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ITU-T R.100

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TELEGRAPHY

TELEGRAPH TRANSMISSION

TRANSMISSION CHARACTERISTICS OF INTERNATIONAL TDM LINKS

ITU-T Recommendation R.100

(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.100 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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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TRANSMISSION CHARACTERISTICS OF INTERNATIONAL TDM LINKS

(Geneva, 1980, modified at Melbourne, 1988 and at Helsinki, 1993)

NOTE – The application of TDM systems providing code- and speed-independent channels in addition to code- and speed-dependent channels is a subject for further study.

1 Analogue path links

1.1 Standard telephone carrier systems with 4 kHz and 3 kHz spaced channels permit homogeneous time division multiplex (TDM) telegraph systems, operated in association with 600-, 2400- and 4800-bit/s data modems, to provide the capacities of telegraph channels shown in Table 1.

TABLE 1/R.100

Channel capacities of homogeneous TDM systems

TDM system type and aggregate rate	Quality of channels provided by homogeneous system									
	Code-dependent channels (bauds) (Note 1)						Code-independent channels (bauds)			
	50	75	100	150	200	300	50	100	200	300
R.101 2400 bit/s Alternative A (Note 2)	46	22	–	–	–	–	–	–	–	–
R.101 2400 bit/s Alternative B	46	30	22	15	10	7	–	–	–	–
R.102 4800 bit/s	92	46	46	30	22	15	30	15	7	–
R.103 600 bit/s	8	–	–	–	–	–	–	–	–	–
R.105 2400 bit/s (Note 3)	128 or 256	–	–	–	–	–	–	–	–	–
R.111 2400 bit/s (Note 4)	–	–	–	–	–	–	8	4	2	2
R.111 4800 bit/s (Note 4)	–	–	–	–	–	–	16	8	4	4
R.112 2400 bit/s (Note 5)	46	30	22	15	10	7	15	7	3	–

NOTES

1 Code-dependent channels provide regeneration of output signals.

2 Alternative B is preferred to use for leased circuits.

3 Given numbers concern virtual channels having average load from 0.1 to 0.2 Erlangs and from 0.05 to 0.1 Erlangs, respectively. The number of assigned channels depending on their rates is in compliance with Recommendation R.101, Alternative B.

4 5% maximum isochronous distortion per code-independent channel due to sampling. 75- and 150-baud signals may be carried on nominal 100- and 200-baud channels with proportionally less distortion, 300-baud signals are carried on 200-baud channels with 7.5%-distortion.

5 8.3% maximum isochronous distortion per code-independent channel due to sampling.

NOTES

1 Standard telephone carrier systems with 3 kHz spaced channels provide operation of telegraph TDM systems in association with 600- and 2400-bit/s modems.

2 The provision of telegraph TDM systems operated at aggregate rates above 4800 bit/s is the subject of further study.

1.2 A 4-wire link is required in association with the data modem employed to provide satisfactory transmission for the 600-, 2400- and 4800-bit/s duplex aggregate signals of an international TDM system.

1.3 The data modem employed should preferably comply with the appropriate aspects of the Series-V Recommendations. The use of modem for telegraph TDM systems operated at aggregate rate above 4800 bit/s requires further study.

1.4 The conditions of use of international TDM links are generally similar to those for VFT links, described in Recommendation H.22 [1]. The requirements of the actual V-Series modem employed should also be respected.

1.5 PCM (pulse code modulation) telephone channels complying with Recommendation G.712 [2] are also generally suitable as bearers for TDM telegraph systems associated with modems complying with the Series-V Recommendations. However, possible transmission arrangements involving tandem connection of a number of PCM telephone channels require further study.

