INTERNATIONAL TELECOMMUNICATION UNION

# ITU-T

**J.80**
**(ex CMTT.721)**
(09/93)

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

**TELEVISION AND SOUND TRANSMISSION**

# TRANSMISSION OF COMPONENT-CODED DIGITAL TELEVISION SIGNALS FOR CONTRIBUTION-QUALITY APPLICATIONS AT BIT RATES NEAR 140 Mbit/s

## ITU-T Recommendation J.80

(Formerly Recommendation ITU-R CMTT.721)

# FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation J.80 (formerly Recommendation ITU-R CMTT.721) was revised by the former ITU-R Study Group CMTT and was approved under the CCIR Resolution 97 procedure on 8 September 1993. See Note 1 below.

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NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector (ITU-R).

Conformorming to a joint decision by the World Telecommunication Standardization Conference (Hensinki, March 1993) and the Radiocommunication Assembly (Geneva, November 1993), the ITU-R Study Group CMTT was transferred to ITU-T as Study Group 9, except for the satellite news gathering (SNG) study area which was transferred to ITU-R Study Group 4.

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

# CONTENTS

**Recommendation J.80**[1)]

# TRANSMISSION OF COMPONENT-CODED DIGITAL TELEVISION SIGNALS FOR CONTRIBUTION-QUALITY APPLICATIONS AT BIT RATES NEAR 140 Mbit/s

*(1990; revised 1992, 1993)*

The ITU-R,

*considering*

(a) that for contribution-quality applications, transmission should be based on component-coded digital video signals conforming to Recommendation ITU-R BT.601;

(b) that such transmission should satisfy the user requirements for contribution-quality codecs at 60/70 to 140 Mbit/s as specified by ITU-R Study Group 11, in Recommendation ITU-R BT.800;

(c) that according to these user requirements such transmission should preserve the picture quality inherent in the 4:2:2 encoding process based on Recommendation ITU-R BT.601 to the maximum extent possible;

(d) that such transmission should similarly preserve the downstream processing capabilities by maintaining the spatial and temporal resolution of the 4:2:2 signals as given by Recommendation ITU-R BT.601;

(e) that in addition to component-coded digital video signals conforming to Recommendation ITU-R BT.601, some features should be applicable for the transmission of TV signals resulting from other source coding methods, in particular, component-coded TV signals for distribution, multiplexed analogue component (MAC) signals in digital form, or composite signals encoded according to Recommendation CMTT.658;

(f) that additional transmission capacity should be provided for two pairs of stereo-sound channels, ancillary signals (e.g. Teletext, test signals) and error-protection data;

(g) that for transmission the complete TV signal could be fitted into the fourth hierarchical level given by Recommendation G.702 as well as into the STM-1 level given by Recommendation G.707;

(h) that such transmission could be realized by hardware implementation at a moderate level of complexity and cost,

*recommends*

that for transmission at data rates near 140 Mbit/s of component-coded digital video signals for 625-line systems according to Recommendation ITU-R BT.601, the bit rate reduction codec should be characterized as follows[2)]:

## 1 Video input/output

A standard 4:2:2 video signal conforming with Recommendation ITU-R BT.601 is used. Bit-parallel or bit-serial interfacing in accordance with Recommendation ITU-R BT.656 can be applied.

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1) Formerly Recommendation ITU-R CMTT.721.

2) The main parameters of a proposal for transmitting YUV contribution signals in countries using the 525-line TV system is given in Annex A.

## 2 Signal pre-processing

The horizontal and vertical blanking intervals are removed. Ancillary data such as Teletext or test signals which are normally transmitted in the vertical blanking interval of the video signal are assigned to separate slots in the video multiplex.

No sub-sampling is used in order to satisfy the down-stream processing requirements of inter-studio links.

## 3 Coding scheme

Fixed two-dimensional predictors are applied both for the luminance and colour-difference components. Non-adaptive hybrid DPCM in combination with folded quantizers form the main elements of the coding scheme which reduces significantly the picture quality degradations due to overload effects as shown by simple DPCM systems. In addition, sensitivity to transmission errors comparable to systems with PCM representation is obtained. The same folded quantizer characteristic is used for the DPCM and PCM quantization of the luminance and colour-difference components.

Details of the quantizer characteristics used for the DPCM and PCM quantization of the luminance and colour-difference components are given in Table 1.

The necessary limitation is performed for the reconstructed values in the DPCM-loop.

No variable-length coding will be used and no post-processing is provided for the output signal.

TABLE 1/J.80

**Quantizer characteristics**

| Level No. | From | Value | To |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |
| 10 | 10 | 11 | 12 |
| 11 | 13 | 14 | 15 |
| 12 | 16 | 17 | 18 |
| 13 | 19 | 20 | 21 |
| 14 | 22 | 23 | 24 |
| 15 | 25 | 26 | 27 |
| 16 | 28 | 30 | 32 |
| 17 | 33 | 35 | 37 |
| 18 | 38 | 40 | 42 |
| 19 | 43 | 45 | 47 |
| 20 | 48 | 50 | 52 |
| 21 | 53 | 55 | 57 |
| 22 | 58 | 61 | 64 |
| 23 | 65 | 68 | 71 |
| 24 | 72 | 75 | 78 |
| 25 | 79 | 82 | 85 |
| 26 | 86 | 89 | 92 |
| 27 | 93 | 96 | 99 |
| 28 | 100 | 103 | 106 |
| 29 | 107 | 110 | 113 |
| 30 | 114 | 117 | 120 |
| 31 | 121 | 124 | 127 |

