INTERNATIONAL TELECOMMUNICATION UNION

ITU-T X.56

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

PUBLIC DATA NETWORKS

TRANSMISSION, SIGNALLING AND SWITCHING

INTERFACE BETWEEN SYNCHRONOUS DATA NETWORKS USING AN 8 + 2 ENVELOPE STRUCTURE AND SINGLE CHANNEL PER CARRIER (SCPC) SATELLITE CHANNELS

ITU-T Recommendation X.56

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation X.56 was published in Fascicle VIII.3 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation X.56

INTERFACE BETWEEN SYNCHRONOUS DATA NETWORKS USING AN 8 + 2 ENVELOPE STRUCTURE AND SINGLE CHANNEL PER CARRIER (SCPC) SATELLITE CHANNELS

(Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that the bearer rate recognized by the CCITT is 64 kbit/s;

(b) that 64 kbit/s satellite channels on TDMA systems are not yet operational;

(c) that 64 kbit/s channels on SCPC systems are under investigation;

(d) that for an interim period, only 48, 50 or 56 kbit/s channels via a satellite will be available in many cases;

(e) that there is a requirement of a multiplexing scheme for the interworking between two networks where both use 10-bit envelope structure but transmission is at a gross bit rate of 56 kbit/s, typically via an SCPC satellite system with forward error correction.

recommends

that the fundamental parameters for a multiplexing scheme using a 10-bit envelope structure for transmission via a 56-kbit/s SCPC satellite channel should be as described in this Recommendation.

1 Gross bit rate

For transmission on the international digital satellite link, the multiplexed bit stream shall have a gross bit rate of 56 kbit/s. The fundamental multiplex structure shall have a gross bit rate of 54 kbit/s and shall utilize padding techniques for transmission on the 56 kbit/s bearer channel. On the tributary channel interface, each transmitted and received tributary channel data stream has the 10-bit envelope structure as recommended in Recommendation X.51. The adaptation to the SCPC 56-kbit/s channel is achieved by suppressing the A bit of each envelope within the multiplex system.

2 Fundamental multiplex

For the fundamental multiplexing of information bearer channels, the following applies:

2.1 The signal elements of each individual channel shall be assembled in 9-bit envelopes, in which bit 1 is a status bit (S bit) (see Note), and bits 2-9 are information bits, as in Figure 1/X.56.

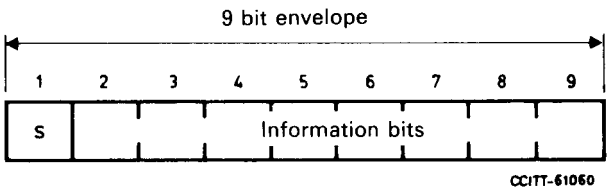


FIGURE 1/X.56

The addition of the status bit results in a 12 ½ % increase in bit rate, so that the bearer channel rates are:

10.8 kbit/s for the 9.6 kbit/s data signalling rate;

5.4 kbit/s for the 4.8 kbit/s data signalling rate;

2.7 kbit/s for the 2.4 kbit/s data signalling rate;

675 bit/s for the 600 bit/s data signalling rate.

Note - A status bit (S bit) is associated with each envelope and in conjunction with the associated 8-bit data byte conveys call control information (cf. Recommendations X.21, X.21 *bis*, X.60, X.71 and X.50).

2.2 A 9-bit envelope interleaved structure shall be used.

2.3 These interleaved envelopes will appear on the 54 kbit/s fundamental multiplex as follows:

- 10.8 kbit/s channels will repeat every 5th envelope,
- 5.4 kbit/s channels will repeat every 10th envelope;
- 2.7 kbit/s channels will repeat every 20th envelope;
- 675 bit/s channels will repeat every 80th envelope.

