Recommendation X.20 *bis*

USE ON PUBLIC DATA NETWORKS OF DATA TERMINAL EQUIPMENT (DTE) WHICH IS DESIGNED FOR INTERFACING TO ASYNCHRONOUS DUPLEX V–SERIES MODEMS

(Geneva, 1976; amended at Geneva, 1980, Malaga–Torremolinos, 1984 and Melbourne, 1988)

The CCITT,

considering

(a) that the interface between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for start–stop transmission on public data networks is specified in Recommendation X.20,

(b) that several Administrations are planning to provide as an interim measure the connection to public data networks of start–stop DTEs which are designed for interfacing to V–Series modems for start–stop transmission,

unanimously declares

that the interface between a V–Series type DTE and a DCE in public data networks for user classes of service employing start–stop transmission should be as defined in this Recommendation.

1 Scope

This Recommendation applies to the interface between a DTE designed for interfacing to duplex V–Series modems for start–stop transmission and a DCE on public data networks.

The operation is limited to start–stop transmission at data signalling rates and character structures specified for start–stop transmission in Recommendation X.1.

The application comprises:

a) circuit switched service,

b) leased circuit service (point–to–point and centralized multipoint).

2 Interchange circuits

2.1 *Functional characteristics*

The functional characteristics of the interchange circuits concerned (see Table 1/X.20 *bis*) comply with Recommendation V.24.

TABLE 1/X.20 *bis*

Interchange circuit	
Number	Designation
102	Signal ground or common return
103	Transmitted data
104	Received data
106	Ready for sending
107	Data set ready
108/1[a)]	Connect data set to line
108/2[b)]	Data terminal ready
109	Data channel received line signal detector
125[c)]	Calling indicator
141[d)]	Local loop back
142	Test indicator

[a)] Used in case of automatic control of the direct call facility.

[b)] Used in case of switched data network service.

[c)] Not provided in leased circuit service.

[d)] Not provided in those networks which do not provide automatic activation of the test loops.

2.2 *Electrical characteristics*

The electrical characteristics of the interchange circuits comply with Recommendation V.28, using the 25–pole DTE/DCE interface connector and contact number assignments in ISO Standard 2110.

3 Use of interchange circuits

3.1 *Operation of interchange circuit 107 – Data set ready*

This circuit is used to indicate the operational functions given in Table 2/X.20 *bis*.

TABLE 2/X.20 *bis*

Condition of circuit 107	Meaning in the data network
ON	Ready for data (see Note)
OFF	DCE clear indication
OFF	DCE clear confirmation

Note – Since no circuit 105 is operated, the ON condition on circuit 106 is applied 0 to 20 milliseconds after circuit 107 is turned ON.

3.2 *Use of interchange circuits 108/1 and 108/2*

3.2.1 *Circuit 108/1 – Connect data set to line*

This circuit is used alternatively to circuit 108/2. The operational functions given in Table 3/X.20 *bis* should be indicated.

TABLE 3/X.20 *bis*

Condition of circuit 108/1	Meaning in the data network
ON	Call request for direct call (see § 3.4.1)
ON	Call accepted
OFF	DTE clear request
OFF	DTE clear confirmation (see § 3.4.4)

3.2.2 *Circuit 108/2 – Data terminal ready*

This circuit is used alternatively to circuit 108/1. The operational functions given in Table 4/X.20 *bis* should be indicated.

TABLE 4/X.20 *bis*

Condition of circuit 108/2	Meaning in the data network
ON	Call accepted
OFF	DTE clear request
OFF	DTE clear confirmation (see § 3.4.4)

3.3 *Circuit 125 – Calling indicator*

The ON condition indicates *incoming call*. The circuit will be turned OFF as follows:

– in conjunction with circuit 107 turned ON, or

– *DCE ready* is received from the network, or

– *DCE clear indication* is received from the network.

3.4 *Operational requirements for circuits 106, 107, 108/1, 108/2 and 109*

3.4.1 *Call request for direct call*

For a *direct call* facility the DTE indicates a call request by turning circuit 108/1 ON. Circuit 108/2 cannot be used for this purpose.

3.4.2 *Call accepted*

A DTE receiving an *incoming call* should turn circuit 108/1 or 108/2 from OFF to ON within 500 ms to indicate *call accepted*, otherwise the call will be cleared. A DCE presenting an *incoming call* to a DTE which already has circuit 108/2 ON will regard the ON condition on circuit 108/2 as an indication of *call accepted*.

Optionally when a DTE does not provide circuit 108/1 or 108/2, the *call accepted* signal to the network would be generated within the DCE as an answer to the *incoming call* signal received from the network. However, it may also be possible to signal to the network a *DTE controlled not ready* by a manual action on the DCE.

