SECTION 2

INTERFACES

Recommendation X.20

INTERFACE BETWEEN DATA TERMINAL EQUIPMENT (DTE) AND DATA CIRCUIT–TERMINATING EQUIPMENT (DCE) FOR START–STOP TRANSMISSION SERVICES ON PUBLIC DATA NETWORKS

(Geneva, 1972; amended at Geneva, 1976 and 1980, Malaga–Torremolinos, 1984 and Melbourne, 1988)

The CCITT,

considering

(a) that Recommendations X.1 and X.2 define the services and facilities to be provided by a public data network;

(b) that Recommendation X.92 defines the hypothetical reference connections for public synchronous data networks;

(c) that Recommendation X.96 defines *call progress* signals;

(d) that the necessary elements for an interface Recommendation should be defined in architectural levels;

(e) that it is desirable for characteristics of the interface between the DTE and DCE of a public data network to be standardized,

unanimously recommends

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

1 Scope

1.1 This Recommendation defines the physical characteristics and call control procedures for a general purpose interface between DTE and DCE for user classes of service, as defined in Recommendation X.1, employing start–stop transmission.

1.2 The formats and procedures for *selection*, *call progress* and *DCE provided information* are included in this Recommendation.

1.3 The provision for duplex operation is covered.

2 DTE/DCE physical interface elements

2.1 *Interchange circuits*

A list of the interchange circuits concerned is presented in Table 1/X.20. Definitions of these interchange circuits are given in Recommendation X.24.

TABLE 1/X.20

Interchange circuit	Interchange circuit name	Direction	
		to DCE	from DCE
G (see Note)	Signal ground or common return		
G_a	DTE common return	X	
G_b	DCE common return		X
T	Transmit	X	
R	Receive		X

Note – This conductor may be used to reduce environmental signal interference at the interface. In case of shielded interconnecting cable, the additional connection considerations are part of Recommendations X.24 and ISO 4903.

2.2 *Electrical characteristics*

The electrical characteristics of the interchange circuits at the DCE side of the interface will comply with Recommendation X.26.

The electrical characteristics at the DTE side of the interface may be applied according to Recommendations X.26, X.27 (without cable termination in the load), or Recommendation V.28.

For interworking between a V.28–DTE and a X.26–DCE refer to Recommendation X.26 and ISO 4903.

2.3 *Mechanical characteristics*

Refer to ISO 4903 (15–pole DTE/DCE interface connector and contact number assignments) for mechanical arrangements.

2.4 *Fault conditions of interchange circuits*

For the association of the receiver circuit–failure detection to particular interchange circuits in accordance with the type of failure detection, see Recommendation X.26, § 11 and Recommendation X.27, § 9.

2.4.1 *Circuit R in failure state*

The DTE should interpret a fault condition on circuit R as r = 0, using failure detection type 2. When the electrical characteristics are applied according to Recommendation V.28, the DTE should interpret generator in power–off condition or open–circuited interconnecting cable as a binary 0.

2.4.2 *Circuit T in failure state*

The DCE will interpret a fault condition on circuit T as t = 0, using failure detection type 2.

3 Call control characters and error checking

All characters for call control purposes are selected from International Alphabet No. 5 according to Recommendation T.50.

Even parity according to Recommendation X.4 applies for IA5 characters interchanged for call control purposes.

4 Elements of the call control phase for circuit switched service

The state diagram provided in Figure A–1/X.20 shows the relationship between the various *call control* phase states as defined below, together with the recognized transactions between these states under normal operating

conditions. Illustrated examples of the time sequence relationships between these states and associated time–out operation are provided in Figure B–1/X.20.

The *call control* phase can be terminated by either the DTE or the DCE by *clearing* as defined in § 6 below.

4.1 *Events of the call control procedures*

(See Figure A–1/X.20.)

4.1.1 *Ready (state 1)*

Circuits T and R show binary 0.

4.1.2 *Call request (state 2)*

The calling DTE shall indicate a request for a call by signalling steady binary condition t = 1 provided that it was previously signalling *DTE ready* (t = 0).

4.1.3 *Proceed–to–select (state 3)*

When the network is prepared to receive selection information, the DCE will signal steady binary condition r = 1.

The *proceed–to–select* signal will start within 6 seconds of the *call request* being sent.

4.1.4 *Selection signal sequence (state 4)*

The *selection* signal sequence shall be transmitted by the DTE on circuit T.

The format of *selection* signal sequence is defined in § 4.6.1 below.

The information content and coding of the *selection* signal sequence is contained in Annex G and Recommendation X.121.

The *selection* signal sequence shall start within 6 seconds of the *proceed–to–select* being received and shall be completed within 36 seconds.

The maximum permissible interval between individual selection characters is 6 seconds.

4.1.5 *DTE waiting (state 5)*

During *DTE waiting* , the DTE signals steady binary condition t = 1.

