



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

X.61

PUBLIC DATA NETWORKS

TRANSMISSION, SIGNALLING AND SWITCHING

**SIGNALLING SYSTEM No. 7 - DATA
USER PART**

ITU-T Recommendation X.61

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation X.61 was published in Fascicle VIII.3 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.

SIGNALLING SYSTEM No. 7 - DATA USER PART

*(Former Recommendation X.60, Geneva, 1976
amended at Geneva, 1980, and Malaga-Torremolinos, 1984)*

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¹⁾ This Recommendation appears in the Series Q Recommendations as Recommendation Q.741.

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1 Functional description of the signalling system

1.1 *General*

Use of Signalling System No. 7 for call control or for facility registration and cancellation signalling for circuit-switched data transmission services requires:

- application of Data User Part (DUP) functions, in combination with
- application of an appropriate set of Message Transfer Part (MTP) functions.

A general description of the signalling system is given in Recommendation Q.701. That Recommendation also defines the division of functions and the requirements of interaction between the Message Transfer Part and the Data User Part.

1.2 *Data User Part*

The Data User Part specified in this Recommendation defines the necessary call control, and facility registration and cancellation related elements for international common channel signalling by use of Signalling System No. 7 for circuit-switched data transmission services. As regards call control and signalling procedures for international user facilities and network utilities, refer to Recommendation X.300.

The signalling system meets all requirements defined by CCITT concerning service features, user facilities and network utilities for circuit-switched data transmission services.

It can be used to control switching of various types of data circuits, including satellite circuits, to be used in worldwide circuit-switched data connections. It is designed for both-way operation of data circuits.

The signalling system is suitable for national circuit-switched data applications. Most data signalling message types and signals specified for international use are also required in typical national data applications. In addition to these, national data applications typically require additional types of signals; such requirements that have been identified are already provided for. The system provides ample spare capacity to cater for further additions of new message types and signals should such a need arise.

The label structures specified for data signalling messages require that all exchanges using the signalling system are allocated codes from code plans established for the purpose of unambiguous identification of signalling points, see Recommendations Q.701 and Q.704. The principles to apply to the international signalling network are specified in Recommendation Q.708.

1.3 *Message Transfer Part*

The Message Transfer Part of Signalling System No. 7 is specified in separate Recommendations. An overview description of the Message Transfer Part is contained in Recommendation Q.701.

The Message Transfer Part defines a range of functions by which different signalling modes and different signalling network configurations may be realized. Any application of Signalling System No. 7 requires that an appropriate selection of these functions is applied depending on the intended use of the system and the characteristics of the telecommunications network concerned.

2 **General function of data signalling messages, signals, indicators, codes and conditions**

This paragraph describes general functions of data signalling messages, signals, indicators, codes and conditions which are used to set up a call, to control user facilities and to control and supervise a circuit. The requirements relating to the use of the signalling messages and their signalling information content are specified in §§ 3, 4, and 5.

2.1 *Signalling messages*

2.1.1 *Call and circuit related messages*

Call and circuit related messages are used to set up and clear a call or control and supervise the circuit state.

2.1.1.1 *Address message*

A message sent in the forward direction, containing signalling information required to route and connect the call to the called user. This message contains address information, class of service information, etc., and may also contain additional information such as, for example, calling line identity.

2.1.1.2 *Calling line identity message*

A message sent in the forward direction, containing the calling line identity or the originating network identity. This message is sent subsequently to an address message, which does not contain the calling line identity, when requested by the destination network.

2.1.1.3 *Call accepted message*

A message sent in the backward direction, containing information to indicate that connection of the call is allowed by the destination exchange. It may also contain additional information such as, for example, called line identity.

2.1.1.4 *Call rejected message*

A message sent in the backward direction containing a signal to indicate the cause of the failure of the call set-up as the response to the address message and initiating clearing of the call. The call rejected message will be sent as either the first response, or the second response after sending the call accepted message when the call fails to be completed at the destination exchange, e.g. because no call accepted signal was received from the called user.

2.1.1.5 *Clear message*

A message sent in either direction, containing information about the clearing of the call.

2.1.1.6 *Circuit state message*

A message sent in either direction, containing signals to control and supervise a circuit.

2.1.2 *Facility registration and cancellation related messages*

Facility registration and cancellation related messages are used to exchange information between originating and destination exchanges to register and cancel information related to user facilities. The exchange of this type of message is generally not associated with a call between two users.

2.1.2.1 *Facility registration/cancellation request message*

A message sent in the forward direction to register or cancel a user facility. This message contains information which identifies the user requesting facility registration or cancellation and information relating to the facility concerned.

2.1.2.2 *Facility registration/cancellation request accepted message*

A message sent in the backward direction, containing information that registration or cancellation is completed or accepted at the destination exchange.

2.1.2.3 *Facility registration/cancellation request rejected message*

A message sent in the backward direction, containing information that the registration or cancellation is not completed or accepted at the destination exchange with information indicating a reject cause.

2.2 *Service information*

The service information provides the highest level of discrimination between different sets of signalling messages. It contains the following components.

2.2.1 *Service indicator*

Information used to identify the User Part to which the signalling message belongs.

2.2.2 *National indicator*

Information used for discrimination between international and national messages. In case of national messages, it may for example also be used for discrimination between different label alternatives for national use.

2.3 *Signalling information transferred in the signalling messages*

2.3.1 *Label components*

In the case of call and circuit related messages, the label is used for message routing and, in general, for identification of the data circuit selected for the call. In the case of facility registration and cancellation messages, the label only provides a message routing function. The standard label structure consists of the following components.

2.3.1.1 *Destination point code*

Information identifying the signalling point to which the message is to be routed.

2.3.1.2 *Originating point code*

Information identifying the signalling point from which the message has been originated.

2.3.1.3 *Bearer identification code*

Information identifying the 64 kbit/s bearer among those interconnecting the destination point and originating point.

2.3.1.4 *Timeslot code*

Information identifying the submultiplexed circuit at a lower bit rate on the 64 kbit/s bearer which is itself identified by the bearer identification code.

2.3.2 *Message format identifiers*

2.3.2.1 *Heading*

Information discriminating, as applicable, between different groups of individual types of messages within the set of messages identified by the service information. The heading is split into two levels. The first level discriminates between different message groups. The second level either discriminates between different message types or contains a signal.

2.3.2.2 *Field length indicator*

Information associated with and indicating the length of a variable length field.

2.3.2.3 *Field indicator*

Information associated with and indicating the presence or absence of an optional field.

2.3.3 *Basic call set-up address information*

2.3.3.1 *Address signal*

A signal containing an element of a Data Country Code (DCC), Data Network Identification Code (DNIC) or a data number.

2.3.3.2 *Destination address*

Information sent in the forward direction consisting of a number of address signals indicating the complete data number of the called user.

2.3.4 *Basic call set-up indicators*

2.3.4.1 *National/international call indicator*

Information (for national use only) sent in the forward direction indicating whether the call is a national or international call. In the destination network, it may for example be used in connection with user facilities requiring separate handling of international calls.

2.3.4.2 *DCC/DNIC indicator*

Information (for national use only) sent in either direction, associated with a data number, indicating whether the DCC/DNIC is included in that data number.

2.3.4.3 *Alternative routing indicator*

Information sent in the forward direction indicating that the call has been subjected to an alternative routing and which may be used to prevent the call being set up over an alternative route more than once.

Note - This signal is provided provisionally, and will be subject to change when the necessary network capabilities for routing have been determined.

2.3.4.4 *User class indicator*

Information sent in the forward direction, indicating the user class of service of the calling user. This indicator may be used to determine the type of interexchange data circuit to be selected and to verify that the calling and called users belong to the same user class.

2.3.5 *Basic call set-up response signals*

2.3.5.1 *Call accepted signal*

A signal sent in the backward direction, indicating that the call can be completed. At the originating exchange, it results in preparing for data path through-connect and charging.

2.3.5.2 *Transit through-connect signal*

A signal sent in the backward direction, specifically provided for interworking with decentralized signalling (see Recommendation X.80), indicating that the call can be completed and that through-connection of transit exchanges using decentralized signalling may take place.

2.3.5.3 *Network failure signal*

A signal sent in the backward direction indicating that the call cannot be completed because of a temporary fault condition within the network, e.g. expiry of a time-out or line fault. At the originating exchange it results in sending a *no connection* call progress signal to the calling user and clearing the call.

2.3.5.4 *Number busy signal*

A signal sent in the backward direction, indicating that the call cannot be completed because the called user's access line to the exchange is engaged in another call. At the originating exchange it results in sending a *number busy* call progress signal to the calling user and clearing the call.

2.3.5.5 *Access barred signal*

A signal sent in the backward direction, indicating that the call cannot be completed because a user facility prevents connection of the call to the called user, e.g. as a result of failure of a closed user group validation check. At the originating exchange, it results in sending an *access barred* call progress signal to the calling user and clearing the call.

2.3.5.6 *Changed number signal*

A signal sent in the backward direction, indicating that the call cannot be completed because the called number has been changed recently. At the originating exchange, it results in sending a *changed number* call progress signal to the calling user and clearing the call.

2.3.5.7 *Not obtainable signal*

A signal sent in the backward direction, indicating that the call cannot be completed because the called number is not in use or assigned. At the originating exchange, it results in sending a *not obtainable* call progress signal to the calling user and clearing the call.

2.3.5.8 *Out of order signal*

A signal sent in the backward direction, indicating that the call cannot be completed because either the called user's terminal or the called user's access line is out of service or faulty. At the originating exchange, it results in sending an *out of order* call progress signal to the calling user and clearing the call.

2.3.5.9 *Controlled not ready signal*

A signal sent in the backward direction, indicating that the call cannot be completed because the called user's terminal is in a *controlled not ready* condition. At the originating exchange, it results in sending a *controlled not ready* call progress signal to the calling user and clearing the call.

2.3.5.10 *Uncontrolled not ready signal*

A signal sent in the backward direction, indicating that the called user's terminal is in an *uncontrolled not ready* condition. At the originating exchange, it results in sending an *uncontrolled not ready* call progress signal to the calling user and clearing the call.

2.3.5.11 *DCE power off signal*

A signal sent in the backward direction, indicating that the called user's DCE is switched off. At the originating exchange, it results in sending a *DCE power off* call progress signal to the calling user and clearing the call.

2.3.5.12 *Network fault in local loop signal*

A signal sent in the backward direction, indicating that a fault has been detected in the local access connection for the called user. At the originating exchange, it results in sending a *network fault in local loop call* progress signal to the calling user and clearing the call.

2.3.5.13 *Call information service signal*

A signal sent in the backward direction, indicating that the called terminal is not available for reasons which have been indicated to the information service, and which are not covered by another specific signal. At the originating exchange, it results in sending a *call information service* call progress signal to the calling user and clearing the call.

2.3.5.14 *Incompatible user class of service signal*

A signal sent in the backward direction, indicating that the called user's terminal is incompatible with the characteristics of the calling user's terminal, e.g. different user class of service. At the originating exchange, it results in sending an *incompatible user class of service* call progress signal to the calling user and clearing the call.

2.3.5.15 *Network congestion signal*

A signal sent in the backward direction, indicating that the call cannot be completed because of temporary congestion or temporary fault conditions encountered on the route to the called customer. At the originating exchange this signal results in sending a *network congestion* call progress signal to the calling user and clearing the call.

2.3.5.16 *Degraded service signal*

A signal sent in the backward direction, indicating that a part of the network, due to faulty conditions, has a very much reduced grade of service, which is likely to persist for some time. At the originating exchange, it results in sending a *long-term network congestion* call progress signal to the calling user and clearing the call.

2.3.5.17 *Charge/no charge indicator*

Information (for national use only) sent in the backward direction that may be used to indicate that the call should not be charged at the originating exchange.

2.3.6 *Basic call clearing and circuit state signals*

2.3.6.1 *Circuit released signal*

A signal sent in either direction indicating that the interexchange data circuit has been released.

2.3.6.2 *Circuit released acknowledgement signal*

A signal sent in either direction in response to the *circuit released* signal and indicating that the interexchange data circuit has been released.

2.3.6.3 *Reset circuit signal*

A signal sent to return the interexchange data circuit to the idle state at both ends in situations where, due to memory mutilation or other causes, the state of the circuit is ambiguous.

2.3.6.4 *Blocking signal*

A signal sent for maintenance purposes indicating to the exchange at the other end of the interexchange data circuit that the circuit has to be blocked for outgoing calls.

2.3.6.5 *Unblocking signal*

A signal sent to cancel the blocked condition at the exchange at the other end of the interexchange data circuit caused by an earlier *blocking* signal.

2.3.6.6 *Blocking acknowledgement signal*

A signal sent in response to a *blocking* signal indicating that the interexchange data circuit has been blocked.

2.3.6.7 *Unblocking acknowledgement signal*

A signal sent in response to an *unblocking* signal indicating that the interexchange data circuit has been unblocked.

2.3.7 *Additional signals relating to the closed user group facilities*

2.3.7.1 *Closed user group call indicator*

Information sent in the forward direction and in some circumstances in the backward direction, indicating whether or not the call involves a closed user group, whether an interlock code is included in the message and whether or not outgoing access is allowed for the calling user.

2.3.7.2 *Interlock code*

Information sent in the forward direction, and in some circumstances, in the backward direction, identifying a closed user group to which the calling user belongs.

2.3.8 *Additional signals relating to the bilateral closed user group and the bilateral closed user group with outgoing access facilities*

2.3.8.1 *Bilateral closed user group call indicator*

Information sent in the forward direction, indicating whether or not the call is a call within a bilateral closed user group.

2.3.8.2 *Registration request signal*

A signal sent in the forward direction, indicating that facility registration is required.

2.3.8.3 *Cancellation request signal*

A signal sent in the forward direction, indicating that facility cancellation is required.

2.3.8.4 *Registration completion signal*

A signal sent in the backward direction, indicating that facility registration is completed at the destination exchange. At the originating exchange, it results in sending a *registration/cancellation confirmed* call progress signal to the calling user.

2.3.8.5 *Registration accepted signal*

A signal sent in the backward direction, indicating that facility registration is accepted at the destination exchange. At the originating exchange it results in sending a *registration/cancellation confirmed* call progress signal to the calling user.

2.3.8.6 *Cancellation completed signal*

A signal sent in the backward direction, indicating that facility cancellation is completed at the destination exchange. At the originating exchange it results in sending a *registration/cancellation confirmed* call progress signal to the calling user.

2.3.8.7 *Local index*

Information sent in the forward direction and backward direction at bilateral closed user group registration. It indexes the subscriber file to identify the particular bilateral closed user group at the originating or destination exchange.

2.3.9 *Additional signals relating to the calling line identification facility*

2.3.9.1 *Calling line identification request indicator*

Information sent in the backward direction, indicating whether or not the calling line identity should be sent forward.

2.3.9.2 *Calling line identity indicator*

Information sent in the forward direction, indicating whether, and what form of, a calling line identity is included in the message.

2.3.9.3 *Calling line identity*

Information sent in the forward direction, consisting of a number of address signals indicating the (international) data number of the calling user.

2.3.10 *Additional signals relating to the called line identification facility*

2.3.10.1 *Called line identification request indicator*

Information sent in the forward direction, indicating whether or not the called line identity should be returned.

2.3.10.2 *Called line identity indicator*

Information sent in the backward direction, indicating whether, and what form of, the called line identity is included in the message.

2.3.10.3 *Called line identity*

Information sent in the backward direction, consisting of a number of address signals indicating the (international) data number of the called user.