2.4 Both structures suitable for handling homogeneous (with respect to bearer rates) mixes of bearer channels and structures suitable for handling heterogeneous mixes of bearer channels are required, with the constraint that the division of any 10.8 kbit/s bearer channel of the multiplex shall be homogeneous providing either two 5.4 kbit/s, four 2.7 kbit/s or sixteen 675 bit/s bearer channels.

3 Method of framing

3.1 *Overall structure*

The residual 2 kbit/s capacity obtained by carrying the fundamental 54 kbit/s multiplex on the 56 kbit/s bearer shall be distributed so that a padding bit is inserted after each group of 27 bits from the fundamental multiplex (see also Figure 2/X.56).

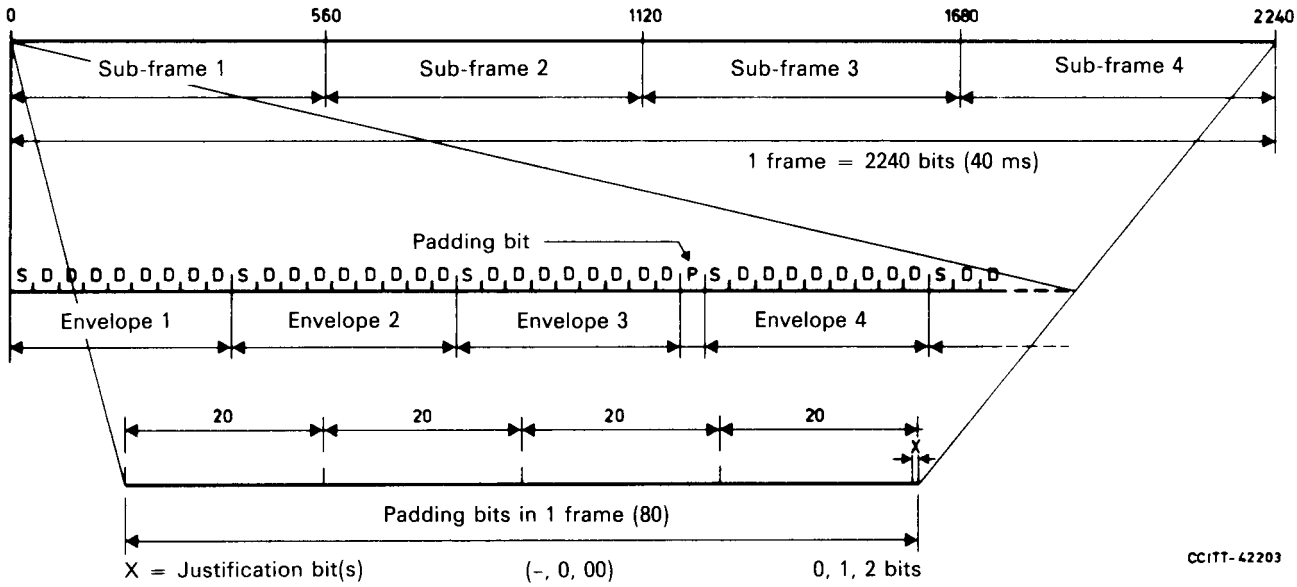


FIGURE 2/X.56

Multiplex frame structure

The frame length shall be 2240 bits in the case of a synchronized bearer, i.e. 2160 bits or 240 envelopes from the fundamental multiplex interleaved with 80 padding units.

When justification is used (for national purposes) in the case of a non-synchronized bearer, the last padding bit in the frame can be deleted or an extra padding bit added when needed, resulting in a variable frame length of 2240 ± 1 bit. (This can allow a maximum speed tolerance of approximately ± 4.5 parts in 10^4.)

The padding bits shall contain the framing pattern, justification service digits and housekeeping signalling (alarms, etc.).

3.2 *Framing*

3.2.1 *Frame alignment patterns*

The frame alignment method is based on the use of 4 equidistantly distributed frame alignment patterns written into the padding bits, dividing the frame into 4 sub-frames. Each sub-frame alignment pattern starts with the 14-bit pattern:

11111001101010

followed by a 2-bit sub-frame identifier unique to the sub-frame, i.e.:

SF1 = 00, SF2 = 01, SF3 = 10, SF4 = 11.