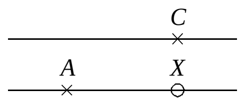
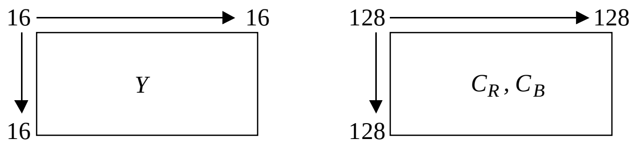
## 4 Video bit rate

A 6 bit/sample for each of the luminance and colour-difference components results in a video bit rate of 124 416 kbit/s.

The main characteristics of the video coding are summarized in Table 2.

TABLE 2/J.80

**Summary of the main characteristics recommended for the coding of component-coded digital television signals for contribution-quality applications at bit rates near 140 Mbit/s**

| | | |
|---|---|---|
| Video input/output | Standard | 625-line digital video in component form |
| | Coding | 4:2:2 signals according to Recommendation ITU-R BT.601 |
| | Interface | Bit parallel or bit-serial in accordance with Recommendation ITU-R BT.656 |
| Pre-processing | Blanking | Removal of horizontal and vertical blanking intervals |
| | Sub-sampling | None |
| | Pre-filtering | None |
| Coding | Predictor | Two-dimensional intra-field for luminance and colour-difference components |
| | Calculation of the prediction value $X$ | $X = \frac{A + C}{2}$  The prediction value $X$ is calculated with 8-bit accuracy (rounded) |
| | Predictor preset | Video levels outside the active picture are set to 16 for $Y$ and 128 for $C_R$, $C_B$ to preset the initial value of the predictor in both the coder and decoder  |
| | Adaptive control of predictors | None |
| | Motion compensation | None |
| | Quantizer characteristics | Folded quantizer combined with non-adaptive hybrid DPCM (Table 1) |
| | Bits/sample | 6, for each of the luminance $Y$, and colour-difference components $C_R$, $C_B$ |
| | Variable length code | None |
| Post-processing | | None |
| Video data rate | | 124 416 kbit/s |

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## 5 Multiplexing scheme

### 5.1 Main characteristics

This scheme makes use of a so-called TV container with a data rate of 138 240 kbit/s that is able to convey different video source signals with data rates of 135 000 kbit/s and sound/data signals with data rates of 2048 kbit/s. Within the video frame data rate of 129 600 kbit/s, two 2048 kbit/s channels are available for sound/data transmission which can be used for the transmission of two stereo sound signals, e.g. according to Recommendation CMTT.724.

Although the main purpose of this TV container is directed to $Y$, $C_R$, $C_B$ contribution signals and MAC/packet family signals, it can be applied to other component or composite signals. By means of stuffing or mapping techniques the TV container could be adapted to the channel framing of different transport media; in particular, the TV container will fit into a channel framing according to Recommendation G.751 as well as those of Recommendations G.707 to G.709.

Table 3 summarizes the main characteristics of the transmission scheme.

The multiplexing scheme is also applicable to the transmission of MAC-type signals. The corresponding multiplexing scheme is given in Annex B.

TABLE 3/J.80

**Main characteristics of transmission scheme**
**(625-line systems)**

| | |
|---|---|
| Video data rate | 124 416 kbit/s |
| Sound/data 1, 2 | 2 × 2048 kbit/s (e.g. 2 stereo audio signal) |
| Ancillary data | 576 kbit/s for teletext channel and test-line channel [a)] |
| Video framing | 2-byte synchronization word per video line (1125 bytes) |
| Video frame data rate | 129 600 kbit/s |
| Video and sound/data error protection | Forward error correction using a two-dimensional product code:<br>[110,108,3] RS code for rows,<br>[102,100,3] RS code for columns<br>(symbol length: 1 byte each) |
| FEC redundancy | 3.89% |
| FEC frame data rate (“TV container” input data rate) | 135 000 kbit/s |
| Sound/data 3 | 2048 kbit/s (e.g. 2 stereo DS-1 audio signals) |
| Service channels (S1 ... S8) [b)] | 8 × 64 kbit/s |
| “TV container” framing | 256 kbit/s |
| “TV container” output data rate | 138 240 kbit/s |
| 1) Channel framing according to Recommendation G.751<br>Channel rate | Recommendation G.751 compatible framing using a frame length of 2928 bits (6 groups of 488 bits) and a 12-bit synchronization word [c)]<br>139 264 kbit/s |
| 2) Channel framing according to Recommendation G.709<br>Channel rate | Recommendation G.709 compatible framing for direct synchronous or asynchronous mapping into virtual container VC-4 [c)]<br>149 760 kbit/s |

a) The protocols for both channels and their multiplexing into the ancillary data stream are for further study.