2.3.11 *Additional signals relating to redirection of calls facility*

2.3.11.1 *Redirection request signal*

A signal (for national use only) sent in the backward direction, indicating that the called user has requested redirection of calls to another address.

2.3.11.2 *Redirection address indicator*

Information (for national use only) sent in the backward direction, indicating that a redirection address is included in the message.

2.3.11.3 *Redirection address*

Information (for national use only) sent in the backward direction, consisting of a number of address signals, indicating the data number to which the call is to be redirected.

2.3.11.4 *Redirected call indicator*

Information (for national use only) sent in the forward direction, indicating that the call is a redirected call. This indicator is used to prevent a further redirection, if the user at new address has also requested redirection of calls.

2.3.11.5 *Redirected call signal*

A signal sent in the backward direction, indicating that the call has been redirected to an address other than the destination address selected by the calling user. At the originating exchange, it results in sending a *redirected call progress signal*.

2.3.12 *Additional signals relating to the connect when free and waiting allowed facilities*

2.3.12.1 *Connect when free signal*

A signal sent in the backward direction, indicating that the called user, having the *connect when free* facility, is busy and that the call has been placed in a queue. At the originating exchange it results in sending a *connect when free call progress signal* to the calling user if he has the *waiting allowed* facility or, if not, in sending *the number busy* call progress signal and clearing the call.

2.3.13 *Additional signals relating to the reverse charging and reverse charge acceptance facilities*

2.3.13.1 *Reverse charging request indicator*

Information sent in the forward direction, indicating that reverse charging is requested by the calling user.

2.3.13.2 *Reverse charge acceptance not subscribed signal*

A signal sent in the backward direction, indicating rejection of the call because the called user does not subscribe to the *reverse charge acceptance* facility. At the originating exchange it results in sending a *reverse charge acceptance not subscribed* call progress signal to the calling user.

2.3.14 *Additional signals relating to manual answer*

2.3.14.1 *Terminal called*

A signal sent in the backward direction, indicating that the called user operates with manual answer. At the originating exchange it results in sending a *terminal called* call progress signal to the calling user.

2.3.15 *Additional signals relating to the RPOA selection facilities*

2.3.15.1 *RPOA selection indicator*

Information (for national use only) sent in the forward direction, indicating whether or not the calling user requires selection of an RPOA for international call routing at the international gateway. When RPOA selection is required, it also indicates that a RPOA transit network identity is included in the message.

2.3.15.2 *RPOA transit network identity*

Information (for national use only) sent in the forward direction, identifying the requested RPOA transit network by its DNIC.

2.3.15.3 *RPOA out of order signal*

A signal (for national use only) sent in the backward direction, indicating that the call cannot be completed, because the selected RPOA transit network is not available for service. At the originating exchange, it results in sending an *RPOA out of order* call progress signal to the calling user.

2.3.16 *Additional signals relating to the network identification utilities*

2.3.16.1 *Network identity*

Information sent in either direction, identifying an originating, a transit or destination network by its DNIC.

2.3.16.2 *Originating network identification request indicator*

Information sent in the backward direction, indicating whether or not the originating network identity should be sent forward.

2.4 *Data channel signalling conditions*

These are interexchange data channel conditions employed in the call set-up and clear-down procedures. The conditions defined in § 2.4 are based on the characteristics of the relevant DTE/DCE interfaces for the circuit-switched service. The implications of other possible new DTE/DCE interfaces on these conditions have not yet been determined.

2.4.1 *Trunk free condition*

A condition transmitted in the forward or backward interexchange data channels when the circuit is free or under release at the sending exchange.

2.4.2 *Trunk seized condition*

A condition transmitted in the forward interexchange data channel when the circuit is seized but not through-connected.

2.4.3 *Call accepted condition*

A condition appearing in the backward interexchange data channel, indicating that all the succeeding exchanges involved in the connection have connected through. This condition is sent by the called user and corresponds to the *call accepted* state at the DTE/DCE interface.

2.4.4 *Clear request condition*

A condition, appearing in the forward and backward interexchange data channels, sent by the user when requesting to clear the call.

3 Formats and codes

3.1 *Basic format characteristics*

3.1.1 *General*

The data signalling messages are carried on the signalling data link by means of Signal Units (SU), the format of which is described in the specifications of the Message Transfer Part (MTP), see Recommendation Q.703.

The data signalling messages are divided into two categories, call and circuit related messages and facility registration and cancellation related messages. The Service Indicator (SI) included in each signal unit identifies to which category the message belongs.

The signalling information of each message constitutes the Signalling Information Field (SIF) of the corresponding SU signal unit and consists of an integral number of octets. It basically contains the label, the heading code and one or more signals and/or indicators.

3.1.2 *Service information octet*

3.1.2.1 *Format*

The service information octet comprises the service indicator and the subservice field.

The service indicator is used to associate signalling information with a particular User Part and is only used with message signal units (see Recommendation Q.703).

The information in the subservice field permits a distinction to be made between national and international signalling messages. In national applications when this discrimination is not required, possibly for certain national User Parts only, the subservice field can be used independently for different User Parts.

The format of the service information octet is shown in Figure 1/X.61.

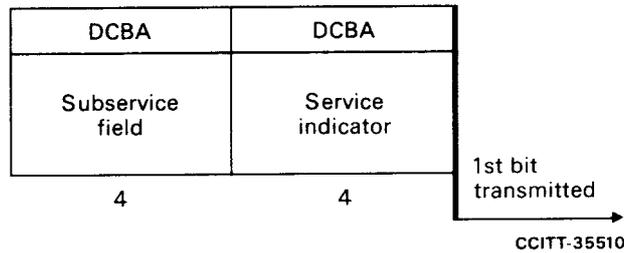


FIGURE 1/X.61

Service information octet

3.1.2.2 *Service indicator*

The service indicator will be coded as follows:

Bits: DCBA

0110 call and circuit related messages

0111 facility registration and cancellation messages.

The use of other service indicator codes is specified in Recommendation Q.704.

3.1.2.3 *Subservice field*

The subservice field is coded as shown in Table 1/X.61.

TABLE 1/X.61

Bits	B A	Spare
	D C	National indicator
	0 0	International message
	0 1	Spare (for international use)
	1 0	National message
	1 1	Reserved for national use

Note - Bits A and B are spare for possible needs that may require a common solution for all international User Parts and MTP level 3. Each bit is coded 0.

3.1.3 *Format principles*

The user generated information in the signalling information field is, in general, divided into a number of subfields which may be of either fixed or variable length. The first field is the label field, see § 3.2. Following the label field is a heading code H0 which, possibly together with a following subheader H1, identifies the structure of the message. Other fields may be mandatory or optional on a per individual message basis, the presence or absence of optional fields being indicated by field indicators. Each field indicated below is mandatory unless explicitly indicated as optional.

3.1.4 Order of bit transmission

Within each defined subfield the information is transmitted least significant bit first.

3.1.5 Coding of spare bits

Each spare bit is coded 0 unless otherwise indicated.

3.1.6 Indicators for national use only

A number of indicators specified are indicated as for national use only. In international use the corresponding bits are coded 0 and are, as regards their interpretation, equivalent to spare bits.

3.2 Label

3.2.1 General

The label is an item of information which forms part of every signalling message and is used by the message routing function at MTP Level 3 to select the appropriate signalling route and by the User Part function to identify the particular transaction (e.g. the call) to which the message pertains.

In general, the label information encompasses an explicit or implicit indication of the message source and destination and, depending on the application, various forms of transaction identification.

For call and circuit related messages the transaction is conveniently identified by including the corresponding circuit identity in the label. In the following, two such label structures are specified:

- a basic label structure which, consistent with the standard telephone label structure (Recommendation Q.723), is designed to meet the requirements for identification of data circuits derived from standard data multiplexers (see Recommendations X.50 and X.51);
- an alternative label structure, identical to the standard telephone label structure, which may be used in applications where the data circuits use full 64 kbit/s digital circuits without submultiplexing.

For facility registration and cancellation related messages the specified label structure is equivalent to the standard routing label of the MTP, see Recommendation Q.704.

Note - The indication (48) below the label field in Figures 5/X.61 to 11/X.61 refers to the basic label, which is described in § 3.2.2, but is intended to show that other label lengths are possible.

3.2.2 Basic label for call and circuit related messages

3.2.2.1 General

The basic label has a length of 48 bits and is placed at the beginning of the signalling information field. The format is as shown in Figure 2/X.61.

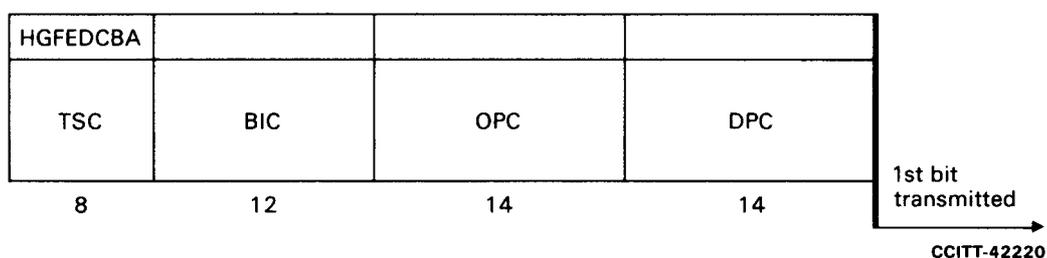


FIGURE 2/X.61
Basic label for data call and circuit related messages

The general function of the label components is defined in § 3.2.1. The portion of the basic label that consists of the Destination Point Code (DPC) and Originating Point Code (OPC) fields and the four least significant bits of the Bearer Identification Code (BIC) field corresponds to the standard routing label specified in Recommendation Q.704.

3.2.2.2 *Destination and originating point codes*

The standard structure requires that each data switching exchange in its role as a signalling point is allocated a code from a code plan established for the purpose of unambiguous identification of signalling points.

Separate code plans will be used for the international signalling network and for different national signalling networks.

The principles of code allocation and the codes for the international signalling network are specified in Recommendation Q.708.

The destination point code will be the code applicable to the data switching exchange to which the message is to be delivered. The originating point code will be the code applicable to the data switching exchange from which the message is sent.

3.2.2.3 *Bearer identification code*

The allocation of bearer identification codes to individual bearers is determined by bilateral agreement and/or in accordance with applicable predetermined rules.

For bearers which form part of a 2.048 Mbit/s PCM system according to Recommendation G.734, the bearer identification code contains in the 5 least significant bits a binary representation of the actual number of the time slot which is assigned to the bearer. The remaining bits of the bearer identification code are used where necessary, to identify one among several systems, interconnecting the originating point and destination point.

For bearers which form part of a 8.448 Mbit/s PCM system the bearer identification code will be coded in accordance with the scheme specified for the circuit identification code for the corresponding case in Recommendation Q.723.

3.2.2.4 *Time slot code*

The coding of the time slot code (TSC) is as follows (bit numbering as in Figure 2/X.61):

- a) In the case where the data circuit is derived from the data multiplex carried by the bearer, identified by the bearer identification code:
 - bits ABCD will contain, in pure binary representation, the channel number of the circuit within the 12.8 kbit/s (Recommendation X.50) or 12 kbit/s (Recommendation X.51) phase; the channel number being in the range (see Recommendations X.50, X.51, X.53 and X.54):
 - 0-15 for 600 bit/s circuits
 - 0- 3 for 2400 bit/s circuits
 - 0- 1 for 4800 bit/s circuits
 - 0 for 9600 bit/s circuits
 - bits EFG will contain, in pure binary representation, the number of the 12.8 kbit/s or 12 kbit/s phase, the phase number being in the range 0-4;
 - bit H will be coded 0.
- b) In the case where the data circuit uses the full 64 kbit/s bearer rate, the time slot code will be 01110000.

3.2.3 *Alternative label for call and circuit related messages*

In applications where all data circuits use full 64 kbit/s digital circuits, a label structure as shown in Figure 3/X.61 may be used in mutual agreement.

This label structure is equivalent to the standard telephone label structure specified in Recommendation Q.704. The destination point code (DPC) and originating point code (OPC) fields are as in the basic label structure and the Circuit Identification Code (CIC) is as the bearer identification code field in the basic label structure (see § 3.2.2).

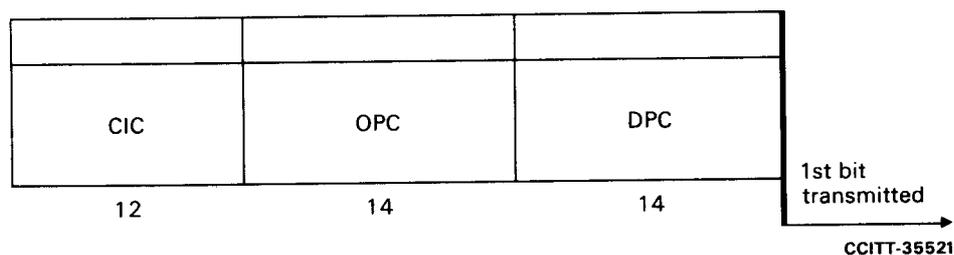


FIGURE 3/X.61
Alternative label for data and circuit related messages

3.2.4 Standard label for facility registration and cancellation messages

Facility registration and cancellation messages will have a label in accordance with Figure 4/X.61.

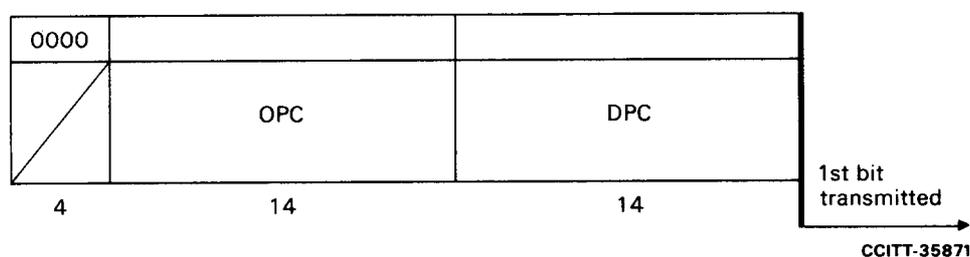


FIGURE 4/X.61
Standard label for facility registration and cancellation messages

This label structure is equivalent to the standard routing label specified for the MTP (see Recommendation Q.704). The destination point code (DPC) and originating point code (OPC) fields are used as for the basic label, see § 3.2.2.

3.2.5 Modified label

In cases where the data transmission service is provided by public data networks comprising few exchanges and signalling relations, it may be attractive to use shorter labels than those specified in §§ 3.2.2 to 3.2.4. In such applications a modified label, having the same order and function, but possibly different sizes, of subfields may be used in mutual agreement. In such a case the label used for MTP Level 3 messages should be modified accordingly. Also, in some national applications it may be necessary to use an extended modified label.

3.3 Formats and codes for call and circuit related messages

3.3.1 Heading

The different heading codes (H0) for the call and circuit control messages are allocated as shown in Table 2/X.61.