1.6 Subclause 1.2.1/R.111 provides for the use of modems complying with the Recommendation cited in [3].

1.7 Whenever possible, tandem connected code-independant TDM telegraph systems according to Recommendation R.111 should have aggregate bearers bit-synchronized to one another

2 Digital path links

2.1 64 kbit/s international digital transmission circuits are realized by PCM time slots or via TDMA satellite systems. SCPC (single channel per carrier) satellite systems provide 56 kbit/s channels. Primary groups (60-108 kHz) in conjunction with V.36 [3] modems may also be used.

2.2 64 kbit/s TDM link

2.2.1 Clause 1/R.111 defines the telegraph TDM systems at 64 kbit/s.

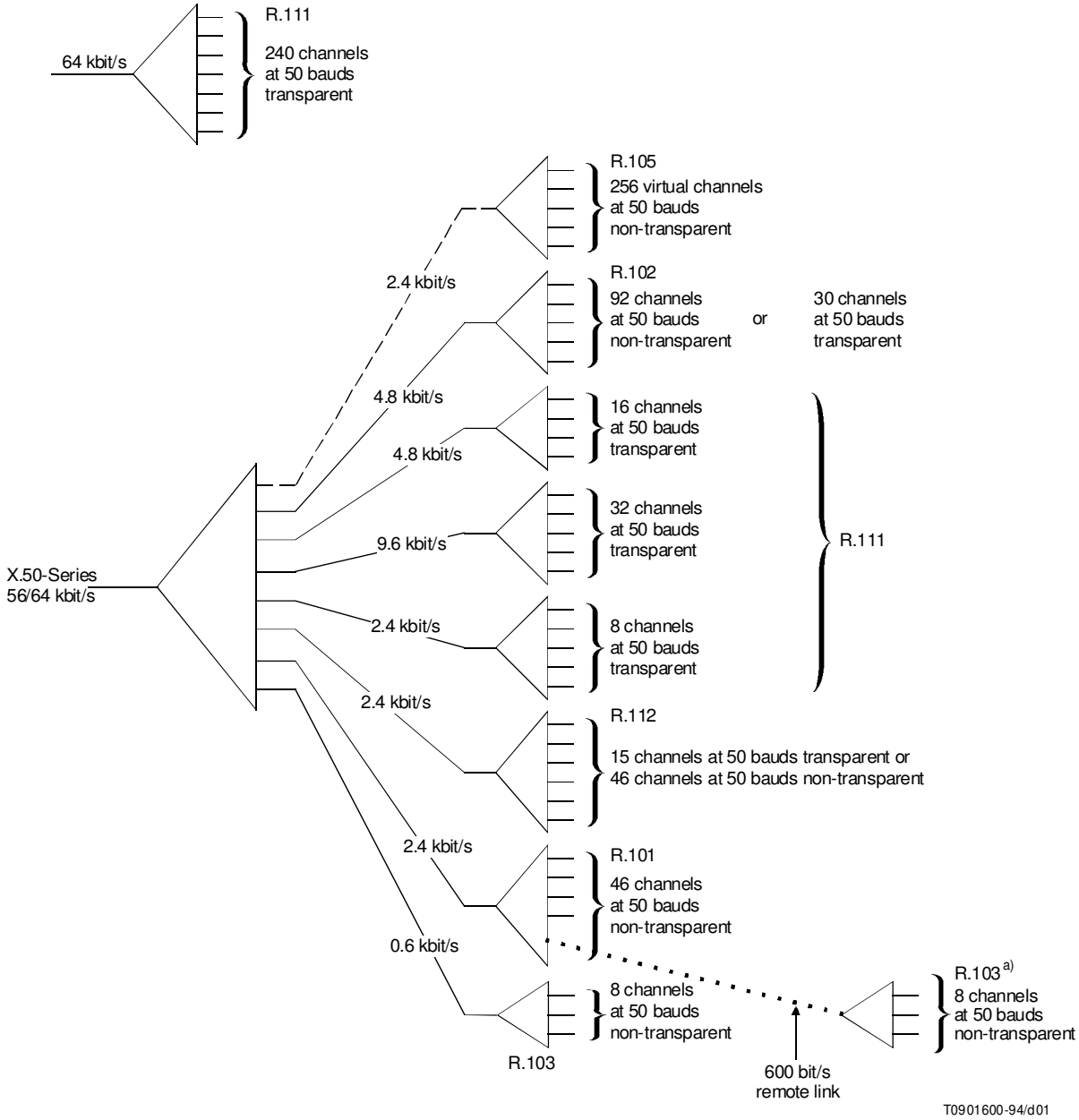
2.2.2 Recommendations X.50 [4] and X.51 [5] set out the parameters of envelope interleaving TDM systems at 64 kbit/s, which provide 0.6, 2.4, 4.8 and 9.6 kbit/s tributary data channels. These data channels can be used to transfer the aggregate signals of TDM systems at 0.6 kbit/s (see Recommendation R.103), 2.4 kbit/s (see Recommendations R.101, R.105, R.112 and clause 2/R.111), 4.8 kbit/s (see Recommendation R.102 and clause 2/R.111) and 9.6 kbit/s (see clause 2/R.111).