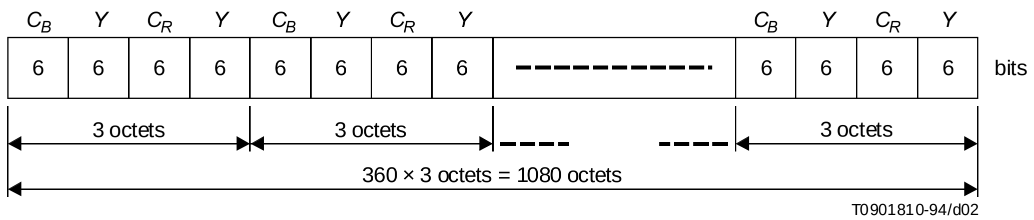
b) The channel S1 is assigned as a supervisory channel.

c) A proposal for the G.751 compatible framing of the TV container and the mapping into VC-4 is given in Annex C.

## 5.2 Multiplexing scheme

### 5.2.1 Sample arrangement of $Y$, $C_R$, $C_B$ within the multiplex scheme

For multiplexing, the 6-bit structure of the video data words is changed to an 8-bit structure whereby the transmission order according to Recommendation ITU-R BT.656 $C_B$, $Y$, $C_R$, $Y$, $C_B$, $Y$, $C_R$, etc. will remain unchanged. Thus, the YUV encoder provides a data output according to the format given in Figure 1.




| | |
|---|---|
| Frame length: (1 TV line) | 1080 octets (1 octet = 8 bits) |
| Repetition rate: (576 active lines) | 14 400 Hz |
| Bit rate: | 124 416 kbit/s |

FIGURE 1/J.80

**Structure of a TV line**

### 5.2.2 Sound/data

For sound/data, two 2 048 kbit/s channels associated with positive justification are included in the video multiplex. Each of these channels can carry a stereo sound signal, e.g. according to Recommendation CMTT.724.

### 5.2.3 Ancillary data

A data rate of 576 kbit/s is available inside the video multiplex for ancillary data (e.g. Teletext, test signals) which are normally transmitted in the vertical blanking interval of the video signal.

### 5.2.4 Video multiplex

The sound/data and ancillary data are interleaved within the video data stream as shown in Figure 2. In addition, the video multiplex includes a 2 byte synchronization word consisting of F1, F2 (which indicate the beginning of the first line of the video frame) and of ,F1, ,F2 for the following lines of the video frame. The bit structure of the two synchronization bytes is given by the following sequences:

F1: 0011 0001

F2: 1000 0011

The video multiplex including video, sound/data, ancillary data and sync words results in a data rate of 129 600 kbit/s.

1

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | JS1 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | A |
| V | A | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | A |
| V | JS2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | A |
| V | A | V | JS4 | V | JS3 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | JD1 | V | JD2 | |

1123

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| | | | |
|---|---|---|---|
| Slots: | V | Video information | 40 × 27 = 1080 |
| | D1 | Data channel 1 | 16 × 1 = 16 |
| | D2 | Data channel 2 | 16 × 1 = 16 |
| | A | Ancillary data | 5 × 1 = 5 |
| | JS1...JS4 | Justification service | 4 × 1 = 4 |
| | JD1, JD2 | Justification data channel | 2 × 1 = 2 |
| | | | Total: 1123 |
| Bytes: | JS1 | J1 J1 J1 J1 J2 J2 J2 J2 | binary |
| | JS2 | J1 J1 J1 J1 J2 J2 J2 J2 | binary |
| | JS3 | D1 D1 D1 D1 D1 D1 D1 J1 | binary |
| | JS4 | D2 D2 D2 D2 D2 D2 D2 J2 | binary |
| | JD1 | D1 D1 D1 D1 D1 D1 D2 S1 | binary |
| | JD2 | D2 D2 D2 D2 D2 D2 D2 S2 | binary |
| Bits: | J1 | 1 = justifying data channel 1, 0 = not justifying | |
| | J2 | 1 = justifying data channel 2, 0 = not justifying | |
| | D1, D2 | Bits from data channel 1, 2 | |
| | S1, S2 | Justification bit data channel 1, 2 | |

FIGURE 2/J.80

**One row of the video multiplexing frame for YUV contribution signals**

### 5.2.5 Error protection

The complete video multiplex is protected from transmission errors by a two-dimensional FEC product code using a 1 octet correcting Reed Solomon (RS) coder in each direction.

*Code for rows:*

(110,108,3) Reed Solomon code defined over GF($2^8$)

*Code for columns:*

(102,100,3) Reed Solomon code defined over GF($2^8$)

The field generator polynomial is:

$$f(\alpha) = \alpha^8 + \alpha^4 + \alpha^3 + \alpha^2 + 1$$

The code generator polynomial is:

$$g(x) = (x + \alpha)(x + 1) = x^2 + \alpha x + x + \alpha$$

with

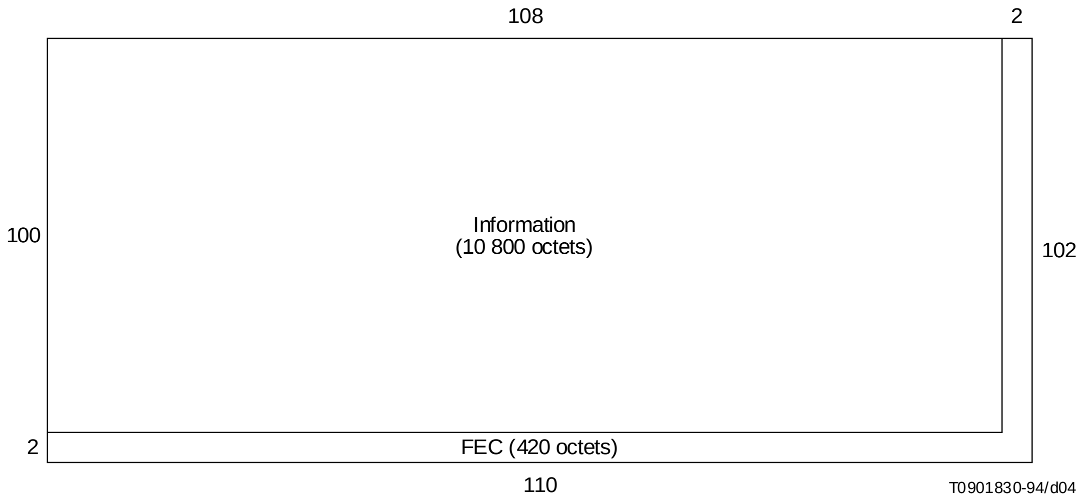
$$\alpha = 0000\,0010$$

The redundancy is 3.89%.

### 5.2.6 FEC framing

The data stream at the FEC coder is arranged in a matrix of 102 rows of 110 columns of octets (see Figure 3). 9.6 TV lines including ancillary data and video sync words will be transmitted within each FEC frame.

The transmission of the FEC matrix results in a data rate of 134 640 kbit/s; the repetition rate of the FEC frame is 1500 Hz.




| | |
|---|---|
| Repetition rate: | 1500 Hz |
| Video, data, sync: | 10 800 octets → 129 600 kbit/s |
| FEC: | 420 octets → 5 040 kbit/s |
| Total: | 11 220 octets → 134 640 kbit/s |

FIGURE 3/J.80

**FEC matrix**

The structure of the FEC framing will provide access to the video channel of the TV container which offers a total bit rate of 135 000 kbit/s for the complete TV input signal. Each output frame contains 9.6 complete TV lines whereby each row of the frame starts with a 2-octet synchronization word (see Figure 4). The bit structure of the four synchronization octets is given by the following sequences:

C1: 0011 1100

C2: 1101 0101

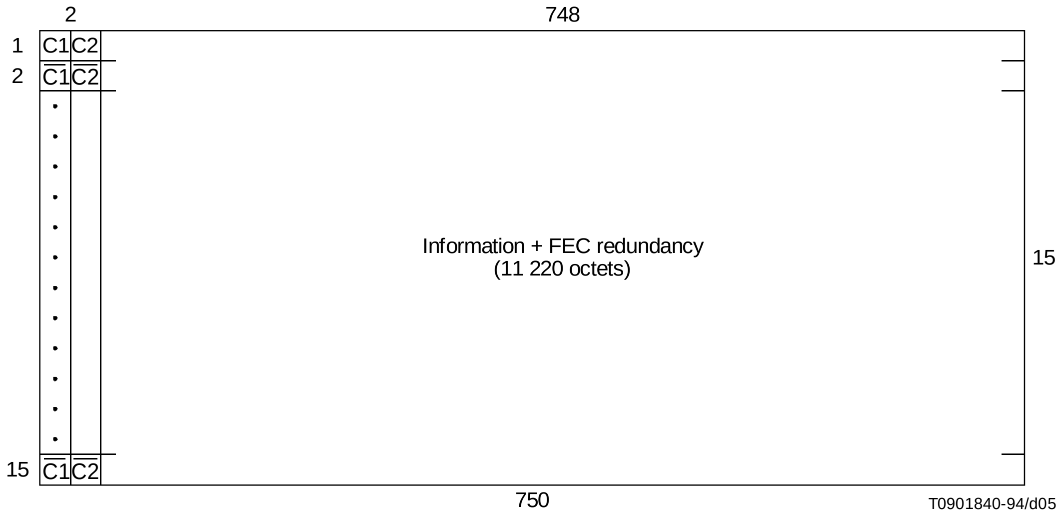
$\overline{\text{C1}}$: 1100 0011

$\overline{\text{C2}}$: 0010 1010

This framing arrangement leads exactly to the bit rate offered by the video channel of the TV container.

### 5.2.7 TV container framing

The structure of the TV container and details on the frame alignment, additional service and data channels as well as on the justification method are given in Figure 5.




| | | |
|---|---|---|
| Repetition rate: | 1500 Hz | |
| Video, data, FEC: | 11 220 octets → | 134 640 kbit/s |
| Framing: | 30 octets → | 360 kbit/s |
| Total: | 11 250 octets → | 135 000 kbit/s |