4.1.6 *Incoming call (state 8)*

The DCE will indicate an incoming call by signalling steady binary condition r = 1.

4.1.7 *Call accepted (state 9)*

The DTE shall accept the incoming call not later than 600 ms by signalling the steady state binary condition t = 1.

10–100 ms thereafter, the DTE transmits the call control character 0/6 (ACK).

4.1.8 *Call not accepted (state 18)*

If the DTE does not wish to accept the incoming call it shall signal this not later than 600 ms by changing circuit T to steady binary condition 1.

10–100 ms thereafter, the DTE shall transmit the call control character 1/5 (NAK) followed by *DTE clear request* (state 13).

4.1.9 *Call progress signal sequence (state 6)*

The *call progress* signal sequence will be transmitted by the DCE to the calling DTE on the R circuit when an appropriate condition is encountered by the network.

A call progress signal sequence will consist of one or more *call progress* signal blocks. A *call progress* signal block will consist of one or more *call progress* signals.

The format of the *call progress* signal sequence is defined in § 4.6.2 below.

The coding of *call progress* signals is provided in Annex E.

The description of *call progress* signals is provided in Recommendation X.96.

A *call progress* signal sequence will be transmitted by the DCE within 60 seconds of: 1) the *end–of–selection* signal or 2) in case of *direct call*, the *proceed–to–select* signal being sent by the DTE. The *call progress* signal sequence, however, will not be sent by the DCE before the reception of the *end–of–selection* signal except in the case of expiration of time–outs described in § 4.1.4 where there may be a *call progress* signal sequence followed by the *clear indication*.

Note – When an error is detected in a received *call progress* signal sequence, the DTE may choose to either ignore the signal or attempt a new call after clearing.

4.1.10 *DCE provided information sequence (states 7A and 7B)*

The *DCE provided information* sequences will be transmitted by a DCE to the calling DTE (state 7A) or a called DTE (state 7B) on circuit R.

A *DCE provided information* sequence will consist of 1 or more *DCE provided information* blocks. Each *DCE provided information* block will be limited to a maximum length of 128 characters.

The format of the *DCE provided information* sequences is defined in § 4.6.3 below.

The information content of *DCE provided information* is given in Annex G.

A *DCE provided information* sequence (state 7B) will be sent to the called DTE within 60 seconds of the *call accepted* signal being sent.

4.1.10.1 *Line identification*

Calling and called line identification is an optional additional facility.

The information content of *calling* and *called line identification* is provided in Annex G.

Calling and *called line identification* will be transmitted by the DCE on the R circuit during states 7B or 7A respectively.

When provided, *called line identification* (state 7A) will be transmitted by the DCE to the calling DTE after all *call progress* signals, if any.

When provided, calling line identification (state 7B) will be transmitted by the DCE to the called DTE after *call accepted* has been sent by the DTE.

In the case where the *calling line identification* facility is not provided by the originating network, or the *called line identification* facility is not provided by the destination network, a *dummy line identification* shall be provided by the DCE to the DTE.

4.1.10.2 *Charging information*

Charging information is an optional additional facility provided during state 7B.

Upon completion of clearing the call for which *charging information* has been requested, the DCE will, within 200 ms after entering *ready* (state 1), establish an incoming call to the DTE for the purpose of giving *charging information*.

Charging information will be transmitted by the DCE on circuit R.

The DCE will send *clear indication* (state 16) upon sending the last *charging information* block. The DTE should send *clear request* (state 13) when it has correctly received the *charging information* signal, if the DCE has not previously signalled the *clear indication*.

The format of *charging information* is defined in § 4.6.3 below.

4.1.11 *Connected (state 10)*

The DCE signals that the connection is being established by the transmission of the call control character 0/6 (ACK) on circuit R. Because of possible switching delays in the network, the DTE must keep circuit T in steady binary condition 1 during this state.

4.1.12 *Ready for data (state 11)*

20 ms after the reception of the call control character 0/6 (ACK) in state 10, the connection is available for data transfer between both DTEs.

4.1.13 *Events of the call control procedures for multipoint circuit–switched service*

4.1.13.1 *Ready (state 1)*

See § 4.1.1.

4.1.13.2 *Call request (state 2)*

See § 4.1.2.

4.1.13.3 *Proceed to select (state 3)*

See § 4.1.3.

4.1.13.4 *Selection signal sequence (state 4)*

See § 4.1.4.

A *facility request* signal is used to indicate the category of the point to multipoint service which is required.

The coding is defined in Annex F.

4.1.13.5 *DTE waiting (state 5)*

See § 4.1.5.

4.1.13.6 *Incoming call (state 8)*

See § 4.1.6.

4.1.13.7 *Call accepted (state 9)*

See § 4.1.7.

4.1.13.8 *Call not accepted (state 18)*

See § 4.1.8.

4.1.13.9 *Call progress signal sequence (state 6)*

See § 4.1.9.