TABLE 2/X.61

0000	Spare
0001	Address message
0010	Calling line identification messages
0011	Spare
0100	Call accepted messages
0101	Call rejected messages
0110	Clear messages
0111	Circuit state messages
1000 to 1111	Spare

3.3.2 Address message

3.3.2.1 The format of the address message is as shown in Figures 5/X.61, and 5 bis/X.61.

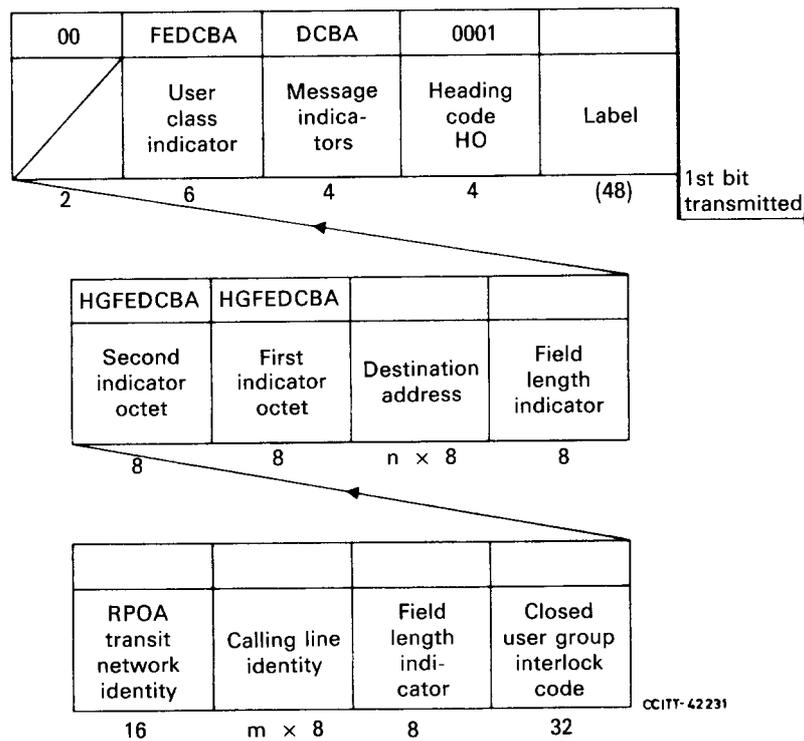


FIGURE 5/X.61

Address message

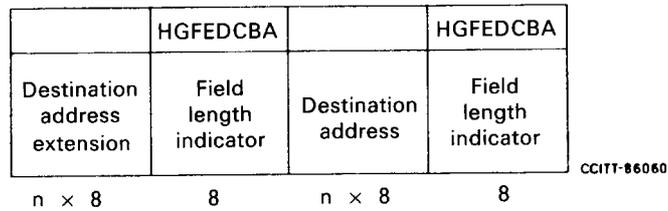


FIGURE 5 bis/X.61

Address message (destination address fields when address extension is used)

The fields, subfields and codes are as follows:

3.3.2.2 *Label*

See § 3.2.

3.3.2.3 *Heading code H0*

See § 3.3.1.

3.3.2.4 *Message indicator*

The coding is shown in Table 3/X.61.

TABLE 3/X.61

Bit	A	Field indicator of first indicator octet
	0	First indicator octet not included
	1	First indicator octet included
	B	DCC/DNIC indicator (national use only, see § 3.1.6)
	0	DCC/DNIC included in destination address
	1	DCC/DNIC not included in destination address
	C	National/international call indicator (national use only, § 3.1.6)
	0	International call
	1	National call
	D	Alternative routing indicator
	0	No alternative routing made
	1	Alternative routing made

3.3.2.5 *User class indicator*

The coding is shown in Table 4/X.61.

TABLE 4/X.61

Bits F E D C B A		
0 0 0 0 0 0 to 1 0 0 0 0 0	Spare	
1 0 0 0 0 1 to 1 0 0 1 1 0	Asynchronous user classes, as applicable; bits ABC coded as bits b1, b2, b3 of first user class character in Recommendation X.71	
1 0 0 1 1 1 to 1 0 1 1 1 1	Spare	
1 1 0 0 0 0 1 1 0 0 0 1 1 1 0 0 1 0 1 1 0 0 1 1 1 1 0 1 0 0	600 bit/s (user class 3) 2 400 bit/s (user class 4) 4 800 bit/s (user class 5) 9 600 bit/s (user class 6) 48 000 bit/s (user class 7)	Synchronous user classes corresponding to second user class character in Recommendation X.71
1 1 0 1 0 1 to 1 1 1 0 1 1	Spare	
1 1 1 1 0 0 to 1 1 1 1 1 1	Reserved for national use	

3.3.2.6 *Spare bits*

3.3.2.7 *Field length indicator for destination address/address and sub-address*

The coding is shown in Table 5/X.61.

TABLE 5/X.61

Bits	B A	00	The following bits of the field length indicator contain the number of digits of address and sub-address information
		01	The following bits of field length indicator contain the number of digits of address information; sub-address information follows in the address extension field
		10	Reserved
		11	Reserved
	H G F E D C		A code expressing in pure binary representation the number of address signals (or address and sub-address signals) in the destination address. The maximum number of digits is limited to 32 (see Note)

Note - The maximum length of 32 decimal digits is derived from the provisional maximum length of the OSI Network Service Access Point (NSAP) address defined in Recommendation X.213.

3.3.2.8 Destination address/address and sub-address field

This field is divided into an even number of semi-octets. The decimal value of each destination address/address and sub-address digit is expressed in pure binary representation of an address/address and sub-address signal. The digits are sent in descending order with the most significant digit first. In case of an odd number of address/address and sub-address signals, a 4-bit 0000 filler code is included in the last semi-octet of the field.

3.3.2.9 Field length indicator for address extension

This field is an optional field that is included if bit A of the field length indicator for the destination address is equal to 1.

This field contains a code expressing in pure binary representation the number of sub-address signals in the destination address.

The coding is shown in Table 6/X.61.

TABLE 6/X.61

Bits	B A	Reserved, coded 00
	H G F E D C	The maximum number of digits is limited to 32 (see Note)

Note - See the Note to Table 5/X.61.

3.3.2.10 Address extension for destination address

This field is an optional field that is included if bit A of the field length indicator for the destination address is equal to 1.

This field is divided into an even number of semi-octets. The decimal value of each destination sub-address digit is expressed in pure binary representation of a sub-address signal. The digits are sent in descending order with the most significant digit first. In case of an odd number of sub-address signals a 4-bit filler code (0000) is included in the last semi-octet of the field.

3.3.2.11 *First indicator octet*

This is an optional field that is included if indicated in bit A of the message indicators. The coding is shown in Table 7/X.61.

TABLE 7/X.61

Bits	B A	Calling line identity indicator
	0 0	Calling line identity not included
	0 1	Calling line identity without DCC/DNIC included (national use only)
	1 0	DCC/DNIC only included
	1 1	Calling line identity with DCC/DNIC included
	D C	CUG call indicator
	0 0	Ordinary call
	0 1	Spare
	1 0	1 CUG call, outgoing access allowed
		CUG call, outgoing access not allowed
	E	
	0	BCUG call indicator
	1	Ordinary call
		BCUG call
	F	
		Reserved for charging information indicator; coded 0
	G	
		Reserved for an additional routing information indicator; coded 0
	H	
	0	Field indicator of the second indicator octet
	1	Second indicator not included
		Second indicator included

3.3.2.12 *Second indicator octet*

This is an optional field that is included if indicated in bit H of the first indicator octet. The coding is shown in Table 8/X.61.

TABLE 8/X.61

Bit	A	Redirected call indicator (national use only, see § 3.1.6)
	0	Ordinary call
	1	Redirected call
	B	RPOA selection indicator (national use only, see § 3.1.6)
	0	No RPOA code included
	1	RPOA code included
	C	Reverse charging request indicator
	0	No reverse charging request
	1	Reverse charging request
	D	Called line identification request indicator
	0	No called line identification requested
	1	Called line identification requested
	E	Spare
	F	
	G	
	H	Reserved for field indicator for third indicator octet; coded 0

3.3.2.13 *Closed user group interlock code*

This is an optional field that is included only when indicated in bits CD in the first indicator octet. The format of the interlock code is in accordance with Figure 6/X.61.

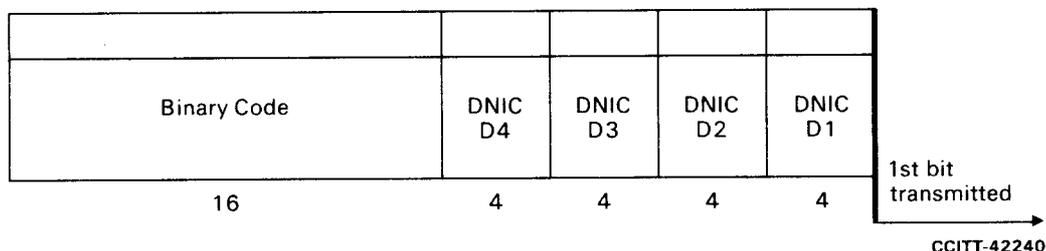


FIGURE 6/X.61
Format of interlock code

Each of the first four semi-octets contains a decimal digit, the value of which is expressed in pure binary representation, of the DNIC (or DCC plus one digit) of the coordinating Administration of the closed user group concerned (see Recommendation X.300). The 16-bit binary code is the code assigned to the closed user group concerned.

3.3.2.14 *Field length indicator for calling line identity*

This field is an optional field that is included only when the calling line identity is included. The coding is shown in Table 9/X.61.

TABLE 9/X.61

Bits	B A	00	The following bits of the field length indicator contain the number of digits of the calling line identity (address and sub-address information)
		01	The following bits of the field length indicator contain the number of digits of the calling line identity (address information). Sub-address information follows in the calling line identity address extension field
		00	Reserved
		11	Reserved
	H G F E D C	00	A code expressing in pure binary representation the number of address signals (or address and sub-address signals) of the calling line identity The maximum number of digits is limited to 32 (see Note)

Note - See the Note to Table 5/X.61.

3.3.2.15 *Calling line identity*

This field is an optional field that is included only if indicated in bits AB of the first indicator octet. The field is divided into an even number of semi-octets. It contains a number of decimal digits of the national or international data number (address/address and sub-address) of the calling line or of the DNIC of the originating network. The coding of each digit, their order of transmission and the use of a filler code is as specified in § 3.3.2.8.

3.3.2.16 *Field length indicator for address extension for calling line identity*

This field is an optional field that is included if bit A of the field length indicator for the calling line identity is equal to 1.

This field contains a code expressing in pure binary representation the number of sub-address signals in the calling line identity.

The coding is shown in Table 6/X.61.

3.3.2.17 *Address extension for calling line identity*

This field is an optional field that is included if bit A of the field length indicator for the calling line identity is equal to 1.

This field is divided into an even number of semi-octets. The decimal value of each calling line identity sub-address digit is expressed in pure binary representation of an address signal. The digits are sent in descending order with the most significant digit first. In case of an odd number of sub-address signals a 4-bit 0000 filler code is included in the last semi-octet of the field.

3.3.2.18 *RPOA transit network identity*

This is an optional field that is included only if indicated in bit B in the second indicator octet. This field is divided into four semi-octets, each of which contains a decimal digit of the applicable DNIC. The coding and order of transmission of these digits is as specified in § 3.3.2.8.

3.3.3 *Call accepted message*

3.3.3.1 The format of the call accepted message is as shown in Figure 7/X.61.

The fields, subfields and codes are as follows:

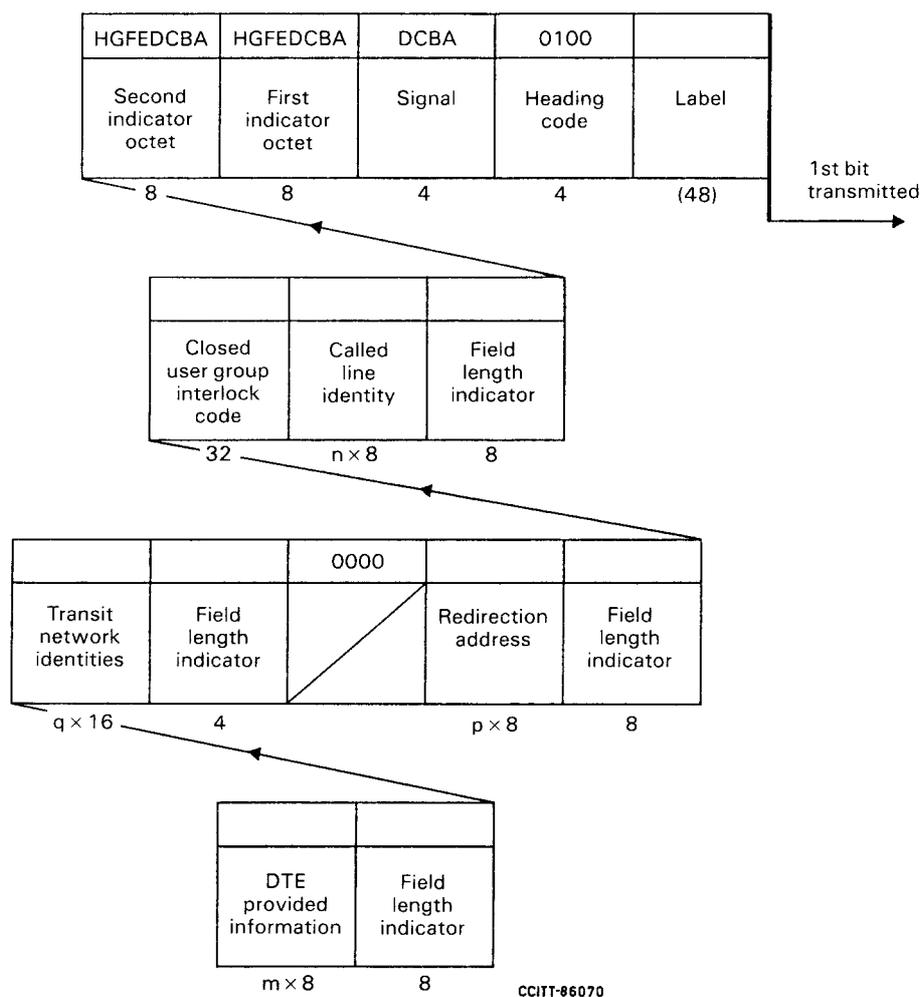


FIGURE 7/X.61

Call accepted message

3.3.3.2 Label

See § 3.2.

3.3.3.3 Heading code H0

See § 3.3.1.

3.3.3.4 Signal

The signal information is coded as shown in Table 10/X.61 (corresponding call progress signal digits, as applicable, are indicated within brackets).

TABLE 10/X.61

Bits	DCBA 0 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1	Reserved for call progress signal code 00 Terminal called (01) Redirected call (02) Connected when free (03)
	0 1 0 0 to 1 0 0 1	Spare
	1 0 1 0 1 0 1 1 1 1 0 0	Call accepted Transit through connect Redirection request
	1 1 0 1 to 1 1 1 1	Spare

3.3.3.5 *First indicator octet*

The coding is shown in Table 11/X.61.

TABLE 11/X.61

Bits	B A	Called line identity indicator
	0 0	Called line identity not included
	0 1	Called line identity without DCC/DNIC included (national use only)
	1 0	DCC/DNIC only included
	1 1	Called line identity with DCC/DNIC included
	C	Charge /no charge indicator (national use only, see § 3.1.6)
	0	Normal charging
	1	No charging
	D	Calling line identity request indicator
	0	Calling line identification not requested
	1	Calling line identification requested
	E	Originating network identification request indicator
	0	Originating network identification not requested
	1	Originating network identification requested
	F	Transit network identity indicator
	0	No transit network identity included
	1	One or more transit network identity(ies) included
	G	DTE provided information indicator
	0	No DTE provided information
	1	DTE provided information
	H	Field indicator of the second indicator octet
	0	Second indicator octet not included
	1	Second indicator octet included

3.3.3.6 *Second indicator octet*

An optional field that is included if indicated in bit H of the first indicator octet. The coding is shown in Table 12/X.61.