FIGURE 4/J.80

**FEC framing**

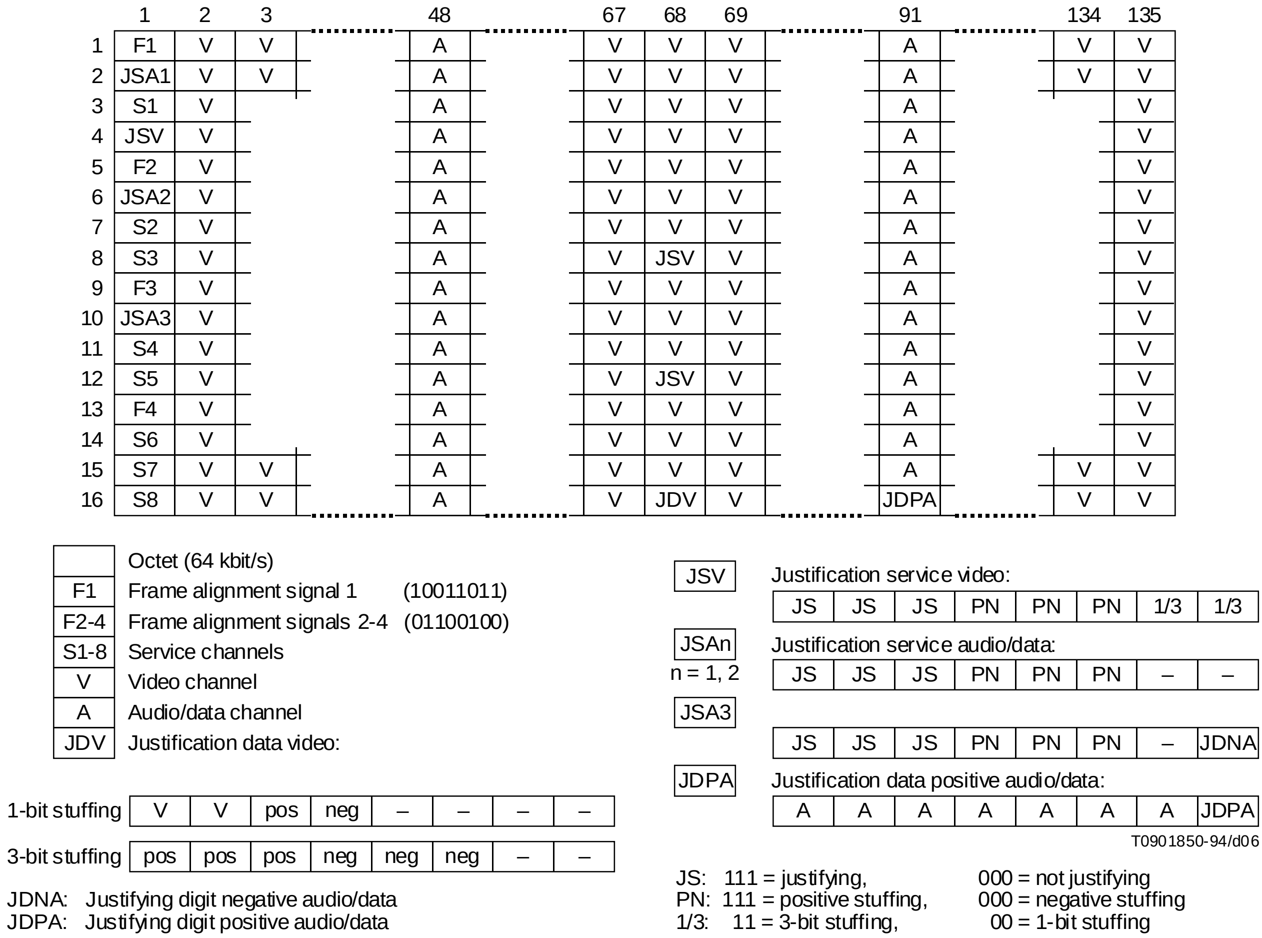



FIGURE 5/J.80

**TV container frame**

### 5.2.8 Bit rate budget

The bit rate budget chosen for the video multiplexing, FEC framing and TV container is given in Table 4.

TABLE 4/J.80

**Bit rate budget**

| 1) Video multiplexing frame: (Repetition rate: 25 Hz) | YUV contribution signal | |
|---|---|---|
| Channel | Number of bits | Data rate (kbit/s) |
| Video information | 576 × 8 640 | 124 416.000 |
| Sound/data channel 1 | 576 × 142 | 2 044.800 |
| Justification [a] | 576 × 1 | 14.400 |
| Justification service | 576 × 9 | 129.600 |
| Sound/data channel 2 | 576 × 142 | 2 044.800 |
| Justification [a] | 576 × 1 | 14.400 |
| Justification service | 576 × 9 | 129.600 |
| Ancillary data | 576 × 40 | 576.000 |
| Video framing | 576 × 16 | 230.400 |
| Total sum | 576 × 9 000 | 129 600.000 |
| 2) FEC frame: (Repetition rate: 1500 Hz) | | |
| Channel | Number of bits | Data rate (kbit/s) |
| Information | 86 400 | 129 600.000 |
| FEC redundancy | 3 360 | 5 040.000 |
| FEC framing | 240 | 360.000 |
| Total sum | 90.000 | 135.000.000 |
| 3) TV container: | Number of 64 kbit/s slots | Bit rate (kbit/s) |
| Video channel | 2 109 | 134 976 |
| Video justification [b] | 1 | 64 |
| Video justification control [b] | 3 | 192 |
| Video channel data rate: 135 000 kbit/s ± (0/59.26/177.78) ppm | | |
| Sound/data channel | 31 | 1 984 |
| Sound/data justification [b] | 1 | 64 |
| Sound/data justification control [b] | 3 | 192 |
| Sound/data channel data rate: 2048 kbit/s ± (0/3 906) ppm | | |
| Service channels (S1 . . . S8) | 8 | 512 |
| TV container framing | 4 | 256 |
| Total sum | 2 160 | 138 240 |

[a] Positive justification, channel data rate: 2048 kbit/s (+5468/–1562) ppm.