The *call progress* signals related to each of the called DTEs are transmitted and then, in the same order, the *called line identification* signals of the different called DTEs.

When no specific *call progress* signals are necessary for a given called DTE, then the call progress signal “00” is used for this DTE so that the order could be kept.

4.1.13.10 *DCE provided information sequence (states 7A and 7B)*

The DCE provided information sequences will be transmitted by a DCE to the calling DTE (state 7A) or a called DTE (state 7B) on circuit R.

A DCE provided information sequence will consist of one or more *DCE provided information* blocks. Each *DCE provided information* block will be limited to a maximum length of 128 characters, except for *called line identification* in case of multipoint calls where the maximum length is 512 characters.

The format of the *DCE provided information* sequences is defined in § 4.6.3 below.

The information content of DCE provided information is given in Annex G.

A *DCE provided information* sequence will be sent to the called DTE within 60 seconds of the call accepted signal being sent.

4.1.13.10.1 *Line identification*

See § 4.1.10.1.

The *called line identification* related to the different called DTEs are provided in sequence.

4.1.13.10.2 *Charging information*

See § 4.1.10.2.

4.1.13.11 *Connected (state 10)*

See § 4.1.11.

4.1.13.12 *Ready for data (state 11)*

See § 4.1.12.

4.2 *Unsuccessful call*

If the required connection cannot be established, the DCE will indicate this and the reason to the calling DTE by means of a *call progress* signal. Afterwards the DCE will signal *DCE clear indication* (state 16).

4.3 *Call collision (state 19)*

A *call collision* is detected by the DCE when it receives *call request* in response to an *incoming call*. The DCE may either accept the *call request* or may perform *DCE clearing*.

4.4 *Direct call*

For the *direct call* facility, *selection* signals (state 4) are always bypassed.

Note – The *direct call* facility can only be provided on a subscription basis and not on a per–call basis.

4.5 *Facility registration/cancellation procedure*

Registration/cancellation of optional user facilities shall be carried out by a DTE in accordance with normal call establishment procedures using the *selection* sequence, which is defined in § 4.6.1 below.

The format of the *facility registration/cancellation* signal is defined in § 4.6.1.3 below.

The *facility registration/cancellation* procedure shall not be combined with establishment of a normally addressed call, but shall be taken as an independent procedure.

In response to acceptance or rejection of the *facility registration/cancellation* procedure, the network will provide the appropriate *call progress* signal followed by *clear indication*.

4.6 *Selection, call progress and DCE provided information formats*

(See also Annex D for a syntactic description of the formats.)

4.6.1 *Format of selection sequence*

A selection sequence shall consist of a *facility request* block, or an *address* block, or a *facility request* block followed by an *address* block, or a *facility registration/cancellation* block.

4.6.1.1 *Facility request block*

A *facility request* block shall consist of one or more *facility request* signals.

Multiple *facility request* signals shall be separated by character 2/12 (“ , ”).

A facility request signal shall consist of a facility *request* code and may contain one or more facility parameters. The *facility request* code, *facility* parameter and subsequent *facility* parameters shall be separated by character 2/15 (“ / ”). For an interim period the 2/15 (“ / ”) separator will not be used in some networks.

The end of a *facility request* block shall be indicated by character 2/13 (“–”).

The coding of *facility request* , indicator and parameter is provided in Annex F.

4.6.1.2 *Address block*

An *address* block shall consist of one or more *address* signals.

An address signal shall consist of either a *full address* signal or an *abbreviated address* signal.

Start of an abbreviated address signal shall be indicated by a prefix character 2/14 (“ . ”).

Multiple *address* signals shall be separated by character 2/12 (“ , ”).

4.6.1.3 *Facility registration/cancellation block*

A *facility registration/cancellation* block shall consist of one or more *facility registration/cancellation* signals.

A facility registration/cancellation signal shall consist of up to four elements in order: *facility request* code, *indicator*, *registration* parameter, *address* signal.

The elements of a *facility registration/cancellation* signal shall be separated by character 2/15 (“ / ”).

If a *facility registration/cancellation* signal contains less than four of the elements, the elements should be eliminated in reverse order (e.g. a two–element *facility registration/cancellation* signal will contain the *facility request* code “ / ” *indicator*). If any element to be sent within the sequence is not required, a 3/0 (“0”) character should be inserted in the position of each missing element (e.g. *facility request* code /0/0/*Address* signal).

Multiple *facility registration/cancellation* signals shall be separated by character 2/12 (“ , ”).

The end of a *facility registration/cancellation* block shall be indicated by character 2/13 (“–”) followed by character 2/11 (“+”).

4.6.1.4 *End of selection sequence*

The end of a selection sequence shall be indicated by character 2/11 (“+”).

4.6.2 *Format of a call progress sequence*

A call progress block shall consist of one or more *call progress* signals.

Each call progress signal need not be repeated.

Multiple *call progress* signals shall be separated by characters 0/13 (“CR”) and 0/10 (“LF”).