3.4.3 *Operation of interchange circuits 109 and 106*

The DCE switches circuit 109 to ON together with circuit 107. Circuit 106 is put to ON 0 to 20 ms after the appearance of the ON condition on circuit 107.

The circuits 109 and 106 are switched to OFF either when circuit 108 is switched to OFF or when circuit 108 is ON and the DCE signals *DCE clear indication* (see § 3.4.4).

3.4.4 *DCE clear indication and DTE clear confirmation*

DCE clear indication is signalled to the DTE by turning circuit 107 OFF. The *DTE clear confirmation*, when implemented, should be given by the DTE turning OFF circuit 108/1 or 108/2 within 500 ms after the *DCE clear indication* is signalled on circuit 107. Otherwise, the DCE may consider the DTE as being *uncontrolled not ready* until circuit 108/1 or 108/2 is turned OFF or a *ready* signal is generated by a manual action on the DCE.

Circuit 108/1 should always be able to give *DTE clear confirmation*.

Optionally, when a DTE does not turn circuit 108/2 OFF for *DTE clear confirmation* this would be automatically generated within the DCE as an answer to the *clear indication* received from the network and the DTE will be considered in the *ready* condition.

In the case when the DTE expects to have circuit 107 OFF only as a response to circuit 108/1 or 108/2 OFF, the DCE will not turn circuit 107 OFF as a *DCE clear indication* and in this case the DCE indication will not be signalled to the DTE across the interface. The necessary *DTE clear confirmation* signal will then be automatically generated within the DCE as an answer to the *clear indication* signal received from the network. The DTE may be regarded as *uncontrolled not ready* until circuit 108/1 or 108/2 is turned OFF.

3.4.5 *Centralized multipoint operation*

As the circuits 106 and 109 are always in the ON condition, the transmission disciplines must be determined by end–to–end control procedures of the DTEs.

4 Call progress signals and DCE provided information

Call progress signals and *DCE provided information* cannot be handled by V–Series DTEs.

5 Failure detection and isolation

5.1 *Fault conditions of interchange circuits*

If the DTE or DCE is unable to determine the condition of circuits 107, 108/1 or 108/2 and possibly circuits 103 and 104, it shall interpret this as an OFF condition or binary 1 (circuits 103 and 104) as specified in the relevant electrical interface specifications.

5.2 *DCE fault conditions*

If the DCE is unable to provide service (e.g. loss of incoming line signal) for a period longer than a fixed duration it will turn circuit 107 to the OFF condition. The value of this duration is network dependent.

5.3 *Test loops*

The definitions of the test loops and the principles of maintenance testing using the test loops are provided in Recommendation X.150.

5.3.1 *DTE test loop – type 1 loop*

This loop is used as a basic test of the operation of the DTE, by looping back the transmitted signals inside the DTE for checking. The loop should be set up inside the DTE as close as possible to the DTE/DCE interface.

Except as noted below, while the DTE is in loop 1 test condition:

– circuit 103 is connected to circuit 104 inside of the DTE;

– circuit 103 as presented to the DCE must be in the binary 1 condition;

– circuit 108/1 or 108/2 may be in the same condition as it was before the test;

– circuits 140 and 141, if implemented, must be in the OFF condition.

The conditions of the other interchange circuits are not specified but they should if possible permit normal working.

Loop 1 may be established from either the *data transfer* phase or the *idle* phase.

If the loop is established from the *data transfer* phase, the DCE may continue to deliver data to the DTE during the test as though the DTE were in normal operation. It will be the responsibility of the DTE to recover from any errors that might occur while the test loop is activated.

If the loop is established from the *idle* phase, the DTE should continue to monitor circuit 125 so that an incoming call may be given priority over a routine test.

5.3.2 *Local test loop – type 3 loop*

Local test loops (type 3 loops) are used to test the operation of the DTE, the interconnecting cable and either all or parts of the local DCE, as discussed below.

Where allowed by national testing principles loop 3 may be established from any state.

For testing on leased circuits and for short duration testing, on circuit–switched connections the DCE should continue to present toward the line the conditions that existed before the test (e.g. either *data transfer* or *ready* state). Where this is not practical (e.g. in some cases for loop 3a) or desirable (e.g. for long duration testing in circuit–switched applications) the DCE should terminate an existing call.

Manual control should be provided on the DCE for activation of the test loop.

The automatic activation on this loop, if provided, should be controlled by circuit 141.

The precise implementation on the test loop within the DCE is a national option. At least one of the following local test loops should be implemented.

5.3.2.1 *Loop 3d*

This loop is used to test the operation of the DTE, including the interconnecting cable, by returning transmitted signals to the DTE for checking. The loop is set up inside the local DCE and does not include interchange circuit generators and loads.

While the DCE is in the loop 3d test condition:

– circuit 103 is connected to the circuit 104;

– circuits 107 and 142 are placed in the ON condition.