[b] Positive-zero-negative justification.

## Annex A

## Main parameters for transmitting 525-line YUV contribution signals by use of the TV container

(This annex forms integral part of this Recommendation)

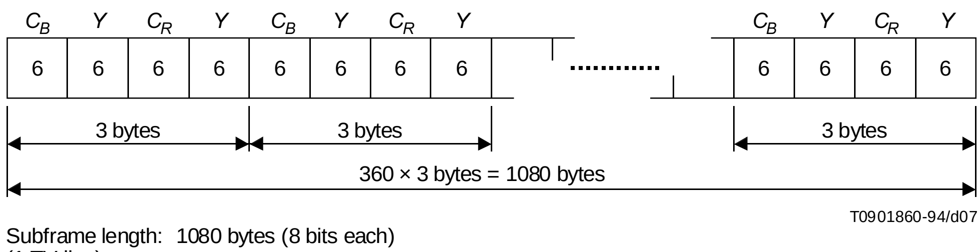
TABLE A.1/J.80

**Main characteristics of TV container**

| | |
|---|---|
| Video data rate | 125 845.355 kbit/s |
| Sound/data 1, 2 | 2 × 1544 kbit/s |
| Ancillary data | 349 kbit/s for teletext channel and test-line channel [b)] |
| Video framing | YUV contribution signal:<br>2-byte synchronization word per video frame (10 008 bytes) |
| Video frame data rate | 129 600 kbit/s |
| Video and sound/data error protection | Forward error correction using a two-dimensional product code:<br>[110,108,3] RS code for rows,<br>[102,100,3] RS code for columns,<br>(symbol length: 1 byte each) |
| FEC redundancy | 3.89% |
| FEC frame data rate<br>("TV container" input data rate) | 135 000 kbit/s |
| Sound/data 3 | 2048 kbit/s |
| Service channels (S1 . . . S8) [a)] | 8 × 64 kbit/s |
| "TV container" framing | 256 kbit/s |
| "TV container" output data rate | 138 240 kbit/s |
| 1) Channel framing according to Recommendation G.751<br><br>Channel rate | Recommendation G.751 compatible framing using a frame length of 2928 bits (6 groups of 488 bits) and a 12-bit synchronization word<br><br>139 264 kbit/s |
| 2) Channel framing according to Recommendation G.709<br><br>Channel rate | Recommendation G.709 compatible framing for direct synchronous or asynchronous mapping into virtual container VC-4<br><br>149 760 kbit/s |

a) The channel S1 is assigned as a supervisory channel.

b) The protocols for both channels and their multiplexing into the ancillary data stream are for further study.




Subframe length: 1080 bytes (8 bits each)
(1 TV line)

Repetition rate: 14 565435 Hz
(486 active lines; line 263 is not transmitted)

Bit rate: 125 845355 kbit/s

FIGURE A.1/J.80

**Structure of a TV line**

TABLE A.2/J.80

**Bit rate of 135 Mbit/s video channel of the TV container with YUV contribution signals**

| 1) Video multiplexing frame: (Repetition rate: 29.97 Hz) | YUV contribution signal | |
|---|---|---|
| Channel | Number of bits | Data rate (kbit/s) |
| Video information | 486 × 8 640 | 125 845.355 |
| Data channel 1 | 486 × 106 | 1 543.936 |
| Justification [a)] | 486 × 1 | 14.565 |
| Justification service | 486 × 9 | 131.089 |
| Data channel 2 | 486 × 106 | 1 543.936 |
| Justification [a)] | 486 × 1 | 14.565 |
| Justification service | 486 × 9 | 131.089 |
| Ancillary data | 486 × 24 | 349.570 |
| Video framing | 1/9 × 486 × 16 | 25.894 |
| Total sum | 4 324 320 | 129 600.000 |
| 2) FEC frame: (Repetition rate: 1500 Hz) | | |
| Channel | Number of bits | Data rate (kbit/s) |
| Information | 86 400 | 129 600.000 |
| FEC redundancy | 3 360 | 5 040.000 |
| FEC framing | 240 | 360.000 |
| Total sum | 90 000 | 135 000.000 |

a) Positive justification; channel data rate: 1544 kbit/s (+4675/–4758) ppm.

1

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | JS1 | V | JS2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | A |
| V | JS3 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | A |
| V | A | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | D1 | V | D2 | V | JD1 | V | JD2 | |

1112

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| | | | |
|---|---|---|---|
| Slots: | V | Video information | 30 × 36 = 1080 |
| | D1 | Data channel 1 | 12 × 1 = 12 |
| | D2 | Data channel 2 | 12 × 1 = 12 |
| | A | Ancillary data | 3 × 1 = 3 |
| | JS1...JS3 | Justification service | 3 × 1 = 3 |
| | JD1, JD2 | Justification data channel | 2 × 1 = 2 |
| | | | Total: 1112 |

| | | | |
|---|---|---|---|
| Bytes: | JS1 | J1 J1 J1 J1 J1 D1 D1 D1 | binary |
| | JS2 | J2 J2 J2 J2 J2 D2 D2 D2 | binary |
| | JS3 | J1 J1 J1 J1 J2 J2 J2 J2 | binary |
| | JD1 | D1 D1 D1 D1 D1 D1 DS1 S1 | binary |
| | JD2 | D2 D2 D2 D2 D2 D2 DS2 S2 | binary |

| | | |
|---|---|---|
| Bits: | J1 | 1 = justifying data channel 1, 0 = not justifying |
| | J2 | 1 = justifying data channel 2, 0 = not justifying |
| | D1, D2 | Bits from data channel 1, 2 |
| | S1, S2 | Justification bit data channel 1, 2 |
| | DS1, DS2 | Bits for fixed justification sequence with the following definitions:<br>in frames of even lines: bit from data channel<br>in frames of odd lines: stuff bit |