The end of a *call progress* block shall be indicated by character 2/11 (“+”).

4.6.3 *Formats of DCE provided information*

The following formats are specified for *DCE provided information* signals which have been identified.

The *DCE provided information* shall be preceded by the IA5 characters 0/13 (“CR”), 0/10 (“LF”), and except for *calling* and *called line identification*, by the IA5 character 2/15 (“ / ”). To distinguish between different types of *DCE provided information*, the prefix should be followed by one or more numerical characters followed by the character 2/15 (“ / ”) before the actual information is presented. The end of a *DCE provided information* block shall be indicated by character 2/11 (“+”). The order in which the *DCE provided information* blocks are presented to the DTE is variable.

4.6.3.1 *Format of called and calling line identification*

Calling line identification block and called line *identification* block shall be preceded by character 2/10 (“ * ”).

When a *calling* or *called line identification* block contains Data Network Identification Codes (DNIC) or Data Country Codes (DCC), the blocks shall be preceded by 2 characters 2/10 (“ ** ”).

A *called line identification* block shall consist of one or more *called line identification* signals.

Multiple *called line identification* signals shall be separated by characters 0/13 (“CR”) and 0/10 (“LF”).

The end of *calling line identification* signal and *called line identification* block shall be indicated by character 2/11 (“+”).

The dummy line identification block shall be indicated by character 2/10 (“ * ”) followed by 2/11 (“+”).

4.6.3.2 *Format of charging information*

The *charging information* block will be preceded by characters 0/13 (“CR”), 0/10 (“LF”), and 2/15 (“ / ”) followed by a second IA5 numerical character (1 or 2 or 3) followed by character 2/15 (“ / ”). The end of the *charging information* block shall be indicated by character 2/11 (“+”).

5 Data transfer phase

5.1 *Data transfer (state 12), point–to–point circuit switched service*

The events during *data transfer* are the responsibility of the DTE.

5.2 *Data transfer, leased circuit service*

5.2.1 *Ready*

Circuits T and R show binary 1.

5.2.2 *Send data (state 12S)*

Data transmitted by the DTE on circuit T are delivered to the remote DTE on circuit R.

5.2.3 *Receive data (state 12R)*

Data transmitted by a distant DTE are received on circuit R.

5.2.4 *Data transfer (state 12)*

Data are transferred on circuits T and R.

5.2.5 *Termination of data transfer*

The termination of *data transfer* is the responsibility of the DTE.

5.3 *Data transfer (state 12), centralized multipoint circuit–switched service*

The events during data transfer are the responsibility of the DTE.

6 Clearing phase

In centralized multipoint calls:

– clearing by the central DTE implies clearing of the call;

– clearing by a remote DTE clears the call for this DTE, and has no effect on the calls which remain established for the other remote DTEs;

– clearing by the last remote DTE which is still in the call leads to the clearing of the call.

6.1 *Clearing by the DTE (states 13, 14, 15)*

The DTE should indicate clearing by signalling the steady binary condition t = 0, *DTE clear request* (state 13) for more than 210 ms.

The DCE will respond within 6 seconds by signalling the steady state condition r = 0, *DCE clear confirmation* (state 14), for more than 210 ms and will not reverse circuit R to binary 1 before *DCE ready* (state 1).

Within 210–490 ms after the beginning of DCE *clear confirmation* the DTE shall be ready to accept an *incoming call*, i.e. it shall be in the state 15, *DTE ready*.

6.2 *Clearing by the DCE (states 16, 17, 15)*

The DCE will indicate clearing to the DTE by signalling the steady binary condition r = 0, *DCE clear indication* (state 16) for more than 210 ms.

Within 210–490 ms after the beginning of *DCE clear indication* , the DTE should signify *DTE clear confirmation* (state 17) by signalling the steady binary condition t = 0 for more than 210 ms.

Within 490 ms after the beginning of the *DTE clear confirmation*, the DTE shall be ready to accept an *incoming call*, i.e. it shall be in the state 15, *DTE ready*.

6.3 *DCE ready (state 1)*

490 ms after the beginning of *DCE* or *DTE clear confirmation*, respectively, the DCE is ready to accept a new *call request*.

6.4 *Clear collision*

In case *DTE clear request* and *DCE clearing* occur at the same instant or during an overlapping time of 210 ms, the DTE shall proceed in its clearing procedure.

7 Test loops

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

7.1 *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.

Circuit T is connected to circuit R of the DTE while the DTE is in test condition.

Loop 1 may be established from either the *data transfer* or *ready* state.

In some networks, for short routine tests during the *data transfer* state, the DTE should maintain the same status on the interchange circuits as before the test.

If the loop is established from the *data transfer* state, 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 DTEs to recover from any errors that might occur while the test loop is activated.

7.2 *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.

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

7.2.1 *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.

Circuit T is connected to circuit R inside of the DCE while the DCE is in test condition.

