



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

R.22

(08/96)

SERIES R: TELEGRAPH TRANSMISSION

Voice-frequency telegraphy

**Data over voice 19 200 bit/s modem standardized
for use on telephone network subscriber lines**

ITU-T Recommendation R.22

(Previously «CCITT Recommendation»)

ITU-T R-SERIES RECOMMENDATIONS
TELEGRAPH TRANSMISSION

Telegraph distortion	R.1-R.19
Voice-frequency telegraphy	R.20-R.39
Special cases of alternating current telegraphy	R.40-R.49
Transmission quality	R.50-R.59
Correction of signals	R.60-R.69
Telegraph maintenance	R.70-R.99
Time-division multiplexing	R.100-R.119
Transmission quality above 50 bauds	R.120-R.139
Definitions	R.140-R.149
Availability and reliability of international telegraph circuits	R.150-R.159

For further details, please refer to ITU-T List of Recommendations.

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). 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, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation R.22 was prepared by ITU-T Study Group 14 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 16th of August 1996.

NOTES

1. In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.
2. The status of annexes and appendices attached to the Series R Recommendations should be interpreted as follows:
 - an *annex* to a Recommendation forms an integral part of the Recommendation.
 - an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

© ITU 1996

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

CONTENTS

	<i>Page</i>
1 Scope	1
2 Normative references	1
3 Line signals	1
4 Transmission level.....	2
5 Data signalling and modulation rate.....	2
6 Interchange circuits	2
6.1 List of interchange circuits	2
6.2 Circuit 109 threshold	2
6.3 Timing arrangements	3
7 Scrambler/descrambler	3
8 Test loop arrangement.....	3

Recommendation R.22

DATA OVER VOICE 19 200 bit/s MODEM STANDARDIZED FOR USE ON TELEPHONE NETWORK SUBSCRIBER LINES

(Geneva, 1996)

1 Scope

This Recommendation defines a modem for use on telephone network subscriber lines which can also be used on leased lines.

On subscriber lines, taking into consideration that there exist and will come into being other modems designed to meet the requirements of Administrations and users, this Recommendation in no way restricts the use of any other modems.

The principal characteristics of the standardized modem are as follows:

- a) digital data transmission on the telephone network subscriber line, ensuring the possibility of telephone communication over the same subscriber line;
- b) duplex mode of operation, with separation of the receiving and transmitting directions by frequency division;
- c) asynchronous mode of operation at up to 19 200 bit/s and synchronous at 1200, 2400, 4800, 9600 and 19 200 bit/s;
- d) use of frequency modulation;
- e) remote control of the establishment of loop 2 as defined in Recommendation V.54.

NOTE – Only one mode of operation can be provided in the modem (either asynchronous or synchronous), by decision of the Administration concerned.

2 Normative references

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision: all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- ISO 2110:1989, Information technology – *Data communication – 25-pole DTE/DCE interface connector and contact number assignments*.
- ITU-T Recommendation V.24 (1993), *List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating equipment (DCE)*.
- ITU-T Recommendation V.28 (1993), *Electrical characteristics for unbalanced double-current interchange circuits*.

3 Line signals

3.1 Characteristic frequencies for the route from exchange to subscriber are as follows:

- F(A) (symbol 1, mark): 50 ± 0.1 kHz;
- F(Z) (symbol 0, space): 60 ± 0.1 kHz.

3.2 Characteristic frequencies for the route from subscriber to exchange are as follows:

- F(A) (symbol 1, mark): 95 ± 0.2 kHz;
- F(Z) (symbol 0, space): 105 ± 0.2 kHz.

4 Transmission level

The transmission level for both channels shall be -3 ± 1 dBm.

5 Data signalling and modulation rate

5.1 The data signalling rate in asynchronous mode of operation shall not be greater than 19 200 bit/s $\pm 3\%$.

5.2 The data signalling rate in synchronous mode of operation shall be 1200, 2400, 4800, 9600 and 19 200 bit/s. Data signalling rates should not deviate from the nominal value by more than $\pm 0.01\%$.