Note – While test loop 3d is operated, the effective length of the interconnecting cable is doubled. Therefore, to insure proper operation of loop 3d, the maximum DTE/DCE interface cable length should be one–half the length normally appropriate for the data signalling rate in use.

5.3.2.2 *Loop 3c*

This loop is used to test the operation of the DTE, including the interconnecting cable and DCE interchange circuit generators and loads.

The configuration is identical to that given for loop 3d in § 5.3.2.1 with the exception that the looping of circuit 103 to circuit 104 includes the interchange circuit generators and loads. The notes concerning restriction of interface cable length and load input impedance are not applicable.

5.3.2.3 *Loop 3b*

This loop is used as a test of the operation of the DTE and the line coding and control logic and circuitry of the DCE. It includes all the circuitry of the DCE with the exclusion of the line signal conditioning circuitry (e.g., impedance matching transformers, amplifiers, equalizers, etc.). The delay between transmitted and received test data is a few octets. (See Note).

The configuration is identical to that given for loop 3c in § 5.3.2.2 except for the location of the point of loopback.

Note – In some networks the setting of loop 3b will cause clearing of existing connections.

5.3.2.4 *Loop 3a*

This loop is used to test the operation of the DTE and the DCE. The loop should include the maximum amount of circuitry used in DCE working including, in particular, the line signal conditioning circuitry. It is recognized that, in some cases, the inclusion of devices (e.g., attenuators, equalizers or test loop translators) may be necessary in the loopback path. The subscriber line is suitably terminated during a loop 3a test condition.

The configuration is identical to that given for test loop 3b in § 5.3.2.3 except for the location of the point of loopback.

Note – In some networks the setting of loop 3a will cause clearing of existing connections.

5.3.3 *Network test loop – type 2 loop*

Network test loops (test 2 loops) are used by the Administration's test centre to test the operation of the leased line or subscriber line and either all or part of the DCE, as discussed below.

Where, allowed by national testing principles loop 2 may be used by a DTE, as follows:

a) In the case of switched circuit networks in the *data transfer* phase to test the operation of the network connection including the remote DCE. It should be possible to reenter the *data transfer* phase after completion of the network loop test.

b) In the case of leased lines in the *idle* phase to test the operation of the line including the remote DCE. When the test is in progress the DCE will return circuits 107 and 109 in the OFF condition, circuit 104 in the binary 1 condition and circuit 142 in the ON condition.

The loop may be controlled manually by a switch on the DCE or automatically by the network. The control of the loop and the method used for automatic control, when implemented, is a national option.

In case of a collision between a *call request* and the activation of the loop, the loop activation command will have priority and the call request is ignored.

The precise implementation of the test loop within the DCE is a national option. One of the following network test loops should be implemented:

5.3.3.1 *Loop 2b*

This loop is used by the Administration's test centre(s) and/or the remote DTE to test the operation of the subscriber line and all the circuitry of the DCE with the exception of interchange circuit generators and loads.

While the DCE is in the loop 2b test condition:

– circuit 104 is connected to circuit 103 inside of the DCE,

– at the interface, the DCE places circuit 104 in the binary 1 condition and circuit 109 in the OFF condition, or alternatively, may present an open circuit or power off condition on circuits 104 and 109,

– circuits 106, 107 and 125 to the DTE are placed in the OFF condition,

– circuit 142 to the DTE is placed in the ON condition.

5.3.3.2 *Loop 2a*

This loop is used by either the Administration's test centre(s) or the remote DTE to test the operation of the subscriber line and the entire DCE.

The configuration is identical to that given for loop 2b in § 5.3.3.1 except for the location of the point of loopback.

5.3.4 *Subscriber–line test loop – type 4 loop*

Subscriber–line test loops (type 4 loops) are provided for the maintenance of lines by the Administrations.

5.3.4.1 *Loop 4a*

This loop is only provided in the case of 4–wire subscriber lines. Loop 4a is for the maintenance of lines by Administrations. When receiving and transmitting pairs are connected together, the resulting circuit cannot be considered normal. Loop 4a may be established inside the DCE or in a separate device.

While the DCE is in the loop 4a test condition:

– circuit 104 to the DTE is placed in the binary 1 condition,

– circuits 106, 107, 109 and 125 to the DTE are placed in the OFF condition,

– circuit 142 to the DTE is placed in the ON condition.

5.3.4.2 *Loop 4b*

This loop is used by Administrations to test the operation of the subscriber line including the line signal conditioning circuitry in the DCE. When the receiving and transmitting circuits are connected at this point, loop 4b provides a connection that can be considered as normal; however, some impairment of the performance is expected since the DCE does not perform a complete signal regeneration.

The configuration is identical to that given for loop 4a in § 5.3.4.1 except for the location of the point of loopback.