Note – While test loop 3d is operated, the effective length of the interface cable is doubled. Therefore, to ensure 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.

7.2.2 *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 § 7.2.1 with the exception that the looping of circuit T to circuit R includes the interchange circuit generators and loads. The note concerning restriction of interface cable length is not applicable.

7.2.3 *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 configuration is identical to that given for loop 3c in § 7.2.2 except for the location of the point of loopback.

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

7.2.4 *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 § 7.2.3 except for the location of the point of loopback.

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

7.3 *Network test loop – type 2 loop*

Network test loops (type 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.

7.3.1 *General*

Loop 2 may be controlled manually on the DCE or automatically from 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 *call request* and the activation of the loop, the loop activation command will have priority.

When the test is in progress, the DCE will signal r = 0.

7.3.2 *Implementation of type 2 loops*

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

7.3.2.1 *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.

Circuit R is connected to circuit T inside of the DCE while the DCE is in loop 2b test condition.

At the interface, the DCE signal r = 0.

7.3.2.2 *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.

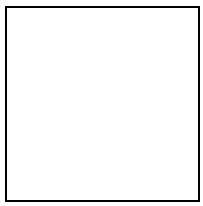
The configuration is identical to that given for loop 2b in § 7.3.2.1 except for the location of the point of loopback.

ANNEX A

(to Recommendation X.20)

Interface signalling state diagrams

Definition of symbols used in state diagrams



Figurer A-1/X.20 CCITT-38370

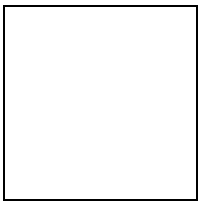


FIGURE A-2/X.20 CCITT-38381

ANNEX B

(to Recommendation X.20)

Interface signalling sequence diagrams and time–out operations

Definition of symbols used to illustrate time–out operation in the signalling sequence diagrams

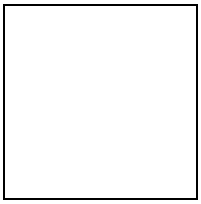


figure CCITT-25052

Note - For additional alternative assignments of DTE time-limits or DCE time-outs not shown together with the signalling sequence diagramas, see Table C-1/X.20.

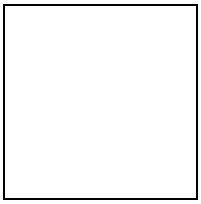


FIGURE B-1/X.20 CCITT-38401

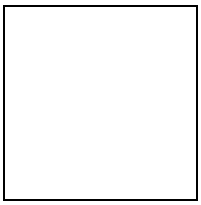


FIGURE B-2/X.20 CCITT-38411

ANNEX C

(to Recommendation X.20)

DTE time–limits and DCE time–outs

C.1 *DTE time–limits*

Under certain circumstances this Recommendation requires the DCE to respond to a signal from the DTE within a stated maximum time. If any of these maximum times is exceeded, the DTE should initiate the action indicated in Table C–1/X.20. To maximize efficiency, the DTE should incorporate time–limits to send the appropriate signal under the defined circumstances summarized in Table C–1/X.20. The time–limits given in the first column are the maximum times allowed for the DCE to respond and are consequently the lower limits of the times a DTE must allow for proper network operation. A time–limit longer than the time shown may be optionally used in the DTE; for example, all DTE time–limits could have one single value equal to or greater than the longest time–limit shown in this table. However, the use of a longer time–limit will result in reduced efficiency of network utilization. The actual DCE response time should be as short as is consistent with the implementing technology and in normal operation should be well within the specified time–limit. The rare situation where a time–limit is exceeded should only occur when there is a failure in DCE operation.

C.2 *DCE time–outs*

Under certain circumstances this Recommendation requires the DTE to respond to a signal from the DCE within a stated maximum time. If any of these maximum times is exceeded, a time–out in the DCE will initiate the actions summarized in Table C–2/X.20. These constraints must be taken into account in the DTE design. The time–outs given in the first column of the table are the minimum time–out values used in the DCE for the appropriate DTE response and are consequently the maximum times available to the DTE for response to the indicated DCE action. The actual DTE response time should be as short as is consistent with the implementing technology and in normal operation should be within the specified time–out. The rare situation where a time–out is exceeded should only occur when there is a failure in the DTE operation.

