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DATA COMMUNICATION OVER THE TELEPHONE NETWORK

MODEMS FOR PARALLEL DATA TRANSMISSION USING TELEPHONE SIGNALLING FREQUENCIES

ITU-T Recommendation V.19

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation V.19 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.

Recommendation V.19

MODEMS FOR PARALLEL DATA TRANSMISSION USING TELEPHONE SIGNALLING FREQUENCIES

(Geneva, 1976; amended at Malaga-Torremolinos, 1984)

Systems for parallel data transmission can be used economically when the transmitting sets (outstations) use the signalling frequencies of push-button telephone sets to transmit data to a central receiving set (instation) via the switched telephone network.

1 Scope

In many networks, the introduction of keyboard telephone sets allows simple, one-way data transmission at speeds up to about 10 characters per second to be made from a large number of push-button telephone sets serving as outstations to a common instation, via the general switched telephone network. Transmissions in the instation-to-outstation direction are generally confined to simple acoustic signals and voice replies.

The CCITT therefore

unanimously recommends

that the modems to be used for stations operating in the general switched telephone network should meet the specifications shown below.

2 General characteristics

2.1 *Data channel*

The transmission system uses two sets of frequencies in accordance with Recommendation Q.23 [1]. Each character is transmitted in the form of two simultaneously transmitted frequencies. These two frequencies belong to two separate sub-assemblies. Each of these two assemblies consists of four frequencies ["2 (1/4)" code]. This coding can thus be used to transmit 16 different character combinations and perhaps more (see Note).

The actual transmission consists in sending a frequency pair for a time greater than 30 ms, followed by a silence period of not less than 25 ms.

Note - In order to stretch the set of characters, several frequency pairs may be transmitted before the silence period. It should be noted that in this case character coding and decoding will not be effected by the DCE but by the DTE.

2.2 *Backward channel*

The following possibilities might be considered:

a) a telephone channel not simultaneous with data transmission in the forward direction;

b) a backward channel for audible signalling;

c) a backward channel for electrical signalling.

Possibilities b) and c) are provided on a basis of non-simultaneity or, optionally, simultaneity with the data transmission channels in the forward direction.

A loudspeaker will be built into the outstation modem. Optionally, a continuous signalling output may be provided. If the national regulations permit, an output for response to the channel may also be provided as an option.

3 Frequency assignments

3.1 *Data transmission channel*

The 2 groups of 4 frequencies specified in Recommendation Q.23 [1] are defined as follows:

- low group frequencies: 697, 770, 852, 941 Hz;
- high group frequencies: 1209, 1336, 1477, 1633 Hz.

The frequency pairs are assigned to the different digits as shown in Table 1/V.19.

TABLE 1/V.19

	B_1 = 1209 Hz	B_2 = 1336 Hz	B_3 = 1477 Hz	B_4 = 1633 Hz
A_1 = 697 Hz	1	2	3	A
A_2 = 770 Hz	4	5	6	B
A_3 = 852 Hz	7	8	9	C
A_4 = 941 Hz	*	0	#	D

3.2 *Backward channel*

For audible signals and electrical signalling, the backward channel frequency will be 420 Hz. This frequency may be amplitude-modulated at a rate of up to 5 bauds.

Use may also be made of an FM backward channel similar to that of the Recommendation V.23 type modem, or of the No. 2 transmission channel of a Recommendation V.21 type modem (if the frequency 1633 Hz is not used). These two types of backward channel may be used at the same time as the data frequencies in the forward direction; the use of these backward channels is optional.

4 Tolerances

4.1 *Data frequency tolerances*

The data frequency tolerances are defined in Recommendation Q.23 [1]; the difference between each frequency and its nominal frequency must not exceed ± 1.8% of the nominal frequency. Apart from this tolerance of ± 1.8% on transmission, the instation receiver should be able to accept a difference of ± 6 Hz due to the carrier systems.

4.2 *Frequency tolerance on backward channel*

The tolerance of 420 Hz on the backward channel should be ± 4 Hz; the receiver of the outstation should also be able to accept a difference of ± 6 Hz due to the carrier systems.