FIGURE A.2/J.80

**One row of the video multiplexing frame for YUV contribution signal**

# Annex B

## Multiplexing scheme for MAC/packet signals

(This annex forms an integral part of this Recommendation)

TABLE B.1/J.80

| Video multiplexing frame: (Repetition rate: 3125 Hz) | MAC and HD-MAC signal | |
|---|---|---|
| Channel | Number of bits | Data rate (kbit/s) |
| Video information | 39 920 | 124 750.000 |
| Data channel 1 | 655 | 2 046.875 |
| Justification [a] | 5 | 15.625 |
| Justification service | 60 | 187.500 |
| Data channel 2 | 655 | 2 046.875 |
| Justification [a] | 5 | 15.625 |
| Justification service | 60 | 187.500 |
| Video framing | 32 | 100.000 |
| Free | 80 | 250.000 |
| Total sum | 41 472 | 129 600.000 |

a) Positive justification; channel data rate: 2048 kbit/s (+7080/–549) ppm.

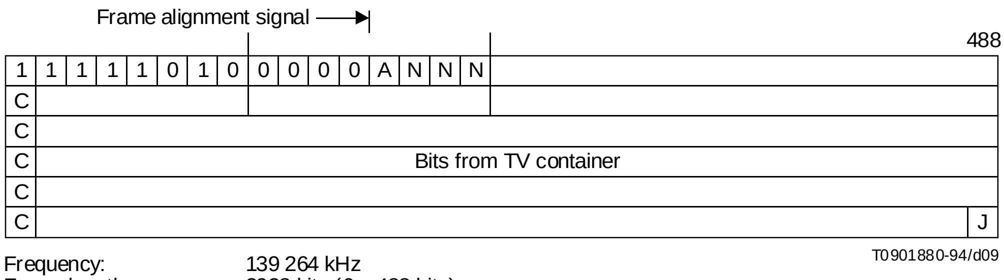
# Annex C

## Channel framing

(This annex forms an integral part of this Recommendation)

### C.1 Insertion of the TV container into a G.751-compatible frame

The TV container consists of a frame as given in 5.2.7 with a bit rate of 138 240 kbit/s. This TV container is used to synchronize plesiochronous TV data into a synchronous frame. To transport this frame within digital networks it is necessary to adapt it to the selected transport media. One possible transport medium is the plesiochronous hierarchy (e.g. Recommendation G.751). The appropriate transmission rate in these networks is 139 264 kbit/s ± 15 ppm. To facilitate the supervision of the signal inside the network, it may be advantageous to use a frame which is compatible to Recommendation G.751, e.g. which contains the frame alignment signal and the exact repetition rate as specified in Recommendation G.751. Such a frame is given in Figure C.1.




Frequency: 139 264 kHz
Frame length: 2928 bits (6 × 488 bits)
Bits for TV container: 2906 bits
Fixed justification ratio: 9/17

A Alarm indication bit
N Bit reserved for national use
J Bit for justification
C Justification service bits (00000 = valid data, 11111 = stuffing)

FIGURE C.1/J.80

**G.751-compatible frame**

The TV container is inserted into the G.751-compatible frame using a bit-interleaved structure. As in Recommendation G.751, a pulse stuffing technique with positive justification as given in Figure C.1 is used.

As both frames will be generated inside the same equipment, a fixed stuffing pattern of 9/17 is used and no waiting jitter will be generated.

### C.2 Mapping of the TV container into Virtual Container VC-4 according to Recommendation G.709

For the mapping of the TV container into Virtual Container VC-4, three possible solutions are given below:[3)]

- Insertion into a frame according to Recommendation G.751 as described in C.1 and mapping this frame into a VC-4 as described in 5.1.1/G.709.
- Mapping of the TV container into VC-4 using positive-zero-negative justification.
- Direct synchronous mapping of the TV container into VC-4 and using AU-4 pointer for justification if needed.

[3)] The mapping of TV signals into SDH virtual containers is proposed to be included in Recommendation G.709.

### C.2.1 Insertion into a frame according to Recommendation G.751 and mapping into VC-4

Insertion into a frame according to Recommendation G.751 is described in C.1 and the mapping into VC-4 is given in 5.1.1/G.709.

### C.2.2 Mapping into VC-4 with justification

One TV container (138 240 kbit/s) could be mapped into a VC-4 container as shown in Figure C.2. The TV container may be transferred from networks operating with plesiochronous transmission to networks operating on a synchronous basis. To handle this a stuffing capability is provided:

- Each of the nine rows is partitioned into 20 blocks, consisting of 13 bytes each.
- In each row a positive (SP) and a negative (SN) justification is possible.
- The first byte of one block consists of:
  - eight fixed stuffing bits (R); or
  - two justification control bits plus six fixed stuffing bits; or
  - eight negative justification bits.
- The remaining 12 bytes of one block carry information bits (I).
- The last byte of the last block in each row consists of eight positive stuffing bits (SP).