TABLE C–1/X.20

DTE time–limits

Time–limit	Time–limit number	Started by	Normally terminated by	Preferred action to be taken when time–limit exceeded
6 s	T1	Signalling of *call request* (state 2)	Reception of *proceed–to–select* (state 3)	DTE signals *DTE ready* (state 1)
60 s	T2	Signalling *end–of–selection* or *DTE waiting* (direct call) (state 5)	Reception of *call progress* signals, *DCE–provided information, connected* or *DCE clear indication* (states 6, 7A, 10 or 16), reset by additional *call progress* signals (state 6)	DTE signals *DTE clear request* (state 13)
2 s	T3	Change of state to *DTE clear request* (state 13)	Change of state to *DCE clear confirmation* (state 14) or *DCE ready* (state 1)	DTE regards the DCE as DCE not ready and signals DTE *ready* (state 15)
60 s	T4	Change of state to *call accepted* (state 9)	Reception of connected or *DCE clear indication* (state 10 or 16), reset by *DCE provided information* (state 7B)	
200 ms	T5	Change of state to *ready* (state 1) when *charge information* has been requested	Reception of *incoming call* (state 8)	DTE returns to normal operation and may note absence of *charge information*

TABLE C–2/X.20

DTE time–outs

Time–out	Time–out number	Started by	Normally terminated by	Action to be taken when time–out expires
36 s	T11 (see Note)	DCE signalling of *proceed–to–select* (state 3)	DCE reception of *end–of–selection* signal	DCE will signal *DCE clear indication* (state 16) or transmit appropriate call progress signal followed by *DCE clear indication* (state 16)
6 s	T12	DCE signalling of *proceed–to–select* (state 3)	DCE reception of first selection character or in the case of *direct call, DTE waiting* (state 5)	
6 s	T13 (see Note)	DCE reception of nth selection character (state 4)	DCE reception of (n+1)th selection character or *end–of–selection* signal	
600 ms	T14	DCE signalling of*incoming call* (state 8)	Change of state to *call accepted* (state 9) or *call not accepted* (state 18)	The DTE is noted as not answering. The DCE will signal *DCE ready* (state 1)
500 ms	T15	Change of state to *DCE clear indication* (state 16)	Change of state to *DTE clear confirmation* (state 17)	DCE will signal *DCE ready* and mark *DTE uncontrolled not ready*

Note – T11, T12 and T13 do not apply in the case of a direct call.

ANNEX D

(to Recommendation X.20)

Formats of Selection, Call Progress, and DCE–provided information signals

The following description uses Backus Normal Form as the formalism for syntactic description. A vertical line " | " separates alternatives.

<LF> : : = IA 5 character 0/10

<CR> : : = IA 5 character 0/13

<*> : : = IA 5 character 2/10

<+> : : = IA 5 character 2/11

< , > : : = IA 5 character 2/12

<–> : : = IA 5 character 2/13

< . > : : = IA 5 character 2/14

< / > : : = IA 5 character 2/15

<η> : : = IA 5 characters 3/0–3/9

< : > : : = IA 5 character 3/10

<Facility request signal> : : = See Annex F

<Facility parameter> : : = See Annex F

<Full address signal> : : = See Recommendation X.121

<Abbreviated address signal> : : = National option

<Calling line identification signal> : : = See Annex G

<Called line identification signal> : : = See Annex G

<Charging information> : : = See Annex G

<Indicator> : : = See Annex F

<Facility request code> : : = See Annex F

<Registration parameters> : : = See Annex F

<Call progress signal> : : = See Annex E

The above signals are combined as follows:

<Address signal> : : = <Full address signal> | < . > <Abbreviated address signal>

<Address block> : : = <Address signal> | <Address block> < , > <Address signal>

<Facility registration/cancellation signal> : : = <Facility request code> < / > <Indicator> < / > <Registration parameter> < / > <Address signal>

<Facility registration/cancellation block> : : = <Facility registration/cancellation signal> | <Facility registration/cancellation block> < , > <Facility registration/cancellation signal>

<Facility request signal> : : = <Facility request code> | <Facility request signal> < / > <Facility parameter>

<Facility request block> : : = <Facility request signal> | <Facility request block> < , > <Facility request signal>

<Selection sequence> : : =	<Facility request block> <–> <Address block> <+> | <Facility request block> <–> <+> | <Address block> <+> | <Facility registration/cancellation block> <–> <+>
<Call progress signal> : : =	<Call progress code> | <Call progress code> <–> <indicator>
<Call progress block> : : =	<CR> <LF> <Call progress signal> <+> | <Call progress signal> < , > <Call progress block>
<Calling line identification> : : =	<CR> <LF> <*> <Calling line identification signal> <+>
<Calling line identification (with DNIC or DCC)> : : =	<CR> <LF> <**> <Calling line identification signal> <+>
<Called line identification> : : =	<CR> <LF> <*> <Called line identification block> <+>
<Called line identification block> : : =	<Called line identification signal> | <Called line identification block> <CR> <LF> <Called line identification signal>
<Called line identification (with DNIC or DCC)> : : =	<CR> <LF> <**> <Called line identification block> <+>
<Dummy line identification> : : =	<CR> <LF> <*> <+>
<DCE–provided information block> : : =	<DCE–provided information signal> <+> | <DCE–provided information signal> < , > <DCE–provided information block> (see Note)

Note – For DCE–provided information signals and blocks other than calling or called line identification signals and blocks.