5 Line power levels

On the basis of Recommendation V.2, the following maximum power levels are recommended for each frequency transmitted, measured at the relative zero point:

-13 dBm0 for the data transmission channel without the simultaneous backward channel;

-16 dBm0 for the data transmission channel with the simultaneous backward channel;

-10 dBm0 for the non-simultaneous backward channel;

-16 dBm0 for the simultaneous backward channel.

6 Power levels on reception

In view of the provision of Recommendation V.2 and the statistical values of the maximum transmission loss between subscribers, it is recommended that the instation receiver should be able to detect frequency pairs received at -45 dBm.

Note - Studies should be continued with a view to permitting levels on reception below -45 dBm.

7 Character reception

A character will be detected and delivered to the DTE interface if, and only if, the two frequencies corresponding to the character are detected and are stable for at least 10 ms.

The silent period will be detected and delivered to the DTE interface if no frequency belonging to the code appears for at least 10 ms.

Note - During silent periods, the microphone of the telephone set is connected to the telephone line, so that interfering signals (ambient noise, speech) may be received. The receiver must be fitted with devices capable of distinguishing between these interfering signals and data signals (speech protection). It would be advisable to study further the method of assessing receiver response to the simulation of data signals by interfering signals. A reproducible test signal should be defined, so that comparable measurements can be made.

8 Detection of line signal received on the data channel

Circuit 109 must be in the ON position when a character is received, the circuit may be switched from ON to OFF:

1) on detection of the silent period;

2) after a time-out of 60 ± 10 ms following detection of the silent period.

9 Timing for characters received

By its very principle, the system is asynchronous; however, it may be useful to provide the DTE, on an optional basis, with a signal which indicates the sampling times of the data wires. In this case, it is advisable to use circuit 131, which will switch from OFF to ON when the character reaches the interface, and then back to OFF after a time *T*. This time will be chosen in such a way that the data are stable at the DTE interface.

The value T = 15 ms may be recommended by way of example.

This clock may optionally be disabled on reception of a silent period.

10 Interface of instation modem

The functional characteristics of the interchange circuits concerned are as defined in Recommendation V.24 (see Note 1).

10.1 *List of interchange circuits concerned*

102 Signal ground or common return

104 Received data [8 circuits. These circuits are designated A_1, A_2 . . . B_4 according to their correspondence with the relevant frequency in Table 1/V.19 (see Note 2 below)]

105 Request to send (see Note 3 below)

107 Data set ready

108/1 Connect data set to line (see Note 4 below)

108/2 Data terminal ready (see Note 4 below)

109 Data channel received line signal detector

125 Calling indicator

130 Transmit backward tone

191 Transmitted voice answer (see Note 3 below)

The following interchange circuits are optional:

110 Data signal quality detector

131 Received character timing

Note 1 - Manufacturers who marketed a modem of this type prior to the publication of this Recommendation may regard the interface defined in this paragraph as optional.

Note 2 - To make the interface compatible with the relevant specifications of Recommendation V.20, the combination A_4, B_4 may be transmitted on circuit 104 instead of a pause ("1" on all circuits), provided circuit 107 is in the ON position and circuit 105 is in the OFF position. This simulated idle combination is optional.

Note 3 - These circuits are required if the "telephone channel" facility is provided in the modem. The electrical characteristics of interchange circuit 191 are still under study.

Note 4 - Circuit 108 must be available either as circuit 108/1 - *Connect data set to line*, or as circuit 108/2 - *Data terminal ready.*

10.2 *Electrical characteristics of interchange circuits*

Use of electrical characteristics conforming to Recommendation V.28 is recommended together with the connector and pin assignment plan specified by ISO 2110.

Note - Manufacturers may wish to note that the long-term objective is to replace electrical characteristics specified in Recommendation V.28, and that Study Group XVII has agreed that the work shall proceed to develop a more efficient, all balanced, interface for the V-Series application which minimizes the number of interchange circuits.

11 Interface of outstation modems

In view of the purpose of these modems, which are or will be more or less integrated in economic terminals, the specification of the interface is liable to result in a much higher equipment cost. Hence no interface is recommended.

Reference

[1] CCITT Recommendation *Technical features of push-button telephone sets*, Rec. Q.23.