

**Recommendation T/CD 01-07 E (Ostende 1979, revised at Cannes 1983)  
concerning the engineering requirements for a parallel data transmission modem using telephone  
signalling frequencies for use in the general switched telephone network**

Recommendation proposed by Working Group T/WG 10 "Data Communications" (CD)

*Text of the revised Recommendation adopted by the "Telecommunications" Commission:*

"The Conference of European Post and Telecommunications Administrations,

*Considering*

- that Recommendation T/CD 01-01 contains the text of the Specifications of the general engineering requirements for data circuit terminating equipment for analogue and digital networks;
- that working groupe CD has studied the harmonization of such modems under the auspices of Question CD 1.

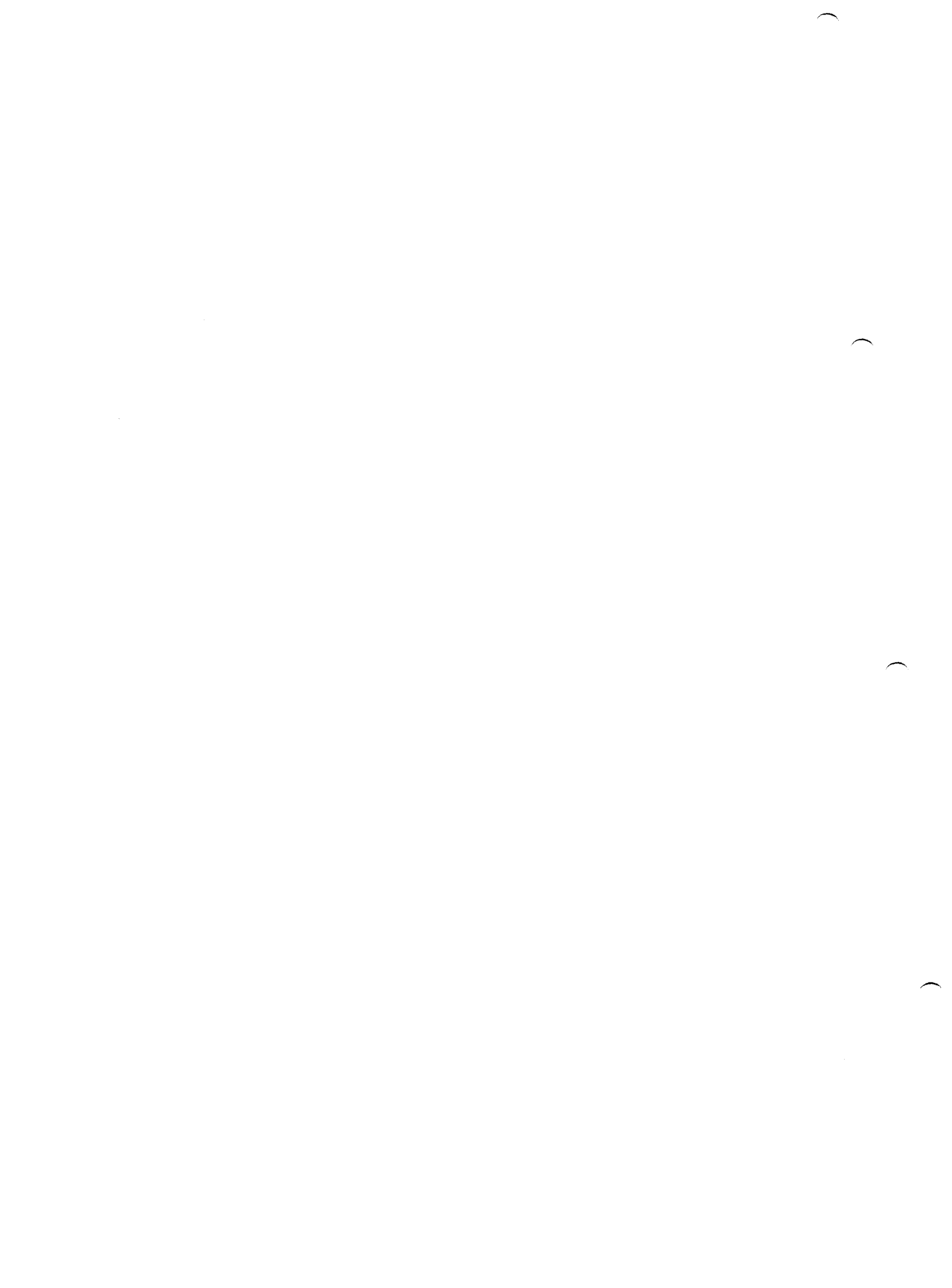
*Recommends*

- that the attached Specification of engineering requirements for a parallel data transmission modem using telephone signalling frequencies for use in the general switched telephone network as contained in Annex I to this Recommendation should be taken into account by all CEPT Administrations when implementation of such a piece of equipment is being planned by Administrations."

Administrations are free to stipulate additional requirements, and also which of the optional requirements, if any, are to be provided.

*Note 1:* The specification is subject of continuing study and possible amendment.

*Note 2:* The Annex is an integral part of the Recommendation.



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### Section B. *Network dependent requirements*

No specific requirements.

Parts of this specifications which are literally copied from CCITT-Recommendations, are marked with a line in the margin of the paper. Sections which need further study, are marked with an asterisk.

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## Section A. *Common requirements*

### 1. **GENERAL**

The modems for central receiving stations (instations) for parallel data transmission using telephone signalling frequencies for one-way transmission, where keyboard telephone sets are used as simple transmitting stations (outstations), are intended for use in the general switched telephone network only.

The modems must meet the requirements given in the Specification of the general engineering requirements and in this specification. They must comply with CCITT Recommendations V.19 and V.24/V.28.

The main characteristics of this recommended modems for parallel data transmission using telephone signalling frequencies are as follows:

- (a) simultaneous reception of two frequencies of two separate sub-assemblies of four frequencies:  $2(\frac{1}{4})$  code with 16 different character combinations;
- (b) reception of frequency pair for more than 30 ms, followed by a silent period of not less than 25 ms;
- (c) reception with speech protection;
- (d) existence of a backward channel transmitting either simple acknowledgement signals or analog signals (voice-answering).

### 2. **DATA SIGNALLING RATES**

The data signalling rate of the keyboard telephone is up to 10 characters per second.

### 3. **INTERFACES**

#### 3.1. **Interchange circuits**

The interchange circuits to be used are given in the list below.

*List of interchange circuits:*

102	Signal ground or common return.
104	Received data (8 circuits). These circuits are designated $A_1, A_2 \dots B_4$ according to their correspondence with the relevant frequency in Table 1 (see <i>Note 1</i> below).
105	Request to send (see <i>Note 2</i> below).
107	Data set ready.
108/1	Connect data set to line (see <i>Note 3</i> below).
108/2	Data terminal ready (see <i>Note 3</i> below).
109	Data channel received line signal detector.
125	Calling indicator.
130	Transmit backward tone.
191	Transmitted voice answer (see <i>Note 2</i> below).
110	Data signal quality detector.
131	Received character timing.

*Note 1:* To make the interface compatible with the relevant specifications of Recommendation T/CD 01-08, 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 2:* These circuits are required if the "telephone channel" facility is provided in the modem. (Speech channel facility.)

*Note 3:* Circuit 108 must be available either as circuit 108/1: Connect data set to line, or as circuit 108/2: Data terminal ready. For automatic calling, this circuit is used exclusively as circuit 108/2.

The functions of the above interchange circuits are defined in the Specification of the general engineering requirements T/CD 01-01 and comply with CCITT Recommendation V.24.

#### 3.2. **Interchange circuit connector**

The allocation of the interchange circuits to pins of the connector is in conformance with ISO Standard 2110.

It is given in Annex I.

#### 3.3. **Electrical characteristics**

The electrical characteristics of the above interchange circuits are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01) and comply with CCITT Recommendation V.28.

3.4. **Electrical characteristics of interchange circuit 191**

The impedance and transmitter requirements must comply with the line requirements for the modem, which are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

4. **MODULATION AND CODING**

4.1. **Data channels**

Two groups of 4 frequencies 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.