ANNEX E

(to Recommendation X.20)

Coding of call progress signals

TABLE E–1/X.20

Code group (see Note 1)	Code	Indicator	Significance	Category
0	00 01 02 03	– – – –	See Note 2 Terminal called Redirected call Connect when free	Without clearing
2	20 21 22 23	– – – –	No connection Number busy Selection signals procedure error Selection signals transmission error	With clearing due to short–term conditions
3	–	–	–	Unassigned
4 and 5	41 42 43 44 45 45 46 47 48 49 51 52	– – – – – YY–MM–DD–hh:mm – – – – – –	Access barred Changed number Not obtainable Out of order Controlled not ready DTE inactive until . . Uncontrolled not ready DCE power off Invalid facility request Network fault in local loop Call information service Incompatible user class of service	With clearing due to long–term conditions
6	61	–	Network congestion	With clearing due to network short–term conditions
7	71 72	– –	Long–term network congestion RPOA out of order	With clearing due to network long–term conditions
8	81 82 83	– – –	Registration/cancellation confirmed Redirection activated Redirection deactivated	With clearing due to network procedure
9	Reserved for national purposes			

Note 1 – From the DTE point of view group 0 means “wait”; groups 2 and 6 mean “try again, next try may result in a call set–up”; groups 4 and 5, and 7 mean “there is no reason for the DTE to try again because the answer will be the same for a longer period of time”. Since group 8 results from a procedure between the DTE and the network, no special action is expected to be taken by the DTE.

Some Administrations may specify by regulation both the delay between and the maximum number of call re–attempts permitted by a DTE in these circumstances (see Recommendation X.96).

Note 2 – Reserved for future use.

ANNEX F

(to Recommendation X.20)

Facility request, indicator, and parameter coding

(for use as appropriate in *facility request* signals and *facility registration/cancellation* signals)

TABLE F–1/X.20

(see Annex D for formats and Note 1 below)

Facility request code	Facility parameter	Indicator	Registration parameter	Address	Facility
0	–	–	–	–	Reserved for future use (may be combined with second character)
1	XX (see Note 2)	–	–	–	Closed user group (other than preferential)
2	–	–	–	–	Unassigned
3	–	–	–	–	Unassigned
45	–	1	YY–MM–DD–hh:mm	–	DTE inactive registration
45	–	2	–	–	DTE inactive cancellation
4	–	–	–	–	Reserved
50	–	–	–	–	Reserved
51	–	–	–	–	Reserved
53	–	–	–	–	Reserved
60	0, 1, 2, 3, 4	–	–	–	Multiple address calling
61	–	–	–	–	Charging information
62	–	–	–	–	Called line identification
63	–	1	–	–	Activation of redirection of call
63	–	2	–	–	Cancellation of redirection of call
63	–	3	–	–	Status of redirection of call
64	–	–	–	–	Reverse charging
65	–	1	–	AS	Direct call registration
65	–	2	–	–	Direct call cancellation
66	–	1	AAS	AS	Abbreviated address registration
66	–	2	AAS	–	Abbreviated address cancellation
68	–	–	–	–	Reserved
7	–	–	–	–	Reserved
8	–	–	–	–	Reserved
9	Reserved for national purposes				

AAS: Abbreviated address signal

AS: Address signal

Note 1 – For an interim period, the 2/15 (i.e. "/") separator in the formats will not be used in some networks.

Note 2 – XX is an index number, i.e. a key code for closed user group other than the preferential group. The index number shall be used to distinguish between parts of groups within one facility. The index number shall furthermore be chosen from IA5, column 3, positions 3/0–3/9, giving a range of possible numbers from 00 to 99.

F.1 *Multiple address calling*

This facility provides the DTE with the capability to request a category of point to multipoint service.

The coding is as follows:

<60> < / > <i> <–> <Address block> <+>

where i is numerical character with the following significance:

0 Reserved

1 Reserved

2 Reserved

3 Centralized multipoint

4 Reserved

5 Reserved

F.2 *Charging information*

This facility enables the DTE to request at the call establishment phase that charging information for the call be provided at the end of the call:

<61> <–> <Address> <+>

F.3 *Redirection of call*

This facility enables the DTE to request the network to route its incoming calls towards another address. The use of this facility is assigned for an agreed contractual period.

Activation of redirection of call – The activation of this facility is coded as follows:

<63> < / > <1> <–> <+>

Cancellation of redirection of call – The cancellation of this facility is coded as follows:

<63> < / > <2> <–> <+>

Status of redirection of call – The DTE has the capability to ask the network for the status of its redirection. The coding is as follows:

<63> < / > <3> <–> <+>

F.4 *Reverse charging*

This facility enables the DTE to request that reverse charging be applied for the call.

The coding is as follows:

<64> <–> <Address> <+>

F.5 *Abbreviated address calling*

This facility enables the DTE to define a full address by an abbreviated address.