TABLE 12/X.61

Bits	B A	Redirection address indicator (national use only, see § 3.1.6)
	0 0	Redirection address not included
	0 1	Redirection address without DCC/DNIC included
	1 0	Spare
	1 1	Redirection address DCC/DNIC
	D C	CUG call indicator (national use only, see § 3.1.6) ^{a)}
	0 0	Ordinary call
	0 1	Spare
	1 0	CUG call, outgoing access allowed
	1 1	CUG call, outgoing access not allowed
	E, F, G	Spare
	H	Reserved for field indicator of a third indicator octet; code 0

a) Note that CUG information is only applicable to CUG calls that are redirected, see Recommendation X.300.

3.3.3.7 *Spare bits*

Included only when the called line identity is included.

3.3.3.8 *Field length indicator for called line identity*

An optional field that is included only when the called line identity is included. The coding is as specified in Table 9/X.61.

3.3.3.9 *Called line identity*

This field is an optional field that is included only if indicated in bits AB in the first indicator octet. This field is divided into an even number of semi-octets. It contains a number of decimal digits of the national or international data number (address/address and sub-address) of the called line or of the DNIC of the destination network. The coding of each digit, their order of transmission and the use of a filler code is as specified in § 3.3.2.8.

3.3.3.10 *Field length indicator for address extension for called line identity*

This field is an optional field that is included if bit A of the field length indicator for the called line identity is equal to 1.

This field contains a code expressing in pure binary representation the number of sub-address signals in the called line identity.

The coding is shown in Table 6/X.61.

3.3.3.11 *Address extension for called line identity*

This field is an optional field that is included if bit A of the field length indicator for the called line identity is equal to 1.

This field is divided into an even number of semi-octets. The decimal value of each called line identity sub-address digit is expressed in pure binary representation of a sub-address signal. The digits are sent in descending order with the most significant digit first. In case of an odd number of sub-address signals a 4-bit 0000 filler code is included in the last semi-octet of the field.

3.3.3.12 *Closed user group interlock code*

An optional field that is included only if indicated in bits CD of the second indicator octet. The format and code of the interlock code is as specified in § 3.3.2.13.

3.3.3.13 *Field length indicator for redirection address*

An optional field that is included only when a redirection address is included. The coding is as specified in Table 9/X.61.

3.3.3.14 *Redirection address*

An optional field that is included only if indicated in bits AB of the second indicator octet. This field is divided into an even number of semi-octets. It contains a number of decimal digits of the address/address and sub-address towards which the call has to be redirected. The coding of each digit, their order of transmission and the use of a filler code is as specified in § 3.3.2.8.

3.3.3.15 *Field length indicator for address extension for redirection address*

This field is an optional field that is included if bit A of the field length indicator for the redirection address is equal to 1.

This field contains a code expressing in pure binary representation the number of sub-address signals in the redirection address.

The coding is shown in Table 6/X.61.

3.3.3.16 *Address extension for redirection address*

This field is an optional field that is included if bit A of the field length indicator for the redirection address is equal to 1.

This field is divided into an even number of semi-octets. The decimal value of each redirection sub-address digit is expressed in a pure binary representation of a sub-address signal. The digits are sent in descending order with the most significant digit first. In case of an odd number of sub-address signals a 4-bit 0000 filler code is included in the last semi-octet of the field.

3.3.3.17 *Field length indicator*

An optional field that is included when at least one transit network identity is included. It is a code expressing in pure binary representation the number of transit network identities, i.e. the number of 16-bit subfields in the transit network identity field.

3.3.3.18 *Transit network identities*

An optional field that is included only when indicated in bit F of the first indicator octet. This field contains one or more 16-bit subfields, each divided into 4 semi-octets. The coding of each digit and their order of transmission is as specified in § 3.3.2.8.

3.3.3.19 Field length indicator for DTE-provided information

An optional field that is included when indicated by bit G in the first indicator octet. It is a code expressing a pure binary representation the number of characters of the DTE-provided information.

3.3.3.20 DTE provided information

An optional field that is included only when indicated by bit G of the first indicator octet. This field contains the characters of the DTE-provided information.

3.3.4 Call rejected message

3.3.4.1 The format of the call rejected message is as shown in Figure 8/X.61.

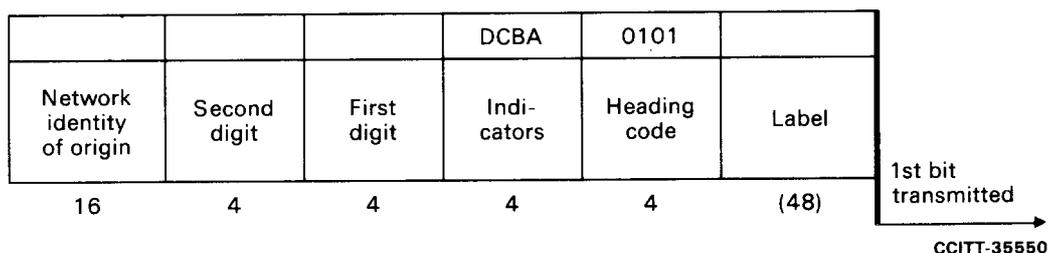


FIGURE 8/X.61
Call rejected message

The fields, subfields and codes are as follows:

3.3.4.2 Label

See § 3.2.

3.3.4.3 Heading code

See § 3.3. 1.

3.3.4.4 Indicators

The coding is shown in Table 13/X.61.

TABLE 13/X.61

Bit	A	Reserved for a field indicator of a possible optional field for extended call progress information
	B	Field indicator of network identity of origin
	0	Network identity of origin not included
	1	Network identity of origin included
	C	DTE provided information indication
	0	No DTE provided information
	1	DTE provided information
	D	Reserved for a possible indication that immediate clearing should not take place: code 0.

3.3.4.5 First, and second digit

Each of the two fields contains a decimal digit expressed in pure binary representation. The combination of the two decimal digits expresses the signal indicating the cause for call rejection. The values of the decimal digits are as shown in Table 14/X.61. This coding should be consistent with the corresponding coding of DTE/DCE interface call progress signals, see Recommendation X.21.

Note 1 - An interexchange signal not corresponding to a specific DTE/DCE interface call progress signal will, as required, be coded by over-decadic combination of the two digits.

Note 2 - Some of the call progress signal code groups specified in Recommendation X.21 correspond to other message types than the call rejected message.

Note 3 - The reverse charge acceptance not subscribed signal has not yet been assigned a code.

TABLE 14/X.61

Digits	20	Network failure
	21	Number busy
	41	Access barred
	42	Changed number
	43	Not obtainable
	44	Out of order
	45	Controlled not ready
	46	Uncontrolled not ready
	47	DCE power off
	48	Invalid facility request ^{a)}
	49	Network fault in local loop
	51	Call information service
	52	Incompatible user class of service
	61	Network congestion
	71	Degraded service
	72	RPOA out of order

^{a)}Applicable to the facility registration/cancellation request rejected message only, see § 3.4.4.4.

3.3.4.6 Field length indicator for DTE-provided information

An optional field that is included when indicated by bit C in the indicator. It is a code expressing in pure binary representation the number of characters of the DTE-provided information.

3.3.4.7 DTE-provided information

An optional field that is included only when indicated by bit C in the indicator. This field contains the characters of the DTE-provided information.

3.3.5 *Clear message*

3.3.5.1 The format of the clear message is as shown in Figure 9/X.61.

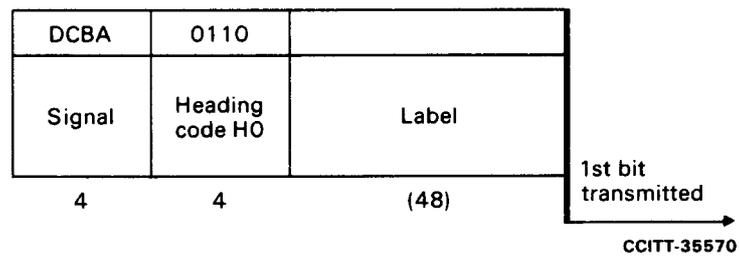


FIGURE 9/X.61
Clear message

The fields and codes are as follows:

3.3.5.2 *Label*

See § 3.2.

3.3.5.3 *Heading code H0*

See § 3.3.1.

3.3.5.4 *Signal*

The coding is shown in Table 15/X.61.

TABLE 15/X.61

Bits	DCBA	
	0 0 0 0	Spare
	0 0 0 1	Spare
	0 0 1 0	Circuit released (forward)
	0 0 1 1	Circuit released acknowledgement (forward)
	0 1 0 0 to 1 0 0 1	Spare
	1 0 1 0 1 0 1 1	Circuit released (backward) Circuit released acknowledgement (backward)
	1 1 0 0 to 1 1 1 1	Spare

3.3.6 *Circuit state message*

3.3.6.1 The format of the circuit state message is as shown in Figure 10/X.61.

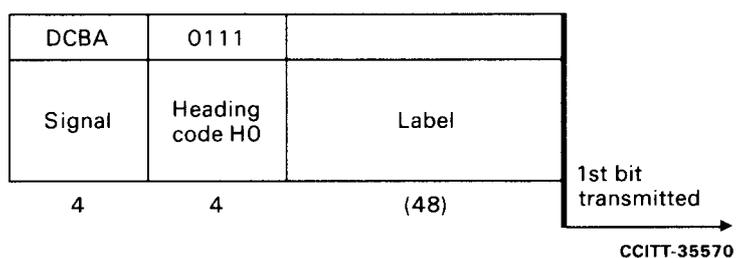


FIGURE 10/X.61
Circuit state message

The fields and codes are as follows:

3.3.6.2 *Label*

See § 3.2.

3.3.6.3 *Heading code H0*

See § 3.3.1.

3.3.6.4 *Signal*

The coding is shown in Table 16/X.61.

TABLE 16/X.61

Bits	DCBA	
	0 0 0 0	Spare
	0 0 0 1	Spare
	0 0 1 0	Blocking
	0 0 1 1	Blocking acknowledgement
	0 1 0 0	Unblocking
	0 1 0 1	Unblocking acknowledgement
	0 1 1 0	Spare
	0 1 1 1	Reset circuit
	1 0 0 0 to 1 1 1 1	Spare

3.3.7 *Calling line identity message*

3.3.7.1 The format of the calling line identity message is as shown in Figure 11/X.61.

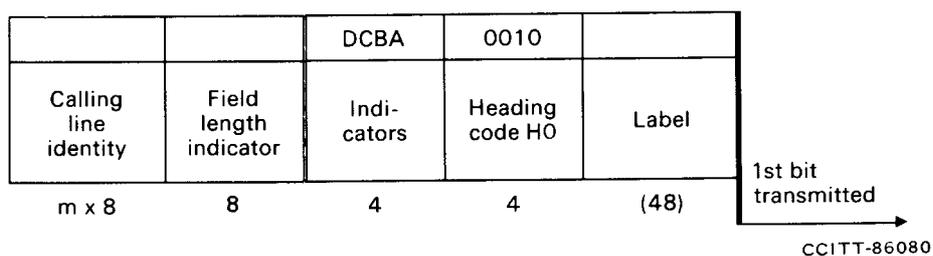


FIGURE 11/X.61
Calling line identity message

The fields, subfields and codes are as follows:

3.3.7.2 *Label*

See § 3.2.

3.3.7.3 *Heading code H0*

See § 3.3.1.

3.3.7.4 *Indicators*

The coding is shown in Table 17/X.61.

TABLE 17/X.61

Bits	B A	Calling line identity indicator
	0 0	Calling line identity not included ^{a)}
	0 1	Calling line identity without DCC/DNIC included (national use only)
	1 0	DCC/DNIC only included
	1 1	Calling line identity with DCC/DNIC included
	C, D	Spare

^{a)} As presently defined, this message always includes the calling line identity.

3.3.7.5 *Field length indicator for calling line identity*

This field is an optional¹⁾ field that is included only when the calling line identity is included. The coding is shown in Table 9/X.61.

3.3.7.6 *Calling line identity*

This field is an optional field that is included only if indicated in bits AB of the indicator field. See also § 3.3.2.15.

3.3.7.7 *Field length indicator for address extension for calling line identity*

See § 3.3.2.16.

¹⁾ As presently defined, this message always includes the calling line identity.

3.3.7.8 *Address extension for calling line identity*

See § 3.3.2.17.

3.4 *Formats and codes for facility registration and cancellation messages*

3.4.1 *Heading*

The different heading codes (H0) for the facility registration and cancellation messages are shown in Table 18/X.61.

TABLE 18/X.61

0000 0001 0010 0011	Spare Facility registration/cancellation request messages Facility registration/cancellation accepted messages Facility registration/cancellation rejected messages
0100 to 1111	Spare

3.4.2 *Facility registration/cancellation request message*

3.4.2.1 The format of the facility registration/cancellation request message is as shown in Figure 12/X.61.

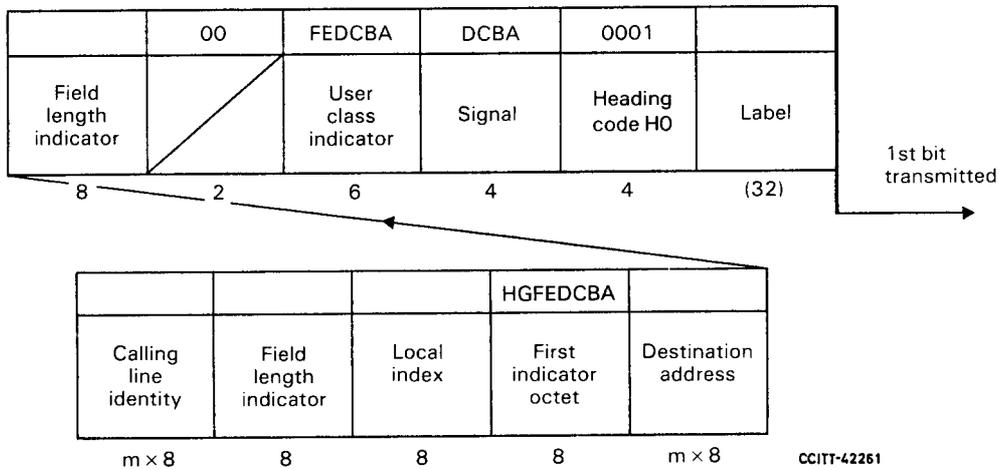


FIGURE 12/X.61

Facility registration/cancellation request message

The fields, subfields and codes are as follows:

3.4.2.2 *Label*

See § 3.2.

3.4.2.3 *Heading code H0*

See § 3.4.1.

3.4.2.4 *Signal*

The coding is shown in Table 19/X.61.

TABLE 19/X.61

Bits	DCBA	
	0 0 0 0	Spare
	0 0 0 1	Registration request
	0 0 1 0	Cancellation request
	0 0 1 1 to 1 1 1 1	Spare

3.4.2.5 *User class indicator*

See § 3.3.2.5.

3.4.2.6 *Spare bits*

3.4.2.7 *Field length indicator for destination address*

A code expressing in pure binary representation the number of address signals in the destination address.

3.4.2.8 *Destination address*

This field is divided into an even number of semi-octets. The decimal value of each destination address digit is expressed in a pure binary representation of an address signal. The digits are sent in descending order with the most significant digit first. In case of an odd number of address signals a 4-bit 0000 filler code is included in the last semi-octet of the field.

