



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

V.22

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

DATA COMMUNICATION OVER THE TELEPHONE NETWORK

**1200 BITS PER SECOND DUPLEX MODEM
STANDARDIZED FOR USE IN THE GENERAL
SWITCHED TELEPHONE NETWORK AND
ON POINT-TO-POINT 2-WIRE LEASED
TELEPHONE-TYPE CIRCUITS**

ITU-T Recommendation V.22

(Extract from the *Blue Book*)

NOTES

- 1 ITU-T Recommendation V.22 was published in Fascicle VIII.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.

© ITU 1988, 1993

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.

Recommendation V.22

1200 BITS PER SECOND DUPLEX MODEM STANDARDIZED FOR USE IN THE GENERAL SWITCHED TELEPHONE NETWORK AND ON POINT-TO-POINT 2-WIRE LEASED TELEPHONE-TYPE CIRCUITS

(Geneva, 1980; amended at Malaga- Torremolinos, 1984; and at Melbourne, 1988)

1 Introduction

1.1 This modem is intended for use on connections on General Switched Telephone Networks (GSTNs), and on point-to-point circuits when suitably conditioned.

The principal characteristics of this modem are as follows:

- a) duplex operation on 2-wire GSTN and point-to-point leased circuits,
- b) channel separation by frequency division,
- c) differential phase shift modulation for each channel with synchronous line transmission at 600 bauds (nominal),
- d) inclusion of a scrambler,
- e) inclusion of test facilities.

1.2 Recognizing the wide range of application, this Recommendation provides for three alternative configurations. The choice of alternative is a matter for the Administration concerned. The facilities given by the alternatives are:

Alternative A

1200 bit/s synchronous

600 bit/s synchronous (optional)

Alternative B

1200 bit/s synchronous }
600 bit/s synchronous (optional) }

as in Alternative A

1200 bit/s start-stop

600 bit/s start-stop (optional)

Alternative C

1200 bit/s synchronous }
600 bit/s synchronous (optional) }
1200 bit/s start-stop }
600 bit/s start-stop (optional) }

as in Alternative B

An asynchronous mode having capability of handling 1200 bit/s start-stop and asynchronous data at up to 300 bit/s.

The selection of the asynchronous mode is made during the handshaking sequence (see § 6). This gives compatibility between Alternative B and Alternative C.

Note - The possibility of transmitting low speed anisochronous data in Alternatives A and B is left for further study.

2 Line signals

2.1 Carrier and guard tone frequencies

The carrier frequencies shall be 1200 ± 0.5 Hz for the low channel and 2400 ± 1 Hz for the high channel. A guard tone of $1800 \text{ Hz} \pm 20$ Hz, to be transmitted only when the modem is transmitting in the high channel, may be disabled as a national option. An alternative guard tone of 550 ± 20 Hz may be incorporated as a national option. The question of international calls between countries requiring different guard tones is left for further study.

2.2 Data and guard tone line signal levels

The 1800-Hz guard tone shall be at a level of 6 ± 1 dB below the level of the data power in the high channel. The level of the optional 550 Hz tone is for further study. The total power transmitted to line shall be in accordance with Recommendation V.2 and shall be the same for transmission in either channel. Because of the 1800-Hz guard tone, the power level of data signals in the high channel will be approximately 1 dB lower than data signals in the low channel.

2.3 Fixed compromise equalizer

Fixed compromise equalization shall be incorporated in the modem. Such equalization shall be equally shared between transmitter and receiver. The characteristics of the equalizer shall be the responsibility of each Administration to recommend nationally. The possibility of producing compromise characteristics for international implementation is for further study.

2.4 Spectrum and group-delay characteristic

After making allowance for the nominal specified compromise equalizer characteristic, the transmitted line signal shall have a frequency spectrum equivalent to the square root of a raised cosine shaping with a 75% roll-off and within the limits of Figure 1/V.22. Similarly, the group delay of the transmitter output shall be within ± 150 microseconds over the frequency range 900 Hz-1500 Hz (low channel) and 2100 Hz-2700 Hz (high channel). These figures are provisional.

