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R.100

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SERIES R: TELEGRAPH TRANSMISSION

Telegraph distortion

TRANSMISSION CHARACTERISTICS OF INTERNATIONAL TDM LINKS

Reedition of CCITT Recommendation R.100 published in the Blue Book, Fascicle VII.1 (1988)

NOTES

1 CCITT Recommendation R.100 was published in Fascicle VII.1 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 R.100

TRANSMISSION CHARACTERISTICS OF INTERNATIONAL TDM LINKS

(Geneva, 1980, modified at Melbourne, 1988)

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 çtime division multiplex (TDM) telegraph systems, operated in association with 2400-bit/s data modems, to provide the capacities of telegraph channels shown in Table 1/R.100.

TABLE 1/R.100

Channel capacities of homogeneous TMD systems

TDM system type (see Note 1)	Quantity of channels provided by homogeneous system					
	50 baud	75 baud	100 baud	150 baud	200 baud	300 baud
Recommandation						
R.101, Alternative A	46	22	–	–	–	–
R.101, Alternative B	46	30	22	15	10	7
R.111	8	(see Note 2)	4	(see Note 2)	2	2

Note 1 – TDM systems complying with Recommendation R.101 provide code-and speed-dependent channels involving inherent regeneration of output signals. The provision of channels above 75 bauds for Recommendation R.101, Alternative A systems, is the subject of further study.

TDM systems complying with Recommendation R.111 provide code-and speed-independent channels by a transition coding process that does not include regeneration of the output signals. Furthermore. these systems may have aggregate signalling rates of either 2.4, 4.8, 9.6 or 64 kbit/s.

Note 2 – The Recommendation R.111 homogeneous system configurations shown involve an aggregate rate of 2400 bit/s and 5% maximum isochronous distortion per channel due to sampling. 75-and 150-baud signals may be carried on nominal 100-and 200-baud channels respectively with proportionally less distortion.

1.2 A 4-wire link is required in association with the data modem employed to provide satisfactory transmission for the 2400-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. Multiple 2400-bit/s aggregates may be multiplexed onto the same 4-wire link using the appropriate internal multiplexing facilities of a Recommendation V.29 [1] modem. The reliability and availability of derived telegraph channels will, however, be highly dependent on the stability and characteristics of the bearer, modem and system arrangements adopted.

1.4 The conditions of use of international TDM links are generally similar to those for VFT links, described in Recommendation H.22 [2]. The requirements of the actual V-Series modem employed however, should be additionally respected.

Note – This subject is under study in Joint Working Party LTG, Study Group IV and Study Group IX.

1.5 PCM (pulse code modulation) telephone channels complying with Recommendation G.712 [3] 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 channels require further study.

1.6 Recommendation R.111, in § 1.2.1, provides for the use of modems complying with the Recommendation cited in [4].

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 [4] modems may also be used.

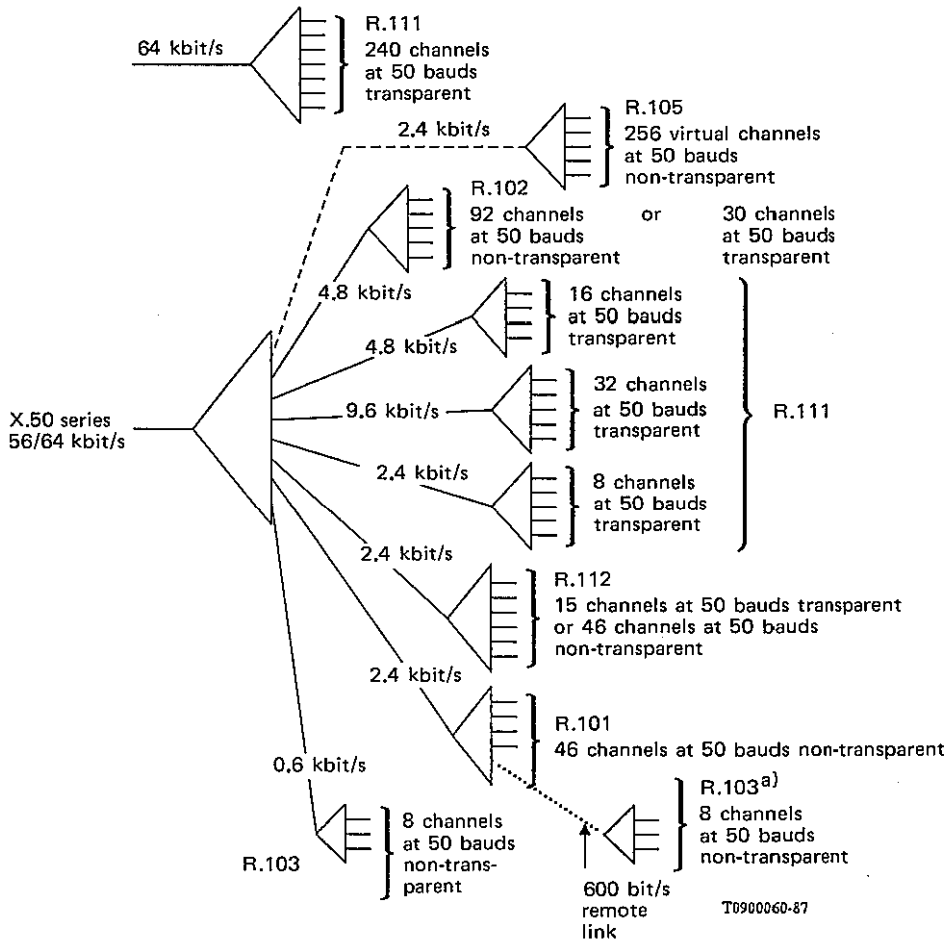
2.2 *64 kbit/s TDM link*

2.2.1 Recommendation R.111, § 1 defines the telegraph TDM systems at 64 kbit/s.

2.2.2 Recommendations X.50 [5] and X.51 [6] 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 (Recommendation R.103), 2.4 kbit/s (Recommendations R.101, R.105, R.112 and R.111, § 2), 4.8 kbit/s (Recommendations R.102 and R.111, § 2) and 9.6 kbit/s (Recommendation R.111, § 2).

2.3 56 kbit/s TDM links are realized using envelope interleaving TDM systems which are defined in Recommendations X.55 [7] and X.56 [8]. These systems provide the same tributary channels as in 2.2.2.

2.4 Figure 1/R.100 shows a typical multiplex hierarchy.



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

2.5 The capacities of 50 baud channels of 64 and 56 kbit/s TDM systems are shown in Table 2/R.100.

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, § 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, § 2 (2.4 kbit/s)	160	–
	10 × R.111, § 2 (4.8 kbit/s)	160	–
	5 × R.111, § 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.

2.6 The characteristics of 64 and 56 kbit/s digital circuit interfaces are described in Recommendations G.703 [9] and V.36 [4].

References

[1] CCITT Recommendation *9600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits*, Rec. V.29.

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

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

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

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

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

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

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

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

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