3.4.2.9 *First indicator octet*

The coding is shown in Table 20/X.61.

TABLE 20/X.61

Bits	B A	Calling line identity indicator
	0 0	Calling line identity not included
	0 1	Calling line identity without DCC/DNIC included (national use only)
	1 0	DCC/DNIC only included
	1 1	Calling line identity with DCC/DNIC included
	C	BCUG indicator
	0	No BCUG registration/cancellation
	1	BCUG registration/cancellation
	D	Field indicator for local index
	0	Local index not included
	1	Local index included
	E, F, G	Spare
	H	Reserve for field indicator for second indicator octet; coded 0

3.4.2.10 *Local index*

This is an optional field that is included only if indicated in bit D in the first indicator octet. In the case of registration request it is the local index assigned by the user requesting registration. In the case of cancellation request it is the local index assigned by the remote user in the BCUG being cancelled.

3.4.2.11 *Field length indicator for the calling line identity*

This field is an optional field that is included only when the calling line identity is included. It is a code expressing in pure binary representation the number of address signals in the calling line identity included.

3.4.2.12 *Calling line identity*

This field is an optional field that is included only if indicated in bits AB in the first indicator octet. The code is as specified in § 3.3.2.15.

3.4.3 *Facility registration/cancellation request accepted message*

3.4.3.1 The format of the facility registration/cancellation request message is as shown in Figure 13/X.61.

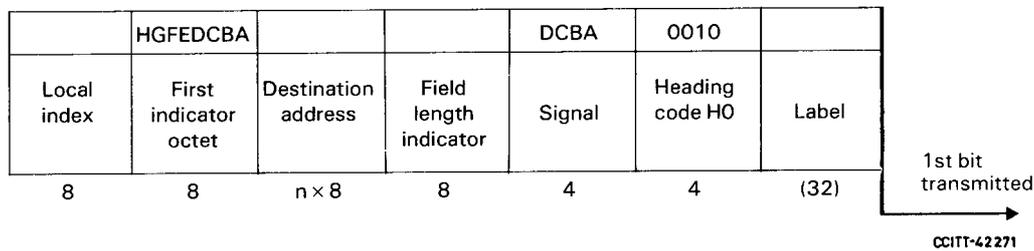


FIGURE 13/X.61

Facility registration/cancellation request accepted message

The fields, subfields and codes are as follows:

3.4.3.2 *Label*

See § 3.2.

3.4.3.3 *Heading code H0*

See § 3.4.1.

3.4.3.4 *Signal*

The coding is shown in Table 21/X.61.

TABLE 21/X.61

Bits 0000	Spare
0001	Registration completion
0010	Registration accepted
0011	Cancellation completed
0100 to 1111	Spare

3.4.3.5 *Field length indicator for the destination address*

See § 3.4.2.7.

3.4.3.6 *Destination address*

See § 3.4.2.8.

3.4.3.7 *First indicator octet*

The coding is shown in Table 22/X.61.

TABLE 22/X.61

Bits	A	Spare
	B	BCUG indicator
	0	No BCUG registration/cancellation
	1	BCUG registration/cancellation
	C	Field indicator for local index
	0	Local index not included
	1	Local index included
	D-G	Spare
	H	Reserved for field indicator for second indicator octet; coded 0

3.4.3.8 *Local index*

This is an optional field that is included only if indicated in bit C of the first indicator octet. It contains the local index of the user at the exchange from which the message is originated.

3.4.4 *Facility registration/cancellation request rejected message*

3.4.4.1 The format of the facility registration/cancellation request rejected message is as shown in Figure 14/X.61.

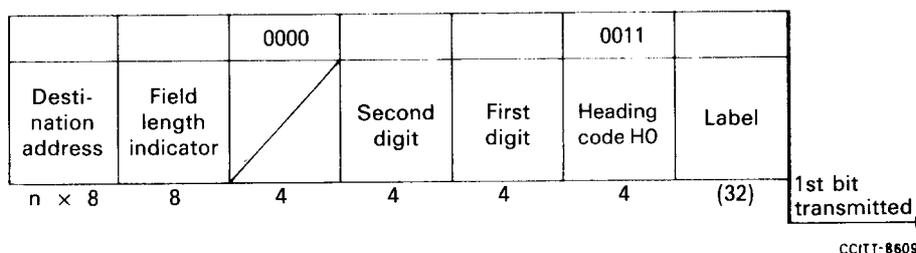


FIGURE 14/X.61

Facility registration/cancellation request rejected message

The fields, subfields and codes are as follows:

3.4.4.2 *Label field*

See § 3.2.

3.4.4.3 *Heading code*

See § 3.4.1.

3.4.4.4 *First and second digit*

Each of the two fields contains a decimal digit expressed in pure binary representation. The combination of the two decimal digits expresses the signal indicating the cause for facility registration/cancellation request rejection. The values of the decimal digits are as specified in § 3.3.4.5 for the relevant signals.

3.4.4.5 *Spare bits*

3.4.4.6 *Field length indicator*

See § 3.4.2.7.

3.4.4.7 *Destination address*

See § 3.4.2.8.

3.5 *Data channel signalling conditions*

The following conditions are those appearing in the interexchange data channels that in certain phases of a call have to be transmitted and/or detected in an exchange.

The coding of the presently specified data channel conditions is determined by the codes of the corresponding DTE/DCE interface states consistent with Recommendation X.21.

The data channel signalling conditions will be coded as follows (data bits/status bit):

- a) *trunk free* condition: 0 ... 0/0 (see Notes 1 and 3),
- b) *trunk seized* condition: 1 ... 1/0,
- c) *call accepted* condition: 1 ... 1/1,
- d) *call request* condition: 0 ... 0/0.

The above codes imply that the code 0 of the status bit on an interexchange data channel results in the OFF condition at the DTE/DCE interface consistent with Recommendation X.21, and that the code 1 results in the ON condition.

Note 1 - The code to be used for the *trunk free* condition in networks that cannot support bit sequence independence is for further study.

Note 2 - The implications for the data channel conditions, and their codes, of potential ISDN applications and/or of possible new DTE/DCE interfaces are a subject for further study.

Note 3 - As a national option, the data bits in the even positions of each envelope may be permanently inverted both at the transmitting and at the receiving ends of the interexchange data channels. Such inversion implies that the above specified codes (as well as information transferred during the data phase) will appear on the data channel correspondingly inverted. This option enables the *trunk free* condition in the case of the 8-bit envelope to be the same as the idle pattern for telephone channels as generated by a digital exchange complying with the standards related to the A-law.

4 Basic call control and signalling procedures

4.1 *General*

4.1.1 The call control procedures specified in § 4 are based on the requirements of the circuit-switched data transmission service as presently defined in the Series X Recommendations. In particular, the requirements specified for exchange through-connection and data channel conditions are dependent on the characteristics of the present DTE/DCE interfaces for the circuit-switched service. Also, the implications of ISDN applications of common channel signalling for circuit-switched data transmission services have not yet been fully determined.

4.1.2 The basic call control procedure is divided into two phases: call set-up and call clear-down, which are separated from one another by the data phase. A combination of messages on the signalling link and exchanges of conditions in the interexchange data channels are used to establish and terminate the different phases of the call.

4.1.3 The procedures specified in this § 4 in principle only relate to basic calls, i.e. calls not involving any user facilities. The additional requirements to be met in the cases of calls involving user facilities and network utilities are specified in § 5 and Recommendation X.300.

4.1.4 The interexchange data channel signalling conditions and the connect-through procedures specified ensure that the conditions in the network are compatible with the conditions and procedures for the present DTE/DCE interfaces.

4.1.5 Link-by-link transfer of signalling information assembled in messages is used and address information is signalled with all the elements of an address contained in one message. The network numbering is specified in Recommendation X.121. The network routing to apply is defined in Recommendation X.110.

4.1.6 Requirements of interworking with decentralized signalling are specified in Recommendation X.80.

4.2 *Overall call set-up and clear-down procedures*

The overall call set-up and clear-down procedures are outlined hereunder. The detailed signalling and switching procedures are covered in §§ 4.3 and 4.4 respectively. These procedures are illustrated in Tables 23/X.61 and 24/X.61.

TABLE 23/X.61 (continued)

Originating exchange	Interexchange data circuit		Interexchange signalling link		Transit exchange	Interexchange signalling link		Interexchange data circuit		Destination exchange
	→	←	→	←		→	←	→	←	
Call accepted message received Call accepted condition received Data path connected Charging started Ready for data received by calling user Data phase Clear request received from calling user Data path released Clear message sent Trunk free sent Clear confirmation sent to calling user										
		CA								
	RD	RD						RD	RD	Ready for data received by called user
	Data	Data			Data phase			Data	Data	Data phase
	CR							CR		Clear request received from called user ^{b)}
	TF		CLM		Clear message received Data path released					Clear request received from called user
		CR		CLM	Clear message sent on both sides	CLM			CR	Data path released
					Free trunk sent on both sides		CLM	TF		Clear message sent
		TF			(Incoming) circuit free				TF	Free trunk sent
										Clear confirmation sent to called user
					Clear message received (Outgoing) circuit free					Clear message received (Incoming) circuit free

b) Optionally, remote user clear request condition may also be used as a release criterion.

TABLE 24/X.61

Call set-up and clear-down procedure for basic call with number busy

Originating exchange	Interexchange data circuit		Interexchange Signalling link		Transit exchange	Interexchange signalling link		Interexchange data circuit		Destination exchange
	→	←	→	←		→	←	→	←	
Trunk free condition Call set up as for successful call Call rejected message received Call released Calling user cleared Clear message sent Trunk free sent (Outgoing) circuit free	TF TS TF 	TF TF 	AM CLM	 CRM	Trunk free condition Call set up as for successful call Call rejected message received Call released Call rejected message sent Clear message sent Trunk free sent (Outgoing) circuit free	 AM CLM	 CRM	TF TS TF 	TF TF 	Trunk free condition Address message received Called user busy Call released Call rejected message sent Clear message sent (Incoming) circuit free

Note - For legends Table 23/X.61.

4.2.1 *Call set-up*

4.2.1.1 When the originating exchange has received the complete selection information from the calling user and has determined that the call is to be routed to another exchange, it seizes a free interexchange data circuit and sends an address message on the signalling link. The address message in principle contains all of the information that is required to route and connect the call to the called user and may also include the calling line identity and other information related to any user facilities and network utilities that are required.

4.2.1.2 A transit exchange, on receipt of an address message will analyse the destination address and the other routing information to determine the routing of the call. The transit exchange then seizes a free interexchange data circuit and sends an address message to the next exchange and connects through the data path. In the case of congestion at the transit exchange it may select an alternative route, or send a call rejected message to the preceding exchange indicating congestion and clearing of the call.

4.2.1.3 Upon receipt of an address message the destination exchange will analyse the destination address to determine to which user the call should be connected. It will also check the called user's line condition and perform various checks to verify whether or not the connection is allowed. These checks will include correspondance of user class and any checks associated with user facilities. In the case where the connection is allowed, the destination exchange will call the called user in accordance with the applicable DTE/DCE interface protocol. The called user will normally respond with a *call accepted* (or corresponding) signal. If the call cannot be completed due to, for instance, the called user being busy, a call rejected message indicating this is sent to the preceding exchange and clearing takes place.

4.2.1.4 At connection of the call the destination exchange normally sends a call accepted message to the preceding exchange. Depending on the circumstances the call accepted message may include information related to specific network conditions and any user facilities or network utilities involved (see § 5).

4.2.1.5 Upon receipt of a call accepted message a transit exchange sends the corresponding call accepted message to the preceding exchange. If it is an international transit exchange the applicable transit network identity (see § 5.11) will be included in the call accepted message.

4.2.1.6 When the originating exchange receives a call accepted message indicating that the call can be completed, it prepares to connect through the data path. The originating exchange then connects through and starts charging, as applicable. In certain cases, e.g. when certain user facilities are involved, data path through-connection is preceded by the sending of a call progress signal or other information to the calling user.

4.2.1.7 In the cases when the call cannot be completed, the originating exchange will send an appropriate call progress signal, indicating the cause of call rejection, to the calling user and clear the call.

4.2.2 *Call clear-down*

4.2.2.1 Normally the clearing action initiated by a user will propagate rapidly along the connection and initiate release at each exchange involved. When both users clear at approximately the same time, clearing will propagate from both ends.

4.2.2.2 When detecting a valid *clearing* signal from the local user, the originating or destination exchange will release the connection and send a clear message to the adjoining exchange. The *clearing* signals originated by a user will pass through the local exchange and will appear on the interexchange data circuits and at the distant local exchange until such time as the *clearing* signals are acted upon and the connection is released. The actions at the exchange releasing the connection, including the condition sent on the interexchange data circuits when released, are therefore specified to be consistent with the clearing procedures of the DTE/DCE interfaces.

4.2.2.3 Clearing may also be initiated by a data exchange during call set-up when the call cannot be connected due to a user or network condition.

4.2.2.4 After release of the connection the clearing procedure is completed for each interexchange data circuit individually. A data circuit is assumed to be free for a new call at an exchange when both the forward and backward clearing indications relating to that data circuit have been sent and received.

4.3 *Normal switching procedures*

4.3.1 *General*

4.3.1.1 The switching procedures specified hereunder define the actions to be performed at call set-up and clear-down and the sequencing of these actions in relation to the handling of signalling messages and data channel signalling conditions. The specified connect-through and release actions and the coding of the data channel signalling conditions (see § 3.4) are based on the requirement for consistency with the present DTE/DCE interface protocol for the circuit-switched service.

Note - The implications for the procedure specified hereunder of possible new DTE/DCE interfaces for the circuit-switched service are for further study.

4.3.1.2 The *trunk free* condition is sent on the free interexchange data channels. Also, at release of an interexchange data circuit, the *trunk free* condition is immediately applied to its transmit channel. Both directions of transmission must be through-connected at (approximately) the same time.

4.3.1.3 The signalling information content in the signalling messages is specified in § 4.4. The time-out supervisions to be performed in relation to interexchange signalling and the procedures to be followed in abnormal conditions are specified in § 4.5.

4.3.2 *Call set-up*

4.3.2.1 *Originating exchange*

The call set-up actions are illustrated by means of a Specification and Description Language (SDL) diagram (see Recommendation Z.101) in Figure 15/X.61.

After having seized an interexchange data circuit, the originating exchange applies the *trunk seized* condition to the forward data channel. The sending of the address message and the application of the *trunk seized* condition may be performed in parallel as independent actions. The originating exchange then waits for the reception of a call accepted message or call rejected message.

Upon receipt of a call accepted message the originating exchange prepares to connect through the data path. In the case where user facilities apply, call progress signals may be sent to the calling user as applicable. The originating exchange then monitors the backward interexchange data channel for the presence of the *call accepted* condition. When this condition is detected, indicating that all succeeding exchanges have connected through, the originating exchange connects through and initiates charging where applicable.

In the cases when a call rejected message is received, the appropriate call progress signal is sent to the calling user and clearing takes place. Receipt of a call rejected message may also occur after receipt of a previous call accepted message.

Note - In the case of Recommendation X.20 concerning start-stop terminals, the originating exchange monitors the backward interexchange data channel for the presence of the call accepted condition (1, ON). When this condition is detected, the through-connection signal character (ACK) is sent by the originating exchange to the calling and called users. Then, the originating exchange connects through and initiates charging.

