INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

R.112

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

TELEGRAPHY

TELEGRAPH TRANSMISSION

TDM HYBRID SYSTEM FOR ANISOCHRONOUS TELEGRAPH AND DATA TRANSMISSION USING BIT INTERLEAVING

ITU-T Recommendation R.112

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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

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Recommendation R.112

TDM HYBRID SYSTEM FOR ANISOCHRONOUS TELEGRAPH AND DATA TRANSMISSION USING BIT INTERLEAVING

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988 and at Helsinki, 1993)

The CCITT,

considering

(a) that there is a limited requirement on certain routes to provide for rates and codes not included in Table 1/R.101 which may be achieved by using time-division multiplexing (TDM) techniques;

(b) that wherever possible the rates and codes given in Table 1/R.101 should not be expanded in the future;

(c) that Administrations may be asked to provide code and speed independent channels for cryptography, for telemetry, for rates outside the Recommendation R.101 tolerance of ± 1.4%, where the rate and code may be changed frequently, and for maintenance purposes;

(d) that the aggregate bit rate may be limited to 2400 bit/s and TDM equipment may be required to pass code independent and code dependent traffic;

(e) that the bearer may not be suitable for using the backward channel as defined by clause 5/V.26 [1], or in the provision of telegraph channels above the Recommendation V.26 aggregate by the technique of subdivision of the frequency band as given in Recommendation H.34 [2],

unanimously declares the view

that where bit-interleaved TDM systems are used for code dependent and code independent anisochronous telegraph and data transmission with an aggregate rate of 2400 bit/s, carried either by analogue telephone-type circuit or by higher order TDM system, the equipment should be constructed to comply with the following standards:

1 System capacity

1.1 The TDM system will be capable of multiplexing the rates shown in Table 1/R.101 for code dependent channels to alternative B.

1.2 Each code and rate independent channel should replace three, six or twelve 50 baud code dependent channels.

1.3 The characteristics of the code independent channels should follow the limits shown in Table 1.

2 Channel inputs

2.1 The nominal modulation rate will be 50, 100 or 200 bauds; the theoretical maximum modulation rate shall be 51.06, 102.12 or 204.24 bauds.

2.2 The transition coding process of telegraph signals is in accordance with Recommendation R.111.

2.3 Each channel provides its individual coding intervals starting within the allocated time slots: each coding interval is subdivided into four quarters. In that coding interval where the skipping bit occurs in the subframe, the forth quarter is shortened by one time slot length.

For a 50 baud channel, transmission of the code character starts with the next corresponding time slot. For channels with higher modulation rates the transmission of the code characters should be delayed by the number of the allocated time slots in the subframe minus 3.

TABLE 1/R.112

Characteristics of code independent channels and system capacity

Nominal modulation rate (bauds)	Maximum degree of isochronous distortion due to sampling (%)	Theoretical maximum modulation rate (bauds)	Data signalling rate on the bearer per channel (bit/s)	Duration of the shortest isolated element (ms)	Maximum number of channels for an aggregate rate of 2400 bit/s
50	8.3	51.06	153.2	6.5	15
100	8.3	102.12	306.4	3.25	7
200	8.3	204.24	612.8	1.625	3

2.4 Where applicable, spurious elements with duration of 1.6 ms (= 8%) or less shall be rejected and elements longer than 2 ms shall be accepted at the 50 baud channel input. The element lengths to be rejected or accepted at higher channel modulation rates is for further study.

3 Channel outputs

3.1 The maximum degree of inherent isochronous distortion due to the sampling process shall be 8.3%.

NOTE – The long-term system distortion on a tandem connection of transition encoded channels of an independent TDM system approximates in the worst case to the arithmetic summation of the individual link distortions.

3.2 After a TDM link failure, actions described in 3.5 and 3.6/R.101, should be taken on the derived channel output.

4 Multiplexing details

4.1 The multiplexing details are in accordance with Recommendation R.101, alternative B, on a bit basis.

4.2 The maximum transfer delay (excluding the modem) for 50, 100 and 200 baud code and rate independent channels for back-to-back terminals shall not exceed 50 ms for the rate 50 bauds and 35 ms for rates 100 and 200 bauds. The values of the delay are subject to further study.

5 Frame structure

This is as defined in Recommendation R.101 alternative B.

6 Synchronizing

This is as defined in Recommendation R.101, alternative B.

7 Aggregate signals and interface, system clock arrangements and system control and alarms

These are defined in Recommendation R.101.

