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TELEGRAPHY

TELEGRAPH TRANSMISSION

COMBINED MULDEX FOR TELEGRAPHY AND SYNCHRONOUS DATA TRANSMISSION

ITU-T Recommendation R.113

(Previously “CCITT Recommendation”)

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 R.113 was prepared by the ITU-T Study Group IX (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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

CONTENTS

Recommendation R.113

COMBINED MULDEX FOR TELEGRAPHY AND SYNCHRONOUS DATA TRANSMISSION

(Helsinki, 1993)

The CCITT,

considering

(a) that the widespread introduction of digital transmission systems gives an advantage to telegraphy and data transmission by using a channel of the digital communication system without modems;

(b) that the simultaneous transmission of synchronous data and anisochronous telegraph signals over a single circuit of digital communication system may be desirable for economical and flexible application of digital circuits;

(c) that 64 and 56 kbit/s digital circuits are available;

(d) that basic parameters of multiplexing in synchronous data networks are specified in Recommendations X.50, X.51, X.55 and X.56;

(e) that the code and speed independent TDM system for anisochronous telegraph and data transmission is specified in Recommendation R.111;

(f) that TDM systems described in Recommendation R.100 also exist;

(g) that telegraph subscribers are often geographically situated in small groups and in this case it is appropriate to use branch-line multiplexing systems;

(h) that circuits established by means of muldex may be used both in switched and in leased circuits,

unanimously declares the view

that the equipment for synchronous data and anisochronous telegraph signals transmission over the digital network circuits at a rate of 64 or 56 kbit/s shall be manufactured to comply with the following standards:

1 Aggregate bearer channels

1.1 Aggregate rates of 56 or 64 kbit/s shall be used.

1.2 Mechanical and electrical characteristics of interchange circuits shall be as specified in Recommendations G.703 and V.36.

1.3 Frame structure

1.3.1 For applications of the aggregate bearer rate of 64 kbit/s, the frame structure should be as specified in Recommendation X.50 or X.51.

1.3.2 For applications of the aggregate bearer rate of 56 kbit/s, the frame structure should be as specified in Recommendation X.55 or X.56.

2 Digital circuits established by muldex

2.1 Digital circuits established by muldex may be used in terminal and transit modes of operation.

2.2 Circuits for synchronous transmission

2.2.1 The data rate should be 0.6, 1.2, 2.4, 4.8 or 9.6 kbit/s.

2.2.2 The principles of multiplexing shall be in accordance with Recommendations X.50, X.51, X.55 or X.56.

2.2.3 Channel interface for synchronous transmission in terminal mode of operation should be in accordance with Recommendation X.21 or X.21 *bis*.

2.2.4 The principles of circuit connection in transit mode of operation is a national option.

2.3 Channels for anisochronous transmission

2.3.1 The nominal modulation rate shall be 50, 100, 200, 300 and 600 bauds.

2.3.2 The following principles of multiplexing shall be used:

2.3.2.1 For anisochronous transmission, channels should be established by groups replacing any channel for synchronous transmission at a rate of 2.4 kbit/s.

2.3.2.2 In the case where frame structure complying with Recommendations X.51 and X.56 is applied, the sequence at a rate of 300 envelopes per second and eight information bits in each envelope shall be used.

2.3.2.3 In the case where frame structure complying with Recommendations X.50 and X.55 is applied, the sequence at a rate of 400 envelopes per second and six information bits in each envelope shall be used.

2.3.2.4 In a case of eight information bit envelope the bit assignment is as follows:

- For 50-baud channel – One information bit from each envelope.
- For 100-baud channel – Two information bits from an envelope being four positions apart.
- For 200 and 300-baud channel – Four information bits from an envelope being two positions apart.
- For 600-baud channel – All eight information bits from an envelope.

2.3.2.5 In a case of six information bit envelope the bit assignment is as follows:

- For 100-baud channel – One information bit from each envelope.
- For 200-baud channel – Two information bits being three positions apart.
- For 300-baud channel – Three information bits being two positions apart.
- For 600-baud channel – All information bits from the envelope.

2.3.2.6 Transition coding process of telegraph signals shall be made in accordance with Annex A/R.111.

2.3.3 Telegraph interface should correspond to national requirements.

2.4 If in a TDM combined muldex the loss of frame alignment is indicated, the output of channel should be controlled as follows:

2.4.1 Channels used for synchronous transmission in a terminal mode of operation are controlled in accordance with Recommendation X.21 or X.21 *bis* for the case of "DCE not ready" condition.

2.4.2 Channels used for synchronous transmission in a transit mode of operation are controlled by setting the outgoing envelopes to all ones.

2.4.3 Channels for anisochronous transmission:

a) *Leased circuit service*

There are two optional methods on per-channel basis:

- continuous condition A;
- continuous condition Z.

b) Circuit-switched service

- continuous condition A.

3 System capability and channel parameters

3.1 The capacity of the system having channels for synchronous transmission in case of homogeneous configurations is shown in Table 1.

TABLE 1/R.113

The capacity of the system having channels for synchronous transmission

Nominal modulation rate (bauds)	Maximum number of channels
600	80
1200	40
2400	20
4800	10
9600	5

3.2 Channel parameters for anisochronous transmission and system capacity for homogeneous configuration are shown in Table 2 when eight information bit envelope is employed, and in Table 3 when six information bit envelope is employed.