4.3.2.2 *Transit exchange*

The call set-up actions are illustrated by means of an SDL diagram in Figure 16/X.61.

Having seized a free interexchange data circuit and sent an address message to the succeeding exchange, the transit exchange connects through the data path.

If a call accepted message is received from the succeeding exchange the transit exchange sends a corresponding message to the preceding exchange. If a call rejected message is received, the corresponding message is sent and clearing takes place. Receipt of a call rejected message may also occur subsequent to the receipt of a previous call accepted message.

4.3.2.3 *Destination exchange*

The call set-up actions are illustrated by means of an SDL diagram in Figure 17/X.61.

In the case where the call is to a user that is indicated as ready to receive a call, the destination exchange sends the *incoming call* (or corresponding) signal to the user. The destination exchange usually connects through the data path when:

- the *call accepted* (or corresponding) signal has been received from the user, and
- the transmission to the called user of any additional information, e.g. related to user facilities, has been completed in accordance with the applicable DTE/DCE interface protocol.

It is necessary to ensure that the *trunk seized* condition is present in the receive data channel of the interexchange data circuit before through-connection for consistency with the called user DTE/DCE interface protocol when this is in accordance with the present standards, e.g. Recommendation X.21, for the circuit-switched service, cf. Note to § 4.3.3.2.

In the case where the call can be connected a call accepted message is sent to the preceding exchange. This message may be sent either before or after the *call accepted* (or corresponding) signal has been received from the called user. Waiting for the receipt of the *call accepted* or corresponding signal has the advantage that sending of the call accepted message is based on a positive indication that the call has been accepted by the called user. Sending the call accepted message earlier, e.g. in conjunction with the sending of the *incoming call* (or corresponding) signal to the user, has the advantage that the call set-up time is reduced in the normal condition.

In the case where certain user facilities apply, see § 5 and Recommendation X.300, through-connection normally takes place in conjunction with the sending of a second call accepted message.

In the case where the call cannot be connected and completed, a call rejected message is sent to the preceding exchange and clearing takes place.

4.3.3 *Call clear-down*

4.3.3.1 *Originating exchange*

The clearing actions are illustrated by means of SDL diagrams in Figures 15/X.61 and 18/X.61. Release of the connection is initiated by one of the following criteria (see also the Note to § 4.3.3.2):

- a) detection of a *clear request* condition from the calling user,
- b) optionally, detection of a *clear request* condition from the called user on the backward channel of the interexchange data circuit,
- c) receipt of a call rejected message, or
- d) receipt of a backward clear message.

After release of the connection a clear message is sent to the succeeding exchange and the calling user is cleared in accordance with the applicable DTE/DCE interface protocol.

4.3.3.2 *Transit exchange*

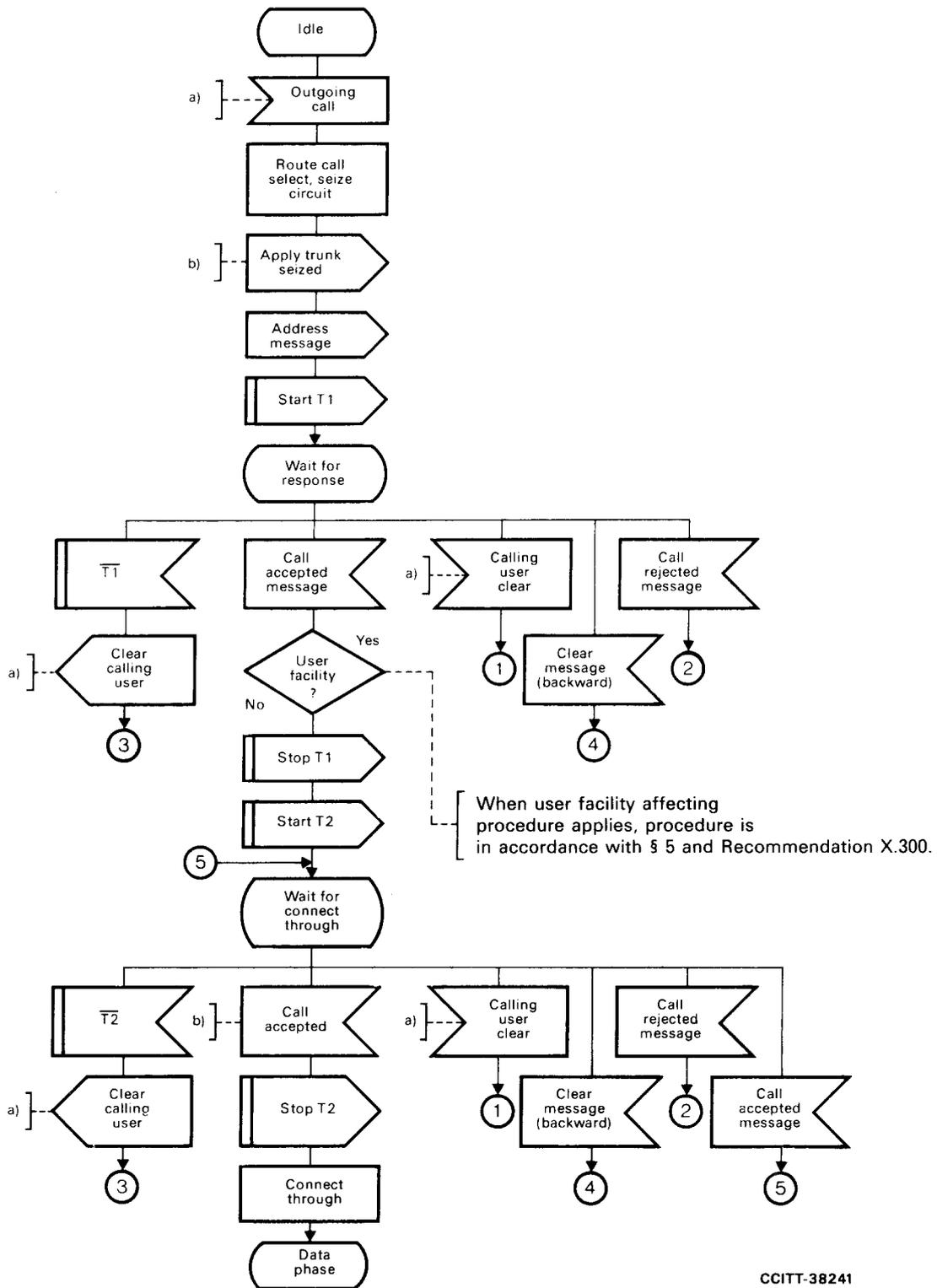
The clearing actions are illustrated by means of SDL diagrams in Figures 16/X.61 and 18/X.61. Release of the connection is initiated by one of the following criteria:

- a) failure to complete call set-up,
- b) receipt of a call rejected message, or
- c) receipt of a forward or backward clear message.

After release of the connection:

- a call rejected message is sent to the preceding exchange in the cases a) and b),
- a clear message is sent to the preceding exchange in the case c),
- a clear message is sent to the succeeding exchange in the cases b) or c).

Note - In the case where satellite data circuits are served by a terrestrial common channel signalling network, there is a probability that a clear message initiated by user clearing may arrive at the other end of the satellite circuit before all user data transmitted immediately before clearing has passed that end. Therefore, the action initiated by receipt of a clear message relating to a satellite circuit must be delayed by an appropriate time interval unless other release criteria have been met. The necessary arrangements to cater for such a situation are for further study.



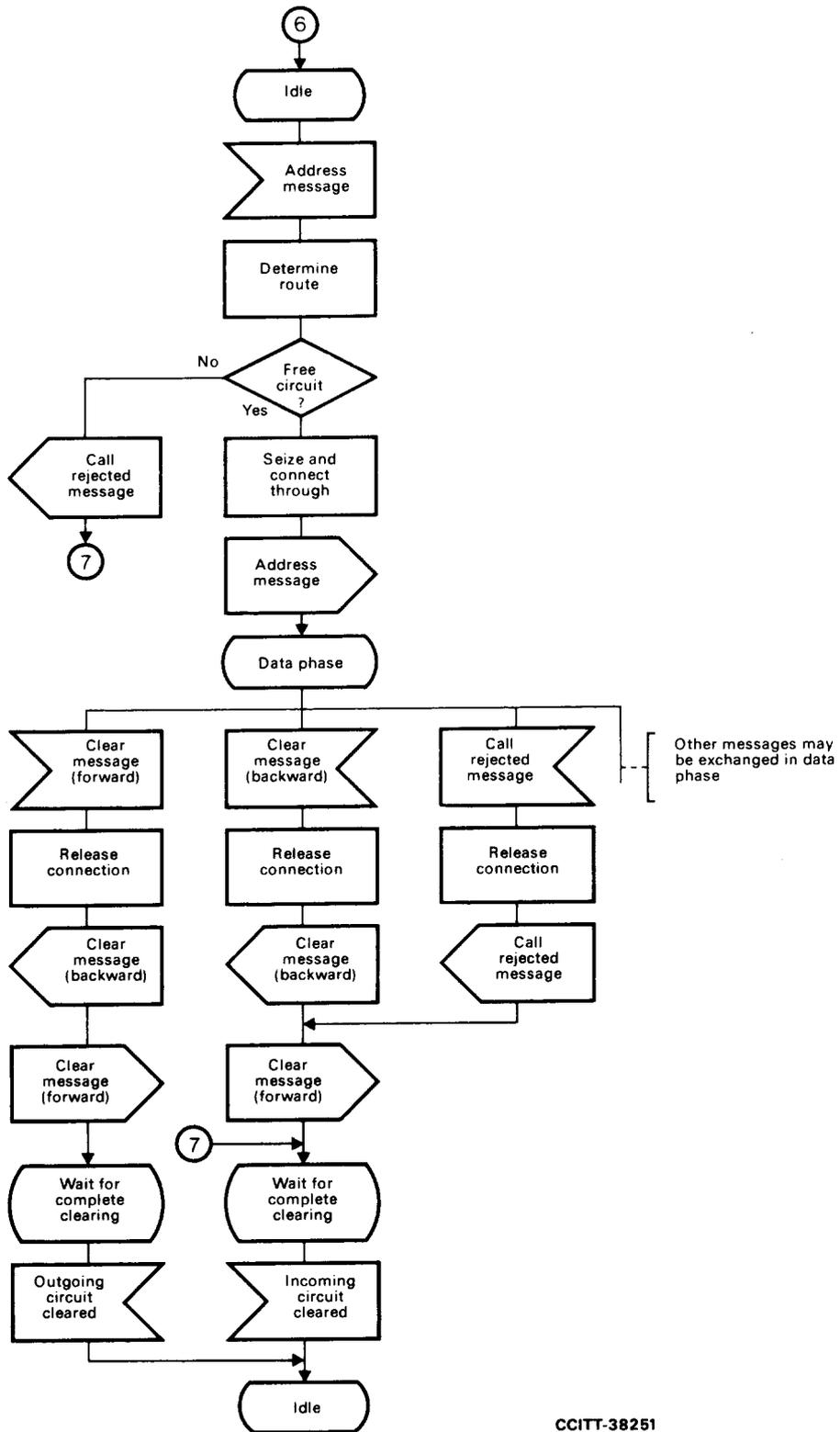
^{ai} In accordance with the applicable DTE/DCE interface protocol.

^{bi} In interexchange data channel.

Note – Connectors ① to ④ go to Figure 18/X.61 which also shows clearing in data phase. Time-outs T1 and T2 as in § 4.5.3.1.

FIGURE 15/X.61

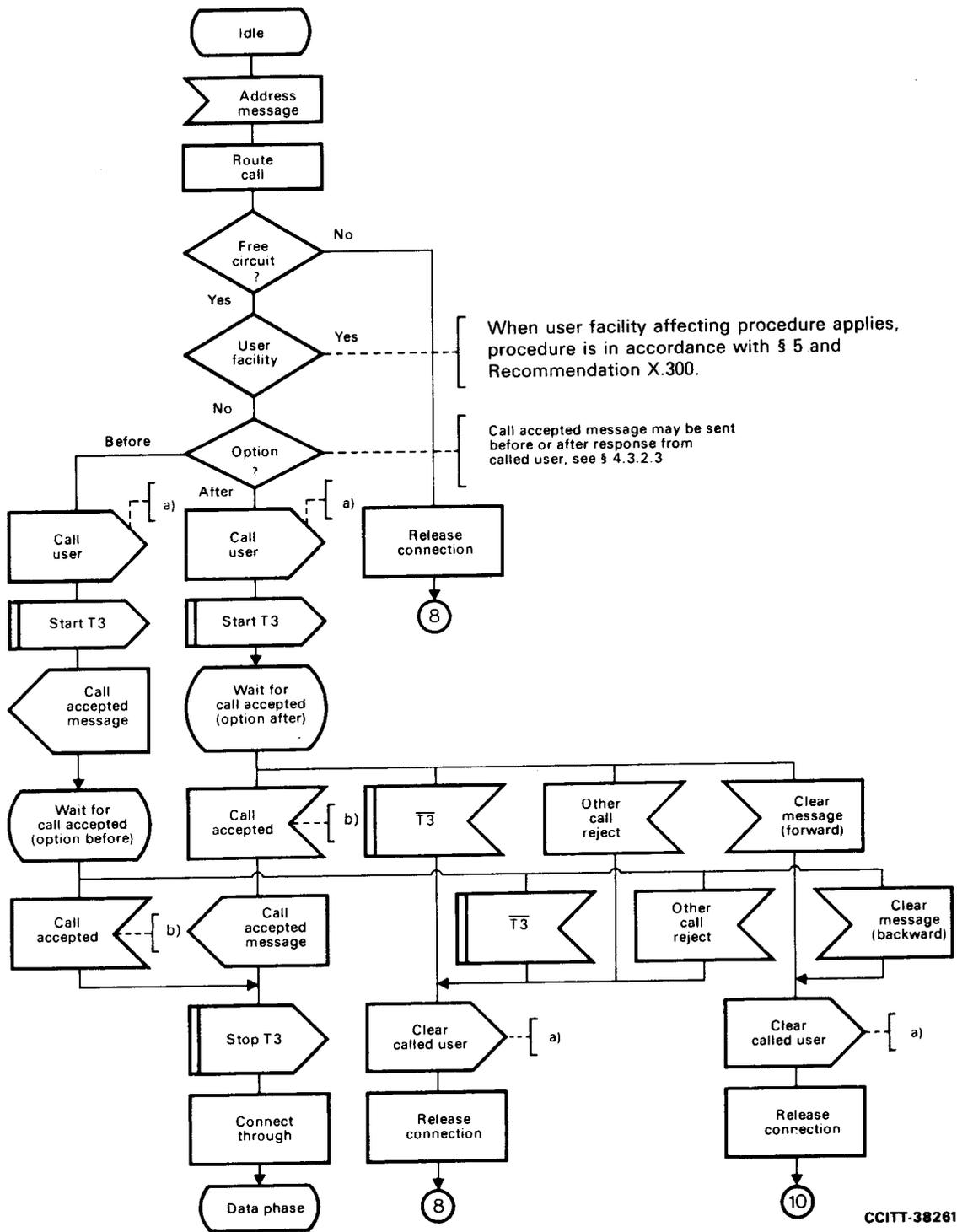
Call set-up at originating exchange



CCITT-38251

Note – Detailed clearing procedures are shown in Figure 18/X.61.