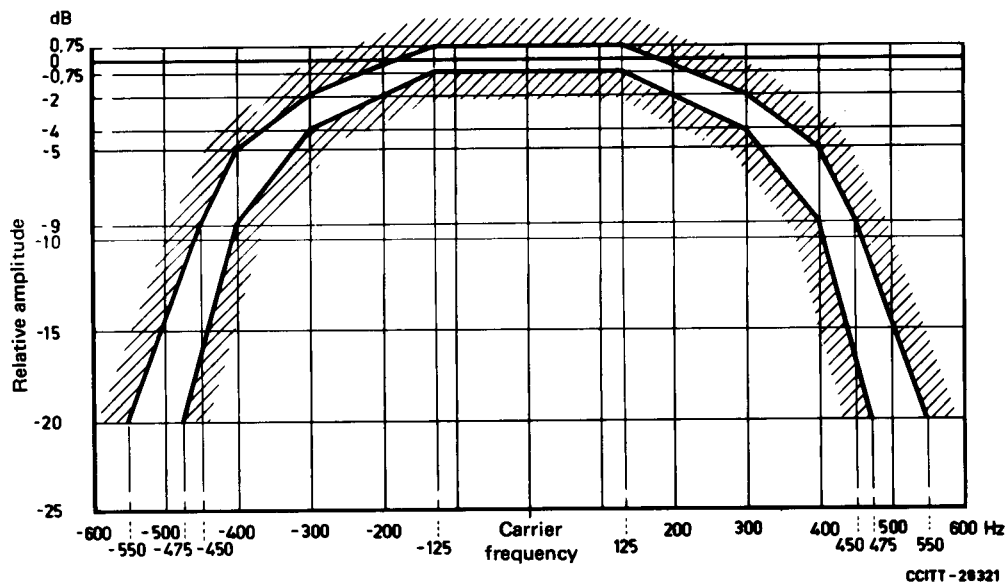


FIGURE 1/V.22

Amplitude limits for transmitted line signal (unequalized)

2.5 Modulation

2.5.1 Data signalling rates

Alternatives A and B: The data signalling rate transmitted to line shall be 1200 bit/s or 600 bit/s $\pm 0.01\%$ with a modulation rate of 600 baud $\pm 0.01\%$.

Alternative C: In Modes i), ii), iii) and iv) (§ 4) the data signalling rates are as in Alternatives A and B. In Mode v), the data signalling rate transmitted to line shall be 1205 1 bit/s with a modulation rate of 602.5 ± 0.5 baud. Optionally in Mode v), the line rate shall be 1223 ± 2 bit/s with a modulation rate of 611.5 ± 1 baud.

2.5.2 Encoding of data bits

2.5.2.1 1200 bits per second

The data stream to be transmitted shall be divided into groups of 2 consecutive bits (dibits). Each dibit shall be encoded as a phase change relative to the phase of the preceding signal element (see Table 1/V.22). At the receiver, the dibits shall be decoded and the bits reassembled in correct order. The left-hand digit of the dibit is the one occurring first in the data stream as it enters the modulator portion of the modem after the scrambler.

TABLE 1/V.22

Dibit values (1200 bit/s)	Bit values (600 bit/s)	Phase change (Modes i, ii, iii, iv)	Phase change (Mode v)
00	0	+ 90°	+ 270°
01	-	0°	+ 180°
11	1	+ 270°	+ 90°
10	-	+ 180°	0°

Note - The phase change is the actual on-line phase shift in the transition region from the centre of one signalling element to the centre of the following signalling element.

2.5.2.2 600 bits per second

Each bit shall be encoded as a phase change relative to the phase of the preceding signal element (see Table 1/V.22).

2.6 Received signal frequency tolerance

Noting that the frequency tolerance of the transmitter carriers is ± 1 Hz or less, and assuming a maximum shift of ± 6 Hz in the connection, the receiver shall be able to accept errors of at least ± 7 Hz in the received frequencies.

3 Interchange circuits

3.1 Table of interchange circuits (Note 1 of Table 2/V.22)

Essential and optional interchange circuits are listed in Table 2/V.22.