3.2.2 *Framing strategy*

3.2.2.1 *Loss of frame alignment*

The criterion for loss of frame alignment shall be three consecutive frame alignment patterns including the sub-frame identifier in error.

The frame alignment shall also be considered lost if the first received frame alignment pattern including sub-frame identifier after reframing is in error.

3.2.2.2 *Reframing*

The criterion for reframing shall be the detection of one valid frame alignment pattern.

3.2.2.3 *Reframing procedure*

After loss of frame alignment:

- the outgoing envelopes shall be set to all ones;
- the state shall be signalled to the distant end; and
- a parallel hunt for a valid frame alignment pattern shall be started.

After a valid frame alignment pattern is found:

- the two following padding bits shall be accepted as sub-frame identifiers and be used to set the frame and sub-frame counter(s) as applicable;
- the blocking of the outgoing data channels shall be removed; and
- the signalling of out-of-frame alarm to the distant end shall be terminated.

4 Justification

The 56 kbit/s bearer carrying the 9-bit envelope multiplex normally shall be locked to the data stream, and therefore justification on international links is not required. However, justification could be required for national

purposes. To achieve this, plus/minus justification shall be used in which four repeated justification service signals occupy the 3 bits immediately following each sub-frame identifier. The last padding bit of the frame is used as a justification digit.

The repeated justification service signals are:

010 no justification (i.e. one padding bit at end of frame);

100 one justification bit has been added (i.e. two padding bits at end of frame);

001 the justification bit has been deleted (i.e. no padding bit at end of frame).

In evaluating the signals in one frame, a majority decision of the four received signals is used. In case of' no majority, no justification shall be assumed.

If framing is lost, no justification shall be assumed before reframing has occurred.

5 Housekeeping signals and functions

The padding bits not used for framing and justification shall be available for housekeeping information signals, for both international and national use. The definition and allocation of the available housekeeping bits is left for further study.

6 Allocation and use of padding bits (20 bits) in one sub-frame (560 bits) for framing, justification and housekeeping

The allocation of padding bits in one sub-frame numbered P1 to P20 is described below and shown in Figure 3/X.56.

P1-P14 Framing pattern: 14 bits
Code 11111001101010

P15-P16 Sub-frame identifier: 2 bits
Code 00, 01, 10 or 11

For P17-P20, two alternatives exist:

a) Synchronous transmission bearer

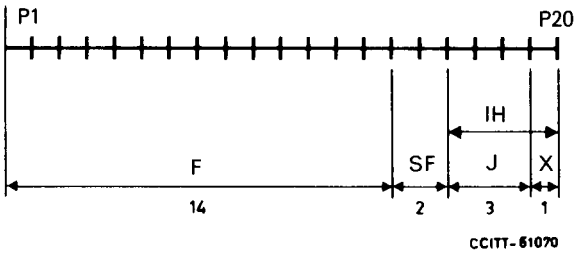
P17-P20 International housekeeping bits A, B, C and D (cf. Recommendation X.50)

b) Asynchronous transmission bearer

P17-P19 Justification service signals: 3 bits
Code 001, 010, 100

P20 In the first three sub-frames (SF1, SF2, SF3), may remain as housekeeping bits as above. Their use is for further study.

P20(P21) In the last sub-frame (SF4), is used for justification:
Justification bit(s) ... 0, 1, 2 bit(s)
Code –, 0, 00



IH	=	International housekeeping	4 bits
F	=	Frame alignment pattern	14 bits
SF	=	Sub-frame identifier	2 bits
J	=	Justification service signals	3 bits
X	=	Justification or housekeeping bit (depending on sub-frame)	1 bit

FIGURE 3/X.56

Allocation of padding bits in one sub-frame (20 bits)