6 Interchange circuits

6.1 List of interchange circuits

The V.24 interchange circuits which apply are shown in Table 1.

TABLE 1/R.22

Interchange circuits

Interchange circuit		Existence	
No.	Designation	Asynchronous mode	Synchronous mode
102	Signal ground or common return	X	X
103	Transmitted data	X	X
104	Received data	X	X
109	Data channel received line signal detector	X	X
113	Transmitter signal element timing (DTE source)	–	X
114	Transmitter signal element timing (DCE source)	–	X
115	Receiver signal element timing (DCE source)	–	X
140	Loopback/maintenance test	X	X
142	Test indicator	X	X

NOTE – Interchange circuit functions shall comply with the requirements of Recommendation V.28, and connector and pin assignments are in accordance with ISO 2110.

6.2 Circuit 109 threshold

For a received line signal level greater than -43 dBm, circuit 109 is ON; during this period the received data line signal is to be transmitted over circuit 104. For a received line signal less than -48 dBm, circuit 109 will be maintained in the OFF condition and the binary 1 signal is to be transmitted over circuit 104.

The condition of circuit 109 for levels between -43 dBm and -48 dBm is not specified, except that the signal detector shall exhibit a hysteresis action such that the level at which the OFF to ON transition occurs is at least 2 dB greater than that for the ON to OFF transition.

When line attenuation is known, Administrations should be permitted at the time of modem installation to change the above levels of the received line signal detectors to less sensitive values (e.g. -33 dBm and -38 dBm, respectively).

The time of OFF to ON transition and vice versa is 10 ± 5 ms.

6.3 Timing arrangements

The modem should provide the data terminal equipment with transmitter signal element timing, circuit 114, and receiver signal element timing, circuit 115, at any data signalling rate used in the modem. The transmitter signal element timing may be originated in the data terminal equipment and be transmitted to the modem via circuit 113.

7 Scrambler/descrambler

7.1 A self-synchronizing scrambler/descrambler having the generating polynomial $1 + x^{-6} + x^{-7}$ shall be included in the modem to provide the synchronous mode of operation.

8 Test loop arrangement

8.1 The modem shall be conditioned to test the digital line between the telephone station and the subscriber by establishing loop 2, when the binary signal from the receiving side output of the modem is applied to the input of its transmitting side, and circuit 104 to the DTE is maintained in the binary 1 condition.

8.2 Loop 2 may be established manually or automatically.

8.3 Automatic control of the loop test procedure may be as follows:

- a) the carrier towards the subscriber modem will be removed from the line (e.g. circuit 140 goes ON) for more than 20 ms, after which the subscriber modem recovers the carrier;
- b) in response to the short removal and subsequent reappearance of the carrier in the subscriber modem, loop 2 shall be established for a period of 30 s;
- c) the subscriber modem, when the loop 2 condition is terminated (30 s), will be returned to normal operation.

ITU-T RECOMMENDATIONS SERIES

- Series A Organization of the work of the ITU-T
- Series B Means of expression
- Series C General telecommunication statistics
- Series D General tariff principles
- Series E Telephone network and ISDN
- Series F Non-telephone telecommunication services
- Series G Transmission systems and media
- Series H Transmission of non-telephone signals
- Series I Integrated services digital network
- Series J Transmission of sound-programme and television signals
- Series K Protection against interference
- Series L Construction, installation and protection of cables and other elements of outside plant
- Series M Maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
- Series N Maintenance: international sound-programme and television transmission circuits
- Series O Specifications of measuring equipment
- Series P Telephone transmission quality
- Series Q Switching and signalling
- Series R Telegraph transmission**
- Series S Telegraph services terminal equipment
- Series T Terminal equipments and protocols for telematic services
- Series U Telegraph switching
- Series V Data communication over the telephone network
- Series X Data networks and open system communication
- Series Z Programming languages