FIGURE 16/X.61
Call set-up at transit exchange



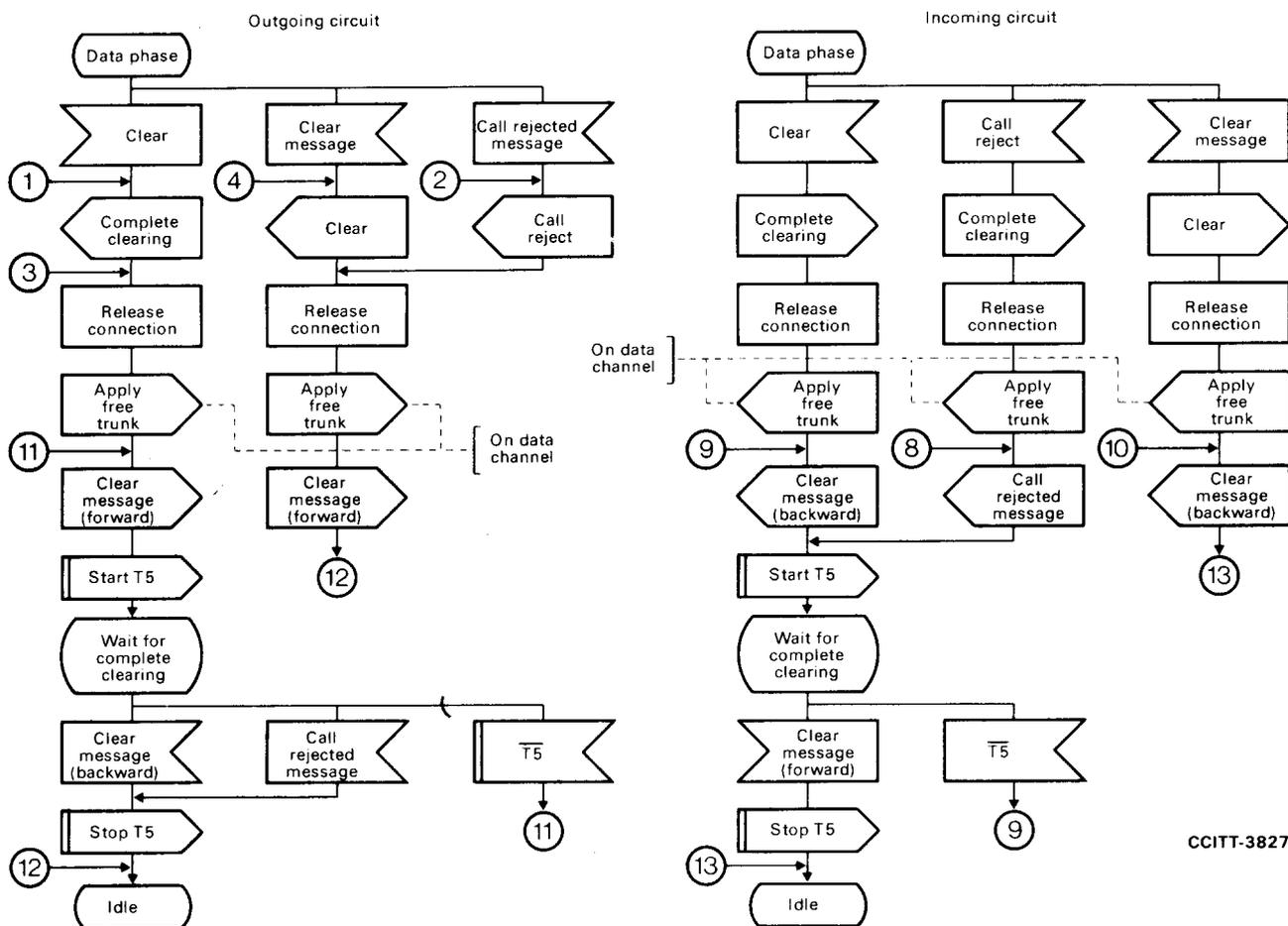
^{a)} In accordance with the applicable DTE/DCE interface protocol.

^{b)} Call accepted state, or corresponding, from called user.

Note – Connectors 8 to 10 go to Figure 18/X.61, which also shows clearing in data phase. Time-out T3 as in § 4.5.3.2.

FIGURE 17/X.61

Call set-up at destination exchange



CCITT-38271

Note – Connectors ① to ④ from Figure 15/X.61 and ⑧ to ⑬ from Figure 17/X.61. Time-out T5 and delayed maintenance alarm in case of ineffective release as in § 4.5.3.4.

FIGURE 18/X.61
Clearing of interexchange data circuits

4.3.3.3 Destination exchange

The clearing actions are illustrated by means of SDL diagrams in Figures 17/X.61 and 18/X.61. Release of the connection is initiated by one of the following criteria (see also the Note to § 4.3.3.2):

- a) failure to complete call set-up,
- b) detection of *clear request* condition from the called user,
- c) optionally, detection of a *clear request* condition from the calling user on the forward channel of the interexchange data circuit, or
- d) receipt of a forward clear message.

After release of the connection:

- a call rejected message is sent to the preceding exchange in the case a),
- a clear message is sent to the preceding exchange in the cases b), c) or d),
- the called user is cleared in accordance with the applicable DTE/DCE interface protocol in the cases b), c) and d).

4.4 *Detailed signalling procedures under normal conditions*

The signalling information content of the different signalling message types is specified in § 3. The general function of the different signalling information components is defined in § 2. In the following, requirements are detailed for the signalling information components that are involved in normal basic calls. The requirements for sending the messages and for the principal actions at their reception are specified in § 4.2.

4.4.1 *Address message*

In the international network the *destination* address will be the complete international data number of the called user in accordance with Recommendation X.121, i.e. including the DCC/DNIC.

The *DCC/DNIC* indicator is provided to cater for discrimination in national networks between cases where the destination address does or does not include the DCC/DNIC component. Depending on the national numbering and routing plans, this indicator may be necessary or useful for interpretation of the destination address and to determine the routing of the call. It may, for example, be used to identify an outgoing international call.

The *national/international call* indicator is provided to cater for discrimination in national networks between national and international calls. Depending on the implementation of user facilities and network functions that imply different handling of national and international calls, this indication may be a necessary or useful means for such differentiation. It may, for example, be used to determine whether a called line identity sent from the destination exchange should include the DNIC.

The *user class* indicator provides information about the user class of the calling user. At a transit exchange the user class information is used for selection of an appropriate type of data circuit. At the destination exchange the user class information is used to verify that the calling and the called users have compatible user classes of service.

The *alternative routing* indicator is set in the case where alternative routing is performed. It may be used to prevent the call being subjected to alternative routing more than once.

Provision is made for transfer in a national network of the calling line identity as part of the basic procedures, e.g. for call management purposes.

An address message may also contain additional signalling information relating to user facilities and network utilities the procedures of which are covered in § 5 and Recommendation X.300.

4.4.2 *Call accepted message*

The *call accepted* signal is used at the time of connection of the call to a called user having automatic answer. In some cases when a user facility applies, or when the called DTE operates with manual answer, another signal is used in the first call accepted message. In such cases the *call accepted* signal is used in a second call accepted message when the call is completed by receipt of a *call accepted* (or corresponding) signal from the called user. At receipt of the *call accepted* signal the originating exchange prepares normal connect through.

In some situations of interworking with decentralized signalling the *transit through-connect* signal will be used as specified in Recommendation X.80. It will normally be followed by a second call accepted message. At receipt of the *transit through-connect* signal the originating exchange waits for a further call accepted message.

In some cases when the called user has a user facility, an alternative signal to the *call accepted* signal and/or additional signalling information will be used as covered in § 5 and Recommendation X.300. Depending on the facility involved this may result in an alternative connect through procedure at the destination exchange.

Provision is made for transfer in a national network of the called line identity as part of the basic procedures, e.g. for call management purposes.

4.4.3 *Call rejected message*

This message contains a signal indicating the cause for call rejection. The signal to be used in a particular case and the applicable translation at the originating exchange to a *DTE/DCE* call progress signal is as defined in § 2.3.

Receipt of a call rejected message will initiate clearing (see § 4.3.2). In international operation the network identity of the exchange originating the signal will be included in the message.

4.4.4 *Clear message*

A clear message containing a *circuit released* signal will be sent after release of the connection in the case when a clear message or a call rejected message has not been received for the same call and circuit. In the case where a clear message or a call rejected message has been received for the same call and circuit, the clear message sent will contain a *circuit released acknowledgement* signal. The signal sent will in both cases be coded as forward and backward respectively depending on the direction of the call at call set-up.

An interexchange data circuit is considered to be free for a new call when a clear message or a call rejected message has been sent, or received, subsequent to receipt, or sending, of those types of messages.

4.4.5 *Other messages*

Other types of messages are also provided for control of user facilities and network utilities as covered in § 5 and Recommendation X.300. Also, some message types are used in abnormal conditions as specified in § 4.5.

4.4.6 *Head-on collision*

When both-way working is used on a group of circuits, head-on collision can occur, i.e. the exchanges at each end may seize the same interexchange data circuit at approximately the same time. Head-on collision is detected when after sending of an address message, an address message is received as the first "backward" message.

In international operation, it may be necessary to employ preventive measures to reduce the probability of head-on collisions and to take action to minimize their effects. The following describes the preferred method:

The available circuits are divided into two groups of circuits, one group where the near end has priority access and one group with priority access for the opposite end. When an outgoing call is to be set up, the group with near end priority is searched according to the FIFO principle (first in - first out). If no circuit is found within this group, the group with opposite end priority is searched according to the LIFO principle (last in - first out). The separation between the groups is dynamic: each time when a circuit is released, it is transferred to the group with near end priority if the last call originated in the near end and to the group with opposite end priority if the last call originated in the opposite end.

The compatibility between the method described above and methods described in Q.724 and in Recommendation X.71 requires further study.

The detailed arrangements, in case of head-on collision requires further study.

4.5 *Call handling in abnormal conditions*

4.5.1 *Sending of a second backward message at call set-up*

As specified in § 4.3.1.3, the call accepted message can be sent before receipt of a *call accepted* (or corresponding) signal from the called user. If subsequently a condition occurs, e.g. *call collision*, that prevents the call from being completed, a call rejected message indicating this condition is sent. In these cases sending of the call rejected message will clear the call. At the originating exchange, receipt of the call rejected message will result in sending the applicable call progress signal to the calling user.

In some interworking situations and with some user facilities, sending of a second call accepted message may apply in the normal condition.

4.5.2 *Blocking and unblocking sequences*

Sending of a *blocking* signal will have the effect of prohibiting outgoing calls from the distant end of the relevant circuit, but will in itself not prohibit incoming calls to the exchange. Sending of the *unblocking* signal will have, the effect of cancelling the blocked condition effected by the *blocking* signal. Acknowledgement sequences are always required for both the *blocking* and *unblocking acknowledgement* signals respectively. The acknowledgement is not sent until the relevant action, i.e. blocking or unblocking of the circuit, has been taken.

Removal (restoration) of a circuit from (to) traffic from both ends thus requires completion of a blocking and blocking acknowledgement (unblocking and unblocking acknowledgement) signal sequence relating to both directions.

Blocking of a circuit may be made during a call. In such a case the blocking sequence will be completed but the progress of the call will not be affected. However, after clearing of the call by means of the normal clearing signal sequence, the *blocked* condition will prevent the circuit from being seized by a new call. A *blocked* condition may in some situations be cancelled by a *reset circuit* signal (see § 4.5.5).

Blocking and unblocking sequences may be initiated by automatic or manual actions.

4.5.3 *Time-out supervision*

At various stages in the call set-up and clear-down procedures it is necessary to wait for receipt of a signal or condition from an adjoining exchange or user. The duration of such periods has to be controlled by appropriate time-outs. See also Figures 15/X.61 to 18/X.61. The operation of some of the time-outs will be affected by certain user facilities, see § 5. The values specified for the time-outs in the following are provisional.

All time-outs related to call set-up are terminated in the case that clearing takes place before expiry of the time-out.

4.5.3.1 *Originating exchange*

The following time-outs are necessary at call set-up:

- a) T1 = 10-20 s; the time between the sending of the address message and the receipt of a call accepted message. On expiry of the time-out T1 the originating exchange will send the *no connection* call progress signal to the calling user and clear the call.
- b) T2 = 5-10 s; the time between the receipt of the first call accepted message and detection of the *call accepted* condition. On expiry of time-out T2 the originating exchange will send the *no connection* call progress signal to the calling user and clear the call.

Note - The operation of time-out T2 is modified when certain user facilities apply (see § 5).

4.5.3.2 *Destination exchange*

The following time-outs are necessary at call set-up:

- a) T3: value as specified for the relevant DTE/DCE interface; the time between the sending of the *incoming call* (or corresponding) signal to the called user and the receipt of the *call accepted* (or corresponding) signal from the called user. On expiry of time-out T3, as specified for the applicable DTE/DCE interface protocol, the destination exchange will send a call rejected message containing a *network failure* signal and thus clear the call.
- b) T4 = 5-10 s; the time between the sending of the call accepted message and receipt of a calling line identity message (when identification is requested). On expiry of time-out T4, the destination exchange will send a call rejected message containing a *network failure* signal and thus clear the call.

4.5.3.3 *Transit exchange*

Because a transit exchange is through-connected without waiting for an external event, no time-out supervision is required at call set-up.

4.5.3.4 *Circuit supervision*

The following time-outs are required in all exchanges:

- a) T5 = 5-10 s; the time between sending of the clear message, containing a *circuit released* signal, or a call rejected message and the receipt of a clear message or a call rejected message (relating to the same interexchange data circuit and clearing action). On expiry of time-out T5, a new clear message containing a *circuit released* signal will be sent. Should clearing continue to be ineffective, a maintenance alarm will be activated after an appropriate time interval, and the circuit is kept busy. No time-out will apply following sending of the clear message containing a *circuit released acknowledgement* signal.
- b) T6 = 5-10 s; the time between sending of a *blocking* or *unblocking* signal and receipt of a *blocking acknowledgement* or *unblocking acknowledgement* signal (respectively). On expiry of time-out T6, the *blocking* or *unblocking* signal will be repeated. Should blocking or unblocking continue to be ineffective, a maintenance alarm will be activated after an appropriate time interval.

4.5.4 *Call clear-down before completion of call set-up*

In some circumstances of call clear-down in abnormal conditions, signalling information relating to the call may subsequently be received. With the exception in § 4.5.6 such information will in all cases be discarded.

In the case where user clearing is detected or a clear message is received during the call set-up, the call set-up process is terminated and normal clear-down is performed. If the originating exchange has seized an interexchange data circuit, a clear message will not be sent unless an address message has already been sent.

In some cases it may be required to clear a call for management purposes. This can be achieved by initiating at any exchange the clearing procedures. See also § 4.5.5.

4.5.5 *Circuit resetting in abnormal situations*

In the case where the state of an interexchange data circuit becomes ambiguous, due to for example memory mutilation or processor disturbances at an exchange (X), the reset circuit may be used by that exchange to align the state of the circuit at both ends. The *reset circuit* signal is always acknowledged by a *circuit released acknowledgement* signal.