The registration coding of an abbreviated address is as follows:

<66> < / > <1> < / > <xy> < / > <Address> <–> <+>

where

<xy> = abbreviated address corresponding to the full address,

<address> = full address

Cancellation – The coding of the cancellation of an abbreviated address is as follows:

<66> < / > <2> < / > <xy> < / > <–> <+>

The coding of the abbreviated address is as follows:

< . > <xy> <+>

F.6 *DTE inactive registration/cancellation*

This facility enables the DTE to inform the network about a period of time during which the DTE is unable to accept incoming calls for circuit–switched service.

DTE inactive registration – The activation of this facility is as follows:

<45> < / > <1> < / > <YY–MM–DD–hh:mm> <–> <+>

where

YY: year, MM: month, DD: day, hh: hour, mm: minute

IA5 characters are used for "YY", "MM", "DD", "hh", "mm", "–", and " : ".

DTE inactive cancellation – The coding is as follows:

<45> < / > <2> <–> <+>

ANNEX G

(to Recommendation X.20)

Information content of DCE provided information

G.1 *General*

Except for the *calling* and *called line identification* , the general format for *DCE–provided information*, as defined in § 4.6.3 should apply.

The coding of the numerical character used to distinguish between different types of *DCE–provided information* is indicated in Table H–1/X.21.

G.2 *Information content of calling and called line identification*

Two formats are defined:

i) *Calling* and *called line identification* consist of the international data number as defined in Recommendation X.121 preceded by *two* prefixes 2/10 (" ** ").

In the case where the originating network does not provide *calling line identification*, only the Data Network Identification Code (DNIC) part of the international data number preceded by two prefixes 2/10 (" ** ") may be sent in place of the *dummy line identification*.

ii) Calling and called line identification consist of the National Number (NN) or Network Terminal Number (NTN) preceded by the prefix 2/10 (" * ").

G.3 *General coding of the DCE provided information*

TABLE G–1/X.20

Coding of DCE provided information

Identifier	Meaning	Remarks
0	Reserved	
1 2 3	Charging information Charging information Charging information	See details in § G.3
4		
5	Date and time indication	See details in § G.4
6	Characteristics of the call	See details in § G.5
7	Type of call indication	See details in § G.6
8	Reserved	
9	Reserved	

G.4 *Information content of charging information*

The *charging information* will inform the subscriber of either the monetary charges for a call, the duration of the call, or the number of units used during the call.

When *charging information* is given in monetary charges for the call, n = 1 and the information shall consist of x number of integer digits optionally followed by a colon and two digits representing the fraction. The format applied is as follows:

< / > <1> < / > <X . . . >

< / > <1> < / > <X . . . > < : > <yy>

When the *charging information* is presented as the duration of a call, n = 2 and the information shall consist of x number of integer digits representing seconds. The format applied is as follows:

< / > <2> < / > <X . . . >

When the *charging information* is presented as the number of units used, n = 3, and the information shall consist of x number of integer digits representing the units. The format applied is as follows:

< / > <3> < / > <X . . . >

G.5 *Date and time indication*

The *date and time indication* will inform the subscriber of the date and time the call is established.

The format for the *date and time indication* is as follows:

< / > <5> < / > <YY–MM–DD–hh:mm>

where

<5> is the DCE–provided information identification number

YY: year, MM: month, DD: day, hh: hour, mm: minute

IA5 characters are used for “YY”, “MM”, “DD”, “hh”, “mm”, “–” and “:”.

G.6 *Characteristics of the call*

The *characteristics of the call* will inform the called DTE of the different facilities that have been requested by the calling DTE.

The format of the *characteristic of the call* is as follows:

< / > <6> < / > <xy>

where

x and y are two numerical characters.

Table G–2/X.20 indicates the allocation of values of these two characters to facilities.

TABLE G–2/X.20

00	Reserved
01	Reverse charging
02	Reserved
03	Reserved

G.7 *Type of call indication*

The *type of call indication* will inform the called DTE of the configuration of the incoming call.

The format of the *type of call indication* is as follows:

< / > <7> < / > <xy>

where

x and y are two numerical characters.

Table G–3/X.20 indicates the allocation of values of those two characters to different configurations of calls.

TABLE G–3/X.20

00	Reserved
01	Reserved
02	Reserved
03	Centralized multipoint
04	Reserved

G.8 *Closed user group indication*

The *closed user group indication* will inform the called DTE to which closed user group the indication call belongs.

The format of the *closed user group indication* is as follows:

< / > <81> < / > <xxxx . . . x>

where

<x> is the closed user group index number.

G.8.1 *Closed user group outgoing access indication*

The *closed user group outgoing access* indication will inform the called DTE from a DTE belonging to a closed user group with outgoing access facility. If the called DTE belongs to the same closed user group, the local user group index number will be indicated. In other cases no indication will be given.

The format of the *closed user group outgoing access indication* is as follows:

< / > <82> < / > <xx . . . x>

where

<x> is the closed user group index number.