

RECOMMENDATION ITU-R BT.1366-2

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)

(1998-2007-2008)

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.

Scope

This Recommendation defines a transmission format for conveyance of linear (LTC) or vertical interval (VITC) time-code data formatted according to Recommendation ITU-R BR.780-2 in 8- or 10-bit digital television data interfaces according to Recommendations ITU-R BT.656, ITU-R BT.799 and ITU-R BT.1120.

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 have installed 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 ancillary data signals to be multiplexed with the video data signal;
- 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;

* Recommendation ITU-R BT.656 – 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.

** Recommendation ITU-R BT.799 – Interface for digital component video signals in 525-line and 625-line television systems operating at the 4:4:4 level of Recommendation ITU-R BT.601.

*** Recommendation ITU-R BT.1120 – Digital interfaces for HDTV studio signals.

- g) that extension of the capacity of the time-code signal to carry additional information is desirable;
- h) that progressive image production beyond 30 Hz requires the use of ancillary time-code packets,

recommends

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

Annex 1

1 Introduction

This Recommendation defines a transmission format for conveyance of linear (LTC) or vertical interval (VITC) time-code data formatted according to ITU-R BR.780-2 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

2.1 Normative provisions

The following Recommendations contain 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.

2.2 Normative references

Recommendation ITU-R BR.780-2 – Time and control code standards, for production applications in order to facilitate 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 (ATC)¹

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

¹ ATC is used to convey time-code data formatted as LTC, VITC, or both.

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:

$$\text{DID} = 60\text{h}$$

$$\text{SDID} = 60\text{h}$$

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

$$\text{DC} = 10\text{h}$$

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 1 – 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	10 bit systems: Even parity for data contained in UDW bit 7 through bit 0 8 bit systems: Even parity for data contained in UDW bit 5 through bit 0
b9 (MSB)	b7	10 bit: Not bit 8, 8 bit: Not bit 6

4.1.1 Bit b7 through bit b4 of the UDW₁₀₋₁ through UDW₁₀₋₁₆ shall contain the time-code information and additional information as per Recommendation ITU-R BR.780-2.

4.2 Bit b3 of the UDW₁₀₋₁ through UDW₁₀₋₁₆ 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 UDW₁₀₋₁ through UDW₁₀₋₈, where UDW₁₀₋₁ (b3) represents the LSB and UDW₁₀₋₈ (b3) represents the MSB.

4.2.2 The second group of distributed binary bits (DBB 2) is formed by bit 3 of UDW₁₀₋₉ through UDW₁₀₋₁₆, where UDW₁₀₋₉ (b3) represents the LSB and UDW₁₀₋₁₆ (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 UDW₁₀ 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

DBB 2 bits b4 through b0					VITC line select			
					525/60I		625/50I	
					bit b5 = x		bit b5 = 1	
					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 (odd) field 2 (even)	field 1 (odd) field 2 (even)	field 1 (odd) field 2 (even)	field 1 (odd) field 2 (even)
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.

TABLE 3
Distributed binary bit group coding

DBB group	Bit 3 of UDW	Distributed binary bit (DBB)		Definition
		MSB	LSB	
DBB 1	UDW ₁₀₋₁ through UDW ₁₀₋₈	0	0 0 0 0 0 0 0 0	Longitudinal time code
		0	0 0 0 0 0 0 0 1	Vertical interval time code No. 1
		0	0 0 0 0 0 0 1 0	Vertical interval time code No. 2
		0	0 0 0 0 0 0 1 1	User defined
		0	0 0 0 0 0 1 1 1	
		0	0 0 0 0 1 0 0 0	Locally generated time address and user data (user defined)
		0	0 1 1 1 1 1 1 1	
1	0 0 0 0 0 0 0 0	Reserved		
1	1 1 1 1 1 1 1 1			
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 1 – These bits are not used in interfaces which are in accordance with Recommendation ITU-R BT.1120, and shall be set to logical zero.

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 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 Rec. ITU-R BR.780-2)
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
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

TABLE 5 (*end*)

UDW		Time-code bit	Time-code definitions (as per Rec. ITU-R BR.780-2)
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 1 – Appropriate flag information for each television system as per Recommendation ITU-R BR.780-2 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 1 – 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 should 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 1) to the normal vertical switching point defined in SMPTE RP 168-2002 (Definition of vertical Interval Switching Point for Synchronous Switching).

NOTE 1 – 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 the preferred location.

6.1.1 For systems implementing ITU-R BT.1120 the following ATC insertion points should be considered as the preferred location. ATC packets shall be inserted into the Y channel of the interface.

Type of time code	Location for multiplexing in 1125-line interlace systems	Location for multiplexing in 1125-line progressive and PsF systems
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	Horizontal ancillary data space of line 11
Packet for others	Available any horizontal ancillary data space except lines 9, 10 and 571	Any lines except lines 9 and 10

6.1.2 When dual link ITU-R BT.1120 interfaces are used for a 1125 line progressive system, the locations of embedded time-code packets in each link are the same as for 1125-line interlaced formats.

6.1.3 When ITU-R BT.656 or ITU-R BT.799 interfaces are used for SDTV signals the preferred location for insertion of ATC packets is in vertical ancillary data space, following the second line after the line specified for switching.

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 Recommendation ITU-R BR.780-2) located in the ancillary binary group of the ATC word (see Table 5). This same flag shall be used to identify a two-frame sequence when the frame rate is greater than 30 Hz (defined in Recommendation ITU-R BR.780-2).