When receiving a *reset circuit* signal an exchange (Y) will:

- a) respond with a *circuit released acknowledgement* signal in the case where the circuit is indicated as free;
- b) release the circuit and respond with a *circuit released acknowledgement* signal in the case where the circuit is busy;
- c) respond with a *blocking* signal followed by a *circuit released acknowledgement* signal in the case where the circuit is unconnected but indicated as being blocked at exchange X by exchange Y;
- d) release the circuit and respond with a *blocking* signal followed by a *circuit released acknowledgement* signal in the case where the circuit is busy and indicated as being blocked at exchange X by exchange Y;
- e) cancel a *blocked* condition (for outgoing calls) indicated as initiated by the distant end and act as in a)-d) above, as applicable, in the case where such a *blocked* condition exists at exchange Y in addition to one of the conditions a)-d).

Note - If the exchange (X) sending the *reset circuit* signal wants to preserve a *blocked* condition at the other end (Y), it (X) has to send a *blocking* signal subsequent to the *reset circuit* signal.

After sending a *reset circuit* signal, the exchange (X) will regard the circuit as unavailable for traffic until a response is received (from Y) at which time the exchange will:

- i) return the circuit to the idle condition when a *circuit released acknowledgement* signal is received;
- ii) regard it as operational but blocked by the distant end (Y) for outgoing calls when a *blocking* signal is received.

Appropriate means to cover situations in which no response to a *reset circuit* signal is received should be provided.

Note - The possible provision of means for resetting a group of circuits by a single action is for further study.

4.5.6 *Receipt of unreasonable signalling information*

The Message Transfer Part of the signalling system will avoid mis-sequencing of or double delivery of messages with a high reliability. However, undetected errors at the signalling link level and exchange malfunctions may produce unreasonable signalling information in messages that are either ambiguous or inappropriate.

In order to resolve some possible ambiguities in the state of a circuit when unreasonable signals are received, the following will apply:

- a) If a *circuit released* signal is received relating to an idle circuit, it will be acknowledged with a *circuit released acknowledgement* signal.
- b) If a *circuit released acknowledgement* signal is received relating to an idle interexchange data circuit, it will be discarded.
- c) If a *circuit released acknowledgement* signal is received relating to a busy interexchange data circuit for which a circuit released signal has not been sent, the circuit will be released and a circuit released signal will be sent.
- d) If a *blocking* signal is received for a blocked interexchange data circuit, a *blocking acknowledgement* signal will be sent.
- e) If an *unblocking* signal is received for an unblocked interexchange data circuit, an *unblocking acknowledgement* signal will be sent.

Any other unreasonable signalling information received will be discarded (see, however, § 4.4.6). If the discarding of the information prevents a call from being completed; that call will eventually be cleared by the expiry of a time-out.

5 **Additional call control and signalling procedures**

5.1 *General*

Paragraph 5 refers to the call control and signalling procedures that apply, in addition to the basic procedures specified in § 4, where user facilities and network utilities are involved.

The principles and procedures for realization of international user facilities and network utilities are defined in Recommendation X.300, which thus gives the basis for the common channel signalling procedures. Therefore, the following is limited to an outline of the implications for the common channel signalling procedures of such user facilities and network utilities.

The additional signalling information components particular to user facilities and network utilities are indicated in § 2. The corresponding formats and codes are specified in § 3.

5.2 *Closed user group facilities*

Depending on whether a closed user group is involved, the address message may include a *closed user group call* indication and an *interlock code*.

In certain cases of redirection of a closed user group call, that closed user group information included in the address message will also be returned back, within a call accepted message, to the exchange controlling redirection.

5.3 *Bilateral closed user group facilities*

The signalling system is capable of supporting automatic user controlled procedures for registration and cancellation of bilateral closed user groups. Three types of messages:

- facility registration/cancellation request message,
- facility registration/cancellation request accepted message, and
- facility registration/cancellation request rejected message,

which may include a number of signalling indications relating to bilateral closed user groups, are provided for those procedures.

At call set-up within a bilateral closed user group, the address message will contain a *bilateral closed user group call* indication.

Note - Subject to further study, it may be necessary to include further information relating to this facility in the address message, see Recommendation X.300.

5.4 *Calling line identification*

The signalling system provides for transfer of the calling line identity:

- a) in the address message, systematically or selectively, or
- b) in a calling line identity message, on request from the destination exchange as indicated in the call accepted message.

5.5 *Called line identification*

The called line identity is transferred in the call accepted message on request from the originating exchange as indicated in the address message.

The *national/international* indicator included in the address message may be used by the destination exchange to determine whether the called line identity should be the national or the complete international data number of the called user.

5.6 *Redirection of calls*

The signalling system provides a number of signals that cater for the *redirection of calls* facility.

In the case where the call is released back to a controlling exchange at redirection, the call accepted message will contain the *redirection request* signal, a *redirection address* indication and the *redirection address*. The original forward connection is cleared from the controlling exchange.

The address message sent for a call that during redirection is set up towards the new number (i.e. the *redirection address*) will contain a *redirected call* indication.

When a redirected call has been connected to the *redirection address*, the call accepted message sent towards the originating exchange will contain the *redirected call* signal. The *redirected call* signal is equivalent to the *call accepted* signal but has also the additional function of sending a *call progress* signal to the called user.

5.7 *Connect when free and waiting allowed*

The call accepted message sent from the destination exchange, when a call to a busy user having the *connect when free* facility is put in a queue, will contain the *connect when free* signal. At the originating exchange this signal will among other actions inhibit time-out T2.

When the waiting call is connected to the called user, a second call accepted message, now containing the *call accepted* signal, will be sent.

5.8 *Reverse charging and reverse charge acceptance*

When a reverse charging request from a calling user is allowed by the originating network, the address message will contain a *reverse charging request* indication. In the case where reverse charging is rejected because the called user does not have the *reverse charge acceptance* facility, the call rejected message will contain the *reverse charge acceptance not subscribed* signal. Otherwise the call is accepted or rejected as an ordinary call.

Note - The principles for accounting of reverse charging calls have not yet been determined; thus the possible implications of special accounting arrangements for the switching or interexchange signalling procedures have not yet been determined.

5.9 *Manual answer*

The call accepted message sent from the destination exchange at connection of a call to a user who employs *manual answer*, will contain the *terminal called* signal. At receipt of the *terminal called* signal at the originating exchange, through-connection will be prepared but time-out T2 will be lengthened to 2-4 minutes.

When the called user responds by a *call accepted* signal, a second call accepted message, now containing the *call accepted* signal, will be sent.

5.10 *RPOA selection*

In the case where a calling user selects a particular RPOA, an address message sent in the originating network will contain an *RPOA selection* indication and the applicable *RPOA transit network identity*. If such a call is rejected because the selected RPOA transit network cannot handle the call, the call rejected message sent will contain the *RPOA out-of-order* signal.

5.11 *Network identification utilities*

The capability for *originating network identification* on request from the destination network is mandatory for international calls. When this utility is employed the call accepted message will contain an *originating network identification request* indication. The identity of the originating network is then sent in a calling line identity message.

The signalling system also provides for transfer of the identity of the originating network within the address message.

Destination network identification and transit network identification by means of transfer of the network identities in the call accepted message are mandatory for international calls.

6 **Signalling performance and traffic characteristics in data applications**

6.1 *Signalling reliability*

6.1.1 *General*

Recommendation Q.706 details the factors that influence the performance of the message transfer service provided by a signalling network that uses the Message Transfer Part of Signalling System No. 7. It also provides information that may be used to estimate that performance in particular applications.

6.1.2 *Unsuccessful calls due to signalling malfunctions*

Although the Message Transfer Part is designed to provide a high reliability for transfer of messages through a signalling network, certain irregularities in message transfer cannot be prevented in certain situations.

Loss of the message will in most cases result in an unsuccessful call. The proportion of lost messages will primarily depend on the reliability of equipment used to realize certain signalling functions. The requirements specified for such equipments in Recommendation Q.706 will ensure that the proportion of lost calls in typical applications is 1 in 10^5 or better.

In certain extreme conditions, it is also possible that the message transfer function delivers faulty messages with reasonable information or delivers messages out-of-sequence. The probability of such malfunctions is, however, negligible from the circuit-switched data service point of view, see Recommendation Q.706.

6.1.3 *Availability of signalling*

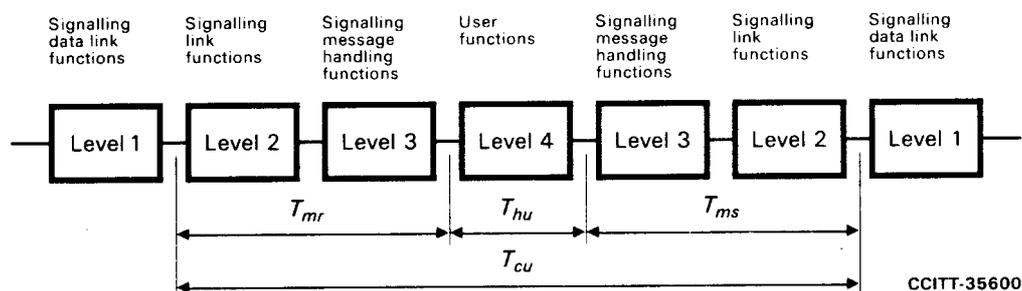
The availability of signalling primarily depends on the reliability of the equipment used to realize the signalling functions and the redundancy with which such equipment is provided.

No availability requirements for international signalling for the circuit-switched data service have yet been defined.

6.2 Message transfer times

6.2.1 Functional reference points and signal transfer time components

See Figure 19/X.61.



T_{cu}	Cross-office transfer time		The definitions of these times are given in Recommendation Q.706.
T_{hu}	Data User Part handling time		
T_{mr}	Message Transfer Part receiving time		
T_{ms}	Message Transfer Part sending time		

FIGURE 19/X.61

Functional diagram of the signal transfer time

6.2.2 Definitions

6.2.2.1 cross-office transfer time T_{cu}

T_{cu} is the period which starts when the last bit of the signal unit leaves the incoming signalling data link and ends when the last bit of the signal unit enters the outgoing signalling data link for the first time. It also includes the queueing delay in the absence of disturbances but not the additional queueing delay caused by retransmission.

6.2.2.2 data user part handling time, T_{hu}

T_{hu} is the period which starts when the last bit of the message has entered the Data User Part and ends when the last bit of the derived message has left the Data User Part.

6.2.3 Queueing delay

An example of the queueing delays which may be expected in a particular case is shown in Appendix I to this Recommendation, see also § 6.3.

6.3 Data signalling traffic models

The characteristics of the signalling traffic generated for data call control will primarily depend on factors such as:

- the data traffic volume (call/s),
- the mix of different call types (international/national, successful/unsuccessful, etc.),
- the proportion of calls involving user facilities and network utilities and the mix of such facilities and utilities.

Appendix I contains two data signalling traffic models that indicate the mix of message types and lengths that result from particular sets of assumed conditions. The appendix also gives an example of the loading capacity of a signalling link for data call control signalling.

APPENDIX I

(to Recommendation X.61)

Examples of signalling traffic characteristics

I.1 *Signalling traffic models*

I.1.1 Tables I-1/X.61 and I-2/X.61 show two examples of mixes of data signalling message types and lengths. The models are simplified and do not fully reflect the possible variation of message lengths.

The following applies for both models:

- a mix of national and international calls is assumed with 8 and 12 digits in the data numbers respectively;
- the closed user group facility applies for 50% of the calls;
- the basic label specified in § 3.2.2.1 is used;
- the message length shown in the tables is the number of octets in the signalling information field of the corresponding signal unit; the overall length of the signal unit on the line is approximately 7 octets longer.

I.1.2 Table I-1/X.61 assumes that the calling line identity is always sent in the address message and that called line identification applies for 10% of the calls.

TABLE I-1/X.61

Example 1 of data signalling message mix

Message type	Messages/call	Message length (octets)
Address message	0.575	24
	0.425	18
Call accepted message	0.1	14
	0.9	8
Clear message	2	7

Message per call = 4

Average message length = 11 octets

Total amount of information per call = 576 bits.

I.1.3 Table I-2/X.61 assumes that the calling line identity is sent on request for 10% of the calls.

I.2 *Queueing delay and link loading*

Figure I-1/X.61 shows the mean value and standard deviation of message queueing delays for different signalling link loads.

The queueing delays shown in Figure I-1/X.61 assume:

- a message mix according to Table I-1/X.61,
- error-free operation of a signalling link using the basic error correction method.

The theoretical basis for calculation of the queueing delays and information about the performance of the signalling system under error conditions are included in Recommendation Q.706.

The equivalent call rate shown in the Figure I-1/X.61 assumes an even distribution of the calls in both directions of transmission.

TABLE I-2/X.61

Example 2 of data signalling message mix

Message type	Messages/call	Message length (octets)
Address message	0.575	18
	0.425	14
Call accepted message	1	8
Calling line identity message	0.1	14
Clear message	2	7

Messages per call = 4.1

Average message length = 9.7 octets

Total amount of information per call = 548 bits.

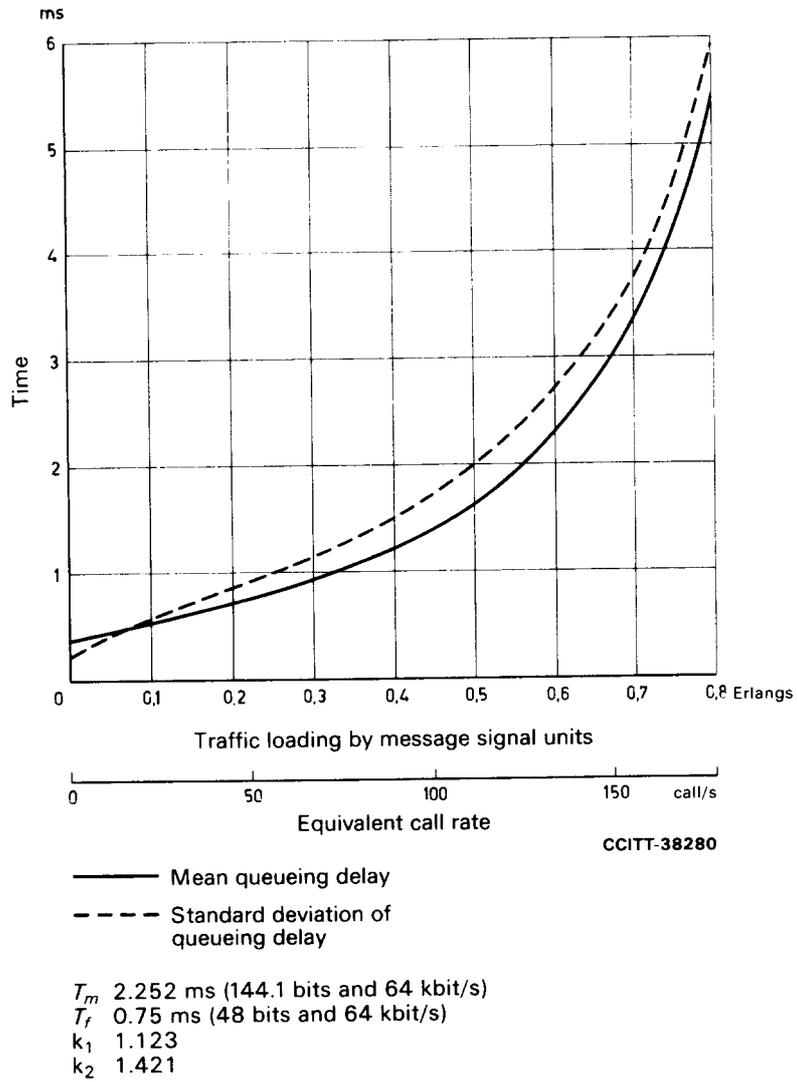


FIGURE I-1/X.61
 Example of queueing delay as a function of link load