8 Channel numbering scheme of code independent channels

Channel numbers used in the given Recommendation represent two last digits of the four-digit numbering scheme in respect to the Figure 1, first two digits are shown in Recommendation R.114.

9 Link performance and availability indicators

A system must be provided for monitoring performance and availability in accordance with Recommendation R.118.

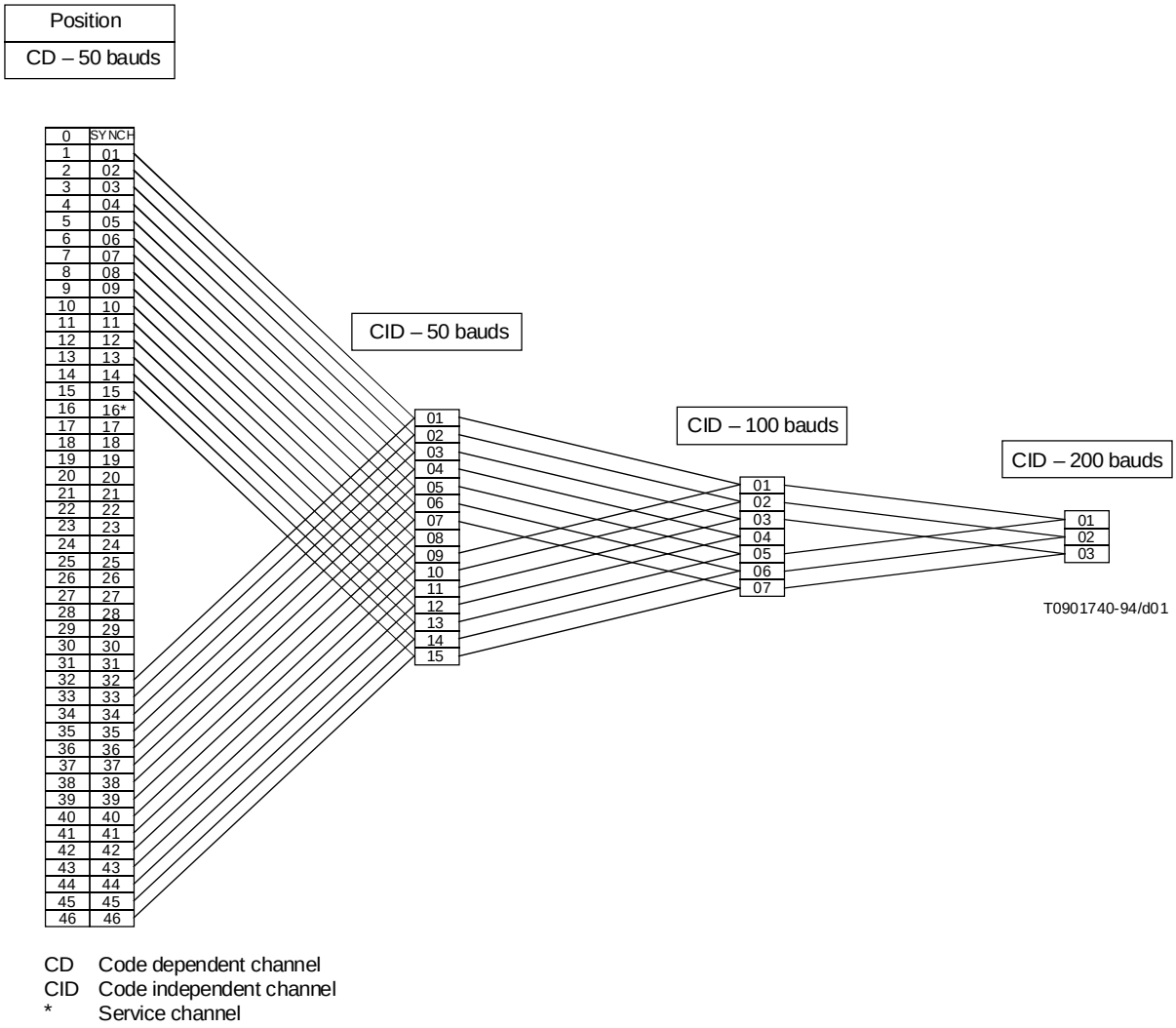

FIGURE 1/R.112

Channel allocation for code independent channels of 50, 100 and 200 bauds

References

[1] CCITT Recommendation *2400 bit per second modem standardized for use on 4-wire leased telephone-type circuits*, Rec. V.26.

[2] CCITT Recommendation *Sub-division of the frequency band of a telephone-type circuit between telegraph and other services*, Rec. H.34.