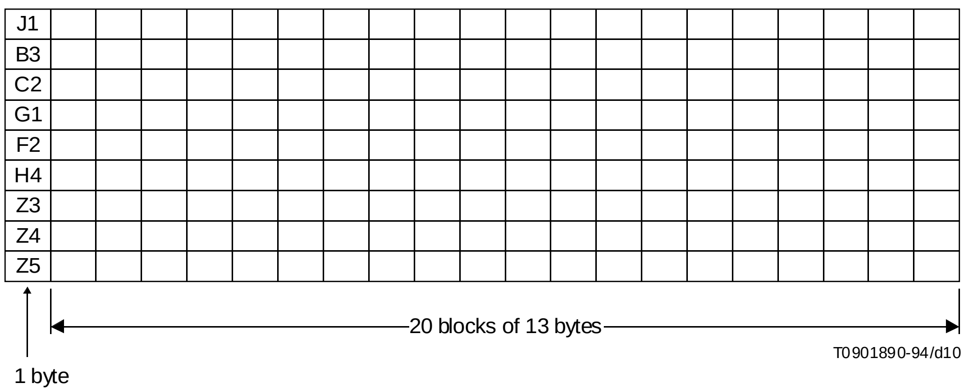



FIGURE C.2/J.80

**Block structure of VC-4 for synchronous mapping**

The sequence of all these bytes is shown in Figure C.3.

The set of five times two justification control bits in every row is used to control the corresponding justification bytes. Majority decision should be used for evaluation of the justification control information.

CCCC = 0000 indicates no justification
CCCC = 1111 indicates justification

PPPP = 0000 indicates negative justification
PPPP = 1111 indicates positive justification

The values in the positive and negative justification bytes are undefined if there is no information in the frame.

Additional information on the synchronous multiplex structure is given in Recommendations G.707 to G.709.

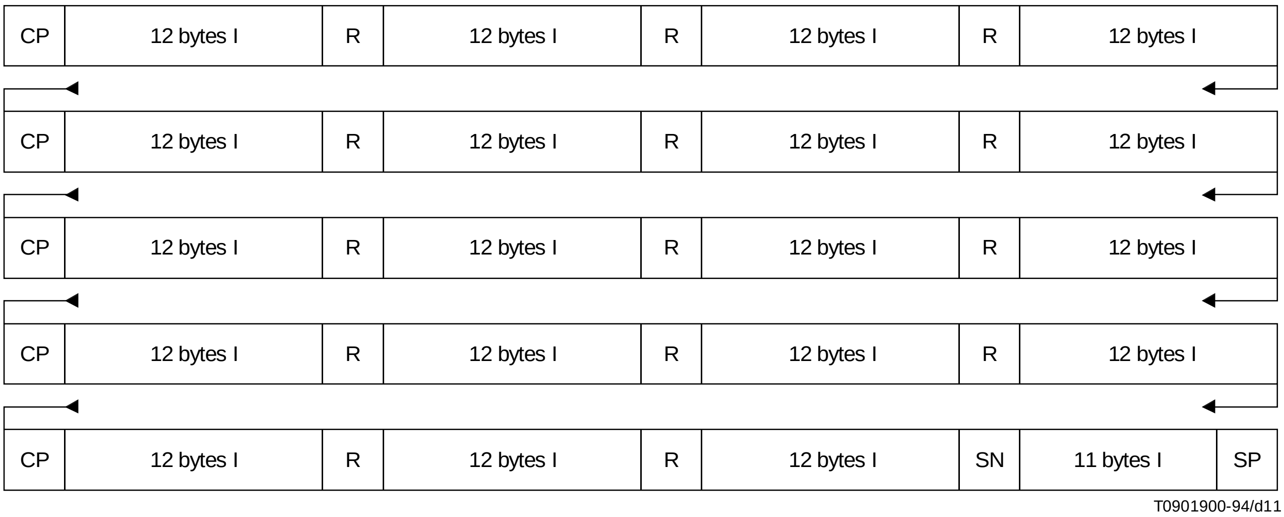



FIGURE C.3/J.80

**Mapping of the TV container into VC-4 (one row)**

### C.2.3 Direct synchronous mapping into VC-4

In this case all blocks of 13 bytes look alike. To ensure compatibility with the justification methods described above, all fixed justification bytes (R) should be 0000 0000. The justification control information is permanently set to no justification (see Figure C.4).

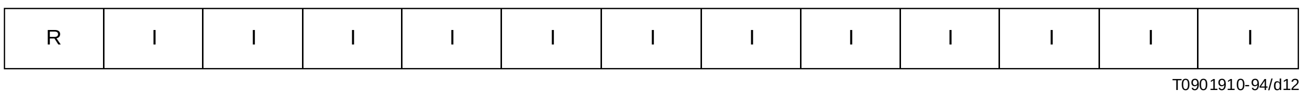



FIGURE C.4/J.80

**Direct synchronous mapping into VC-4 (one block)**