW_{10}-15	b6	Time code validity
	UDW_{10}-16	b7	(User bits) process bit

NOTE – These bits are not used in interfaces which are in accordance with Recommendation ITU-R BT.1120.

TABLE 4

Coding of validity and process bits

VITC validity bit (b6) and process bit (b7)	Definition
b6 = 0	No time code error received or locally generated time code address
b6 = 1	Transmitted time code interpolated from previous time code (received a time code error)
b7 = 0	Binary group of user bits in time code data stream are processed to compensate for latency
b7 = 1	Binary groups of user bits in time code data stream are only retransmitted (no delay compensation)

TABLE 5

Mapping of time code data into UDW

UDW		Time code bit	Time code definitions (as per ANSI/SMPTE 12M)
1	b4	0	Units of frames 1
	b5	1	Units of frames 2
	b6	2	Units of frames 4
	b7	3	Units of frames 8
2	b4	4	LSB binary group 1
	b5	5	xxx binary group 1
	b6	6	xxx binary group 1
	b7	7	MSB binary group 1
3	b4	8	Tens of frames 10
	b5	9	Tens of frames 20
	b6	10	Flag
	b7	11	Flag
4	b4	12	LSB binary group 2
	b5	13	xxx binary group 2
	b6	14	xxx binary group 2
	b7	15	MSB binary group 2
5	b4	16	Units of seconds 1
	b5	17	Units of seconds 2
	b6	18	Units of seconds 4
	b7	19	Units of seconds 8
6	b4	20	LSB binary group 3
	b5	21	xxx binary group 3
	b6	22	xxx binary group 3
	b7	23	MSB binary group 3
7	b4	24	Tens of seconds 10
	b5	25	Tens of seconds 20
	b6	26	Tens of seconds 40
	b7	27	Flag
8	b4	28	LSB binary group 4
	b5	29	xxx binary group 4
	b6	30	xxx binary group 4
	b7	31	MSB binary group 4
9	b4	32	Units of minutes 1
	b5	33	Units of minutes 2
	b6	34	Units of minutes 4
	b7	35	Units of minutes 8

TABLE 5 (*end*)

UDW		Time code bit	Time code definitions (as per ANSI/SMPTE 12M)
10	b4	36	LSB binary group 5
	b5	37	xxx binary group 5
	b6	38	xxx binary group 5
	b7	39	MSB binary group 5
11	b4	40	Tens of minutes 10
	b5	41	Tens of minutes 20
	b6	42	Tens of minutes 40
	b7	43	Flag
12	b4	44	LSB binary group 6
	b5	45	xxx binary group 6
	b6	46	xxx binary group 6
	b7	47	MSB binary group 6
13	b4	48	Units of hours 1
	b5	49	Units of hours 2
	b6	50	Units of hours 4
	b7	51	Units of hours 8
14	b4	52	LSB binary group 7
	b5	53	xxx binary group 7
	b6	54	xxx binary group 7
	b7	55	MSB binary group 7
15	b4	56	Tens of hours 10
	b5	57	Tens of hours 20
	b6	58	Flag
	b7	59	Flag
16	b4	60	LSB binary group 8
	b5	61	xxx binary group 8
	b6	62	xxx binary group 8
	b7	63	MSB binary group 8

NOTE – Appropriate flag information for each television system as per ANSI/SMPTE 12M is inserted into the corresponding positions of Table 5 marked as "flag."

5 Transmission of ancillary time code packets

5.1 Multiple transmissions of ancillary time code packets per video frame code information are permissible under the provisions of this Recommendation.

NOTE – This Recommendation permits transmission of different ATC packets within a single video frame; as for example an ATC packet containing LTC information and a second ATC packet containing VITC information. The time code information in these two ATC packets shall correspond to the relevant video frame (see § 6.2).

5.2 Transmission of ancillary time code packets shall be at least once per frame for LTC data word and once per field for VITC data word.

5.2.1 Only the 64 information bits of time code are transferred to the ATC. The LTC sync word (bits 64-79) and the VITC ("1"/"0") sync bit pairs and CRC word are omitted from the ancillary time code packets.

6 Ancillary time code packets location

6.1 Insertion of ancillary time code (ATC) packets into any available location in the digital data stream is permitted under the provisions of this recommendation, but it is recommended that packet insertion occurs within the vertical blanking interval as defined by the line standard in use (prior) (see Note) to the normal vertical switching point defined in SMPTE RP 168-1993 (Definition of vertical Interval Switching Point for Synchronous Switching).

NOTE – ATC information should correspond directly to the video after the vertical switching point. For that reason the insertion of the ATC after the normal vertical switching point should be considered as preferred location. But this would be in conflict with the existing SMPTE RP 188-1996 on transmission of time code and control code in the ancillary data space of a digital television stream**.** Further studies on this subject are required.

For systems according to ITU-R BT.1120 the following ATC insertion points should be considered as preferred location (further studies on this subject are also required).

Type of time code	location for multiplexing in 1125/60/2:1 system
Packet for LTC	horizontal ancillary data space of line 10
Packet for VITC #1	horizontal ancillary data space of line 9
Packet for VITC #2	horizontal ancillary data space of line 571
Packet for others	available any horizontal ancillary data space except line 9, 10 and 571

6.2 Frame or field address information (LTC or VITC) contained in an ATC packet shall correspond to the respective video frame or field in which the ATC packet resides. Look-ahead compensation shall be applied to the time code (LTC or VITC) frame count when converting between ATC and either LTC or VITC.

6.3 Transmission of the VITC word for field 1 or field 2 in the ancillary time code word is signalled by a corresponding field flag (defined in ANSI/SMPTE 12M) located in the ancillary binary group of the ATC word (see Table 5).