2.3 56 kbit/s TDM links are realized using envelope interleaving TDM systems which are defined in Recommendations X.55 [6] and X.56 [7]. These systems provide the same tributary channels as in 2.2.2.

2.4 Figure 1 shows a typical multiplex hierarchy.

2.5 The capacities of 50-baud channels of 64- and 56-kbit/s TDM systems are shown in Table 2.

2.6 The characteristics of 64- and 56-kbit/s digital circuit interfaces are described in Recommendations G.703 [8] and V.36 [3].



a) The R.103 remote multiplexer may be connected to an R.101, R.112 or an R.102 multiplexer. In this example, the eight remote link channels are included in the 46 channels of the R.101 multiplexer.

FIGURE 1/R.100

Typical multiplex hierarchy

TABLE 2/R.100

50-baud channel capacities of homogeneous TDM systems

Recommendation No. of TDM systems		Maximum No. of 50-baud channels	
		Transparent	Non-transparent
R.111, clause 1 (64 kbit/s)		240	–
X.50 (64 kbit/s) X.51 (64 kbit/s) X.55 (56 kbit/s) or X.56 (56 kbit/s)	20 × R.101 (2.4 kbit/s)	–	920
	20 × R.112 (2.4 kbit/s)	300	920
	10 × R.102 (4.8 kbit/s)	300	920
	20 × R.111, clause 2 (2.4 kbit/s)	160	–
	10 × R.111, clause 2 (4.8 kbit/s)	160	–
	5 × R.111, clause 2 (9.6 kbit/s)	160	–
	20 × R.105 (2.4 kbit/s)	–	5120 (Note)
	80 × R.103 (0.6 kbit/s)	–	640
NOTE – Virtual channels.			

References

[1] CCITT Recommendation *Transmission requirements of international voice-frequency telegraph links (at 50, 100 and 200 bauds)*, Rec. H.22.

[2] CCITT Recommendation *Performance characteristics of PCM channels between 4-wire interfaces at audio frequencies*, Rec. G.712.

[3] CCITT Recommendation *Modems for synchronous data transmission using 60-108 kHz group band circuits*, Rec. V.36.

[4] CCITT Recommendation *Fundamental parameters of a multiplexing scheme for the international interface between synchronous data networks*, Rec. X.50.

[5] CCITT Recommendation *Fundamental parameters of a multiplexing scheme for the international interface between synchronous data networks using 10-bit envelope structure*, Rec. X.51.

[6] CCITT Recommendation *Interface between synchronous data networks using a 6 + 2 envelope structure and single channel per carrier (SCPC) satellite channels*, Rec. X.55.

[7] CCITT Recommendation *Interface between synchronous data networks using an 8 + 2 envelope structure and single channel per carrier (SCPC) satellite channels*, Rec. X.56.

[8] CCITT Recommendation *Physical/electrical characteristics of hierarchical digital interfaces*, Rec. G.703.