TABLE 2/R.113

Channel parameters for anisochronous transmission and system capacity using the eight information bit envelope structure (8 + 2)

Nominal modulation rate (bauds)	Number of bits in an envelope using the channel	Data signalling rate on the bearer per-channel (bit/s)	Distortion due to sampling (%)	Maximum number of channels	Theoretical maximum modulation rate (bauds)
50	1	300	4.25	160	100
100	2	600	4.25	80	200
200	4	1200	4.25	40	400
300	4	1200	6.25	40	400
600	8	2400	6.25	20	800

TABLE 3/R.113

Channel parameters for anisochronous transmission and system capacity using the six information bit envelope structure (6 + 2)

Nominal modulation rate (bauds)	Number of bits in an envelope using the channel	Data signalling rate on the bearer per-channel (bit/s)	Distortion due to sampling (%)	Maximum number of channels	Theoretical maximum modulation rate (bauds)
50	1	400	3.12	120	133.3
100	1	400	6.25	120	133.3
200	2	800	6.25	60	266.7
300	3	1200	6.25	40	400
600	6	2400	6.25	20	800

4 Branch-line transparent submuldex

4.1 For anisochronous transmission the branch-line submuldex shall use bearer channel having an envelope structure and corresponding to channel for synchronous transmission at a rate of 2.4 kbit/s.

The aggregate bit rate of branch-line submuldex line signal is 3 kbit/s when eight information bit envelope structure is used and 3.2 kbit/s when six information bit envelope structure is used.

4.2 The transmission of anisochronous telegraph signals should be made using information bits of envelope in accordance with 2.2. Framing bits of envelope A are used for frame (envelope) alignment of branch-line submuldexes, status bit being used for service purposes (e.g. maintenance loop control).

4.3 The nominal modulation rates are 50, 100, 200 and 300 bauds.

4.4 The branch-line submuldex capacity for homogeneous configuration is given in Table 4. Channel parameters are as shown in Tables 2 and 3.

TABLE 4/R.113

Branch-line submuldex capacity

Nominal modulation rate (bauds)	50	100	200	300
Maximum number of channels when using:				
– 8 information bits	8	4	2	2
– 6 information bits	6	6	3	2

5 Channel numbering

5.1 Numbering of channels at the rates of 600-9600 bit/s should comply with Recommendation X.53.

5.2 Numbering of telegraph channels at the rate of 50-600 bauds should be as shown in Tables 5/R.114 and 6/R.114.

Annex A

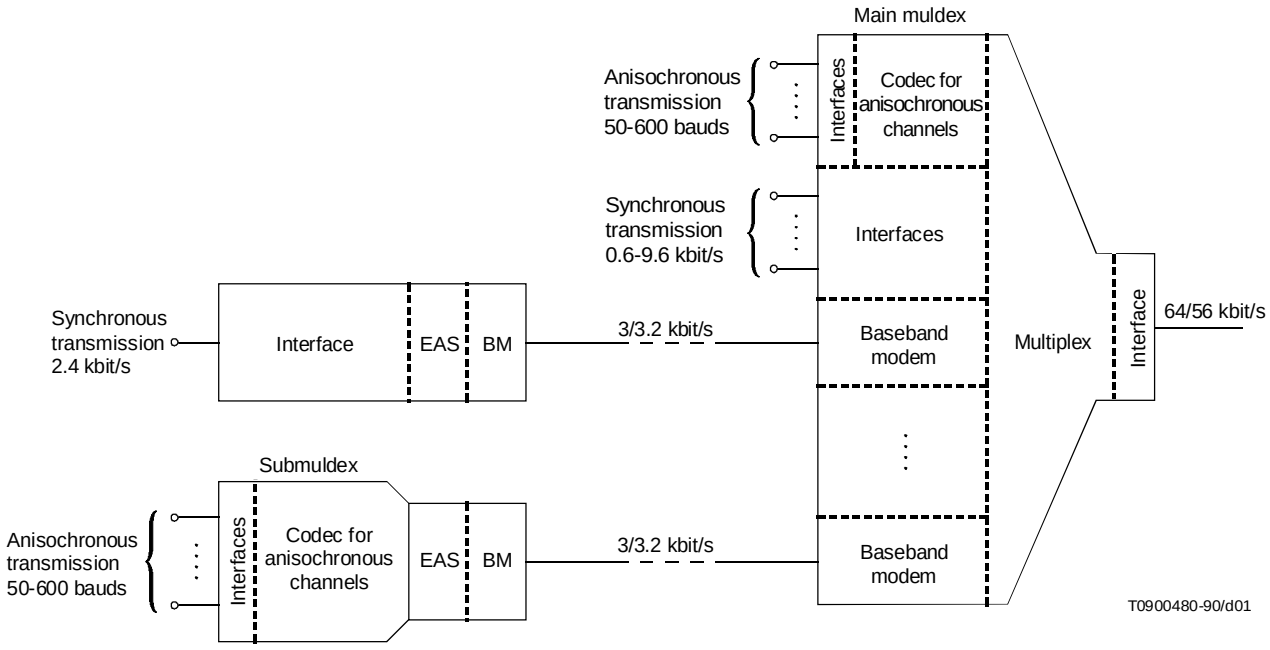
The diagram of combined muldex

(This Annex forms an integral part of this Recommendation)

The diagram of muldex and branch-line submuldex is shown in Figure A.1.

In a main muldex its multiplex (including clock, frame alignment scheme, distributor, etc.) is common for channels both for synchronous and anisochronous transmission. Channel interfaces for synchronous transmission are directly connected to multiplex. Channel interfaces for anisochronous transmission are connected through coding/decoding unit operating in accordance with Annex A/R.111. This unit can be either aggregate or individual.

Submuldex aggregate signal having an envelope structure and a rate of 3 or 3.2 kbit/s is sent from submuldex to the main muldex over the line just as for the remote user of the synchronous channel at a rate of 2.4 kbit/s.



EAS Envelope alignment scheme
MB Baseband modems

FIGURE A.1/R.113