	B <sub>1</sub> = 1209 Hz	B <sub>2</sub> = 1336 Hz	B <sub>3</sub> = 1477 Hz	B <sub>4</sub> = 1633 Hz
A <sub>1</sub> = 697 Hz	1	2	3	A
A <sub>2</sub> = 770 Hz	4	5	6	B
A <sub>3</sub> = 852 Hz	7	8	9	C
A <sub>4</sub> = 941 Hz	★	0	=	D

Section A. Table 1.

5. **SCRAMBLING:** not provided for.

6. **TIMING**

By its very principle, the system is asynchronous; however, it may be useful to provide the DTE, on an optimal 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.

7. **BACKWARD CHANNEL**

The frequency of the backward channel for simple audible signalling shall be 420 Hz. It shall be possible to modulate this tone at rates of up to 5 bauds (AM).

It shall be possible to use this backward channel simultaneously with the data channels.

8. **LINE SIGNAL CHARACTERISTICS**

The transmit power levels shall be adjustable as indicated in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

8.1. **Backward channel**

Provision shall be made for the following facilities:

- (a) a speech channel non-simultaneous with forward data;
- (b) a 420 Hz-backward channel for audible or/and electrical signalling (see 7.).

For the speech channel the signal specifications shall be the same as for the telephone channel indicated in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

8.2. **Threshold levels**

8.2.1. *Threshold levels of the data channel received signal detector*

When the level of the received signal in group B exceeds -40 dBm, circuit 109 shall be ON. When the level of this received signal is less than -52 dBm, circuit 109 shall be OFF. The detector circuit which causes circuit 109 to turn ON or OFF shall exhibit hysteresis action such that the level at which the OFF to ON transition occurs shall be at least 2 dB greater than for the ON to OFF transition.

Group B was chosen for this purpose because it is the most critical from a received level point of view.

8.3. **Tolerance**

8.3.1. *Data frequencies tolerances*

The data frequencies tolerances are defined for the keyboard telephone sets. The difference between each frequency and its nominal frequency must not exceed  $\pm 1,8\%$  of the nominal frequency.

Apart from the tolerance of  $\pm 1,8\%$  the (instation) modem receiver shall be capable of accepting an additional difference of  $\pm 6$  Hz caused by the carrier systems.

8.3.2. *Backward channel frequency tolerances*

The tolerances on the 420 Hz-backward channel frequency should be  $\pm 4$  Hz.

9. **OUT-OF-BAND INTERFERENCE**

The limits of the line signal spectrum shall conform to the requirements indicated in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

10. **PERFORMANCE REQUIREMENTS**

The performance of the equipment will be evaluated by testing in accordance with the Specification for the general engineering requirements (Recommendation T/CD 01-01). In addition to those requirements the following requirements regarding error rate limits and parallel distortion limits apply.

The character error rate under GSTN test conditions shall be less  $10^{-5}$ .

The parallel distortion, that means the time difference of the demodulation in the single frequency groups shall be less 2 m/sec.

11. **TESTING AND MEASURING REQUIREMENTS**

To be able to find the source of errors during a transmission procedure (whether it is in the modem or on the line or in the data terminal equipment), the modem shall offer test possibilities.

The modem shall have a unit which—irrespective of whether the data terminal equipment is connected or not—checks the received data signals. If the received data signal is correct, an audible signal is sent to the transmitted station.

12. **DESIGN AND CONSTRUCTION**

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

12.1. **Maintenance requirements**

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

13. **SPECIFIC DESIGN REQUIREMENTS**

No specific requirements.

14. **POWER SUPPLY**

Power consumption shall be less than 20 VA.

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

15. **ENVIRONMENTAL REQUIREMENTS**

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

**Allocation of the interchange circuits to pins of the connector in conformance with ISO Standard 2110**

CCITT	Interchange circuit	Pin
101	Protective ground or earth	1
102	Signal ground or common return	24
A1 104	Received data	3
A2		4
A3		5
A4		6
B1		9
B2		10
B3		11
B4		12
105	Request to send	20
107	Data set ready	23
108/1	Connect data set to line	
108/2	Data terminal ready	22
109	Data channel received line signal detector	8
110	Signal quality detector	2
125	Calling indicator	21
130	Transmit backward channel	19
131	Received character timing	7
191a	Transmitted voice answer	17
191b		18