INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

RED BOOK

VOLUME VI – FASCICLE VI.8

SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

RECOMMENDATIONS Q.721-Q.795

VIIITH PLENARY ASSEMBLY
MALAGA-TORREMOLINOS, 8-19 OCTOBER 1984

Geneva 1985

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PRELIMINARY NOTES

1 The Questions entrusted to each Study Group for the Study Period 1985-1988 can be found in Contribution No. 1 to that Study Group.

2 In this Volume, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

3 The strict observance of the specifications for standardized international signalling and switching equipment is of the utmost importance in the manufacture and operation of the equipment. Hence these specifications are obligatory except where it is explicitly stipulated to the contrary.

The values given in Fascicles VI.1 to VI.9 are imperative and must be met under normal service conditions.

FASCICLE VI.8

Recommendations Q.721 to Q.795

SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

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SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

Preface

Signalling System No. 7 consists of:

- the Message Transfer Part (MTP), specified in Recommendations Q.701 to Q.709 [1)];
- the PABX application, specified in Recommendation Q.710 [1)];
- the Signalling Connection Control Part (SCCP), specified in Recommendations Q.711 to Q.714 [1)];
- the Telephone User Part (TUP), specified in Recommendations Q.721 to Q.725 [2)];
- the Data User Part (DUP), specified in Recommendation X.61 (Q.741) [2)];
- the Integrated Services Digital Network User Part (ISDN UP), specified in Recommendations Q.761 to Q.766 [2)];
- the monitoring and measurements for the MTP, specified in Recommendation Q.791 [2)];
- the Operations and Maintenance Application Part (OMAP), specified in Recommendation Q.795 [2)].

An overall description of the signalling system and the division of functions and interactions between the Message Transfer Part and the User Parts is given in Recommendation Q.701.

General signalling network considerations are contained in Recommendation Q.705.

The use of Signalling System No. 7 in call control applications of the telephone service is recommended in Recommendations Q.7 [1] and Q.110 [2].

The use of Signalling System No. 7 in call control applications of the circuit switched data transmission service is recommended in Recommendation X.60 [3]. The call control and signalling procedures applicable for international data transmission user facilities and network utilities are defined in Recommendation X.87 [4].

References

[1] CCITT Recommendation *Signalling systems to be used for international automatic and semiautomatic telephone working*, Vol. VI, Fascicle VI.1, Rec. Q.7.

[2] CCITT Recommendation *General aspects of the utilization of standardized CCITT signalling systems on PCM links*, Vol. VI, Fascicle VI.1, Rec. Q.110.

[3] CCITT Recommendation *Common channel signalling for circuit switched data applications*, Vol. VIII, Fascicle VIII.3, Rec. X.60.

[4] CCITT Recommendation *Principles and procedures for realization of international user facilities and network utilities in public data networks*, Vol. VIII, Fascicle VIII.3, Rec. X.87.

1) These Recommendations are contained in Fascicle VI.7 of the Red Book.

2) These Recommendations are contained in this Fascicle VI.8 of the Red Book.

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SECTION 1

TELEPHONE USER PART (TUP)

Recommendation Q.721

FUNCTIONAL DESCRIPTION OF THE SIGNALLING SYSTEM TELEPHONE USER PART (TUP)

1 General

Use of Signalling System No. 7 for telephone call control signalling requires:

- application of *Telephone User Part* (TUP) 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 Telephone User Part.

2 Telephone User Part

The Telephone User Part specified in these specifications defines the necessary telephone signalling functions for use of Signalling System No. 7 for international telephone call control signalling. It is specified with the aim of providing the same features for telephone signalling as other CCITT telephone signalling systems.

Signalling System No. 7 can be used to control the switching of all types of international circuits to be used in a worldwide connection, including circuits with speech interpolation and satellite circuits.

The system meets all requirements defined by the CCITT concerning the service features for worldwide international semiautomatic and automatic telephone traffic. It is designed for the bothway operation of speech circuits.

When used with homogenous digital telephone circuits the continuity of these circuits is ensured by the means for transmission quality supervision and failure detection that are inherent in the digital systems providing these circuits. However, the system includes means for link-by-link assurance of continuity check of the speech path when used with analogue telephone circuits.

The signalling system is suitable for national telephone applications. Most telephone signalling message types and signals specified for international use are also required in typical national applications. In addition to these, national applications typically require additional signalling message types and signals; the system provides ample spare capacity for such additions.

The standard label structure specified for telephone signalling messages requires that all exchanges using the signalling system are allocated codes from code plans established for the purpose of unambiguous identification of signalling points. The principles to apply to the international signalling network are for further study.

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.

Recommendation Q.722

GENERAL FUNCTION OF TELEPHONE MESSAGES AND SIGNALS

This Recommendation describes the general function of telephone signalling messages and the telephone signals and other information components contained in those messages. The requirements relating to the use of the signalling messages and their signal content are specified in Recommendations Q.723 and Q.724.

1 Telephone signalling messages

The definition of formats and codes for telephone messages is based on a functional grouping as indicated in the following. It is expected that national application of the signalling system typically will require further message types in addition to the internationally defined message types indicated in the following. As a result of the criteria on which the grouping of message types are based some groups as yet only contain one message type.

1.1 *Forward address message group*

This message group includes messages sent in the forward direction containing address information. Signals from § 3.3 may be included. Messages so far specified are as follows.

1.1.1 *Initial address message*

A type of message sent first in the forward direction at call set-up. It contains address information and other information relating to the routing and handling of the call.

1.1.2 *Subsequent address message*

A type of message sent in the forward direction subsequent to the initial address message and containing further address information.

1.2 *Forward set-up message group*

This message group includes messages sent in the forward direction, subsequent to address messages containing further information for call set-up. Signals from § 3.3 may be included. Messages so far specified are as follows.

1.2.1 *General forward set-up information message*

A type of message containing information relating to the calling line or possibly other information required for call set-up.

1.2.2 *Continuity message*

A type of message containing a continuity signal.

1.3 *Backward set-up request message group*

This message group includes messages sent in the backward direction requesting further information for call set-up. Signals from § 3.4 may be included. Messages so far specified are as follows.

1.3.1 *General request message*

A type of message containing a signal requesting transfer of information relating to a call, e.g., the identity or the category of the calling party.

1.4 *Successful backward set-up information message group*

This message group includes messages sent in the backward direction containing information relating to a successful call set-up. Signals from § 3.4 may be included. Messages so far specified are as follows.

1.4.1 *Address-complete message*

A type of message containing a signal indicating that all address signals required for routing the call to the called party have been received and giving additional information relating to this.

1.4.2 *Charging message*

A type of message containing charging information.

1.5 *Unsuccessful backward set-up information message group*

This message group includes messages sent in the backward direction containing information relating to an unsuccessful call set-up. Signals from § 3.4 may be included. Messages so far specified are as follows.

1.5.1 *Unsuccessful-call-attempt message*

A message containing a signal, from § 3.4, relating to an unsuccessful call set-up.

1.6 *Call supervision message group*

A message containing a signal, from § 3.5, relating to the supervision of the call.

1.7 *Circuit supervision message group*

A message containing a signal, from § 3.6, relating to the supervision of the circuit.

1.8 *Circuit group supervision message group*

This message group contains messages from § 3.7, relating to the supervision of circuit groups.

1.9 *Node to node message group*

This message group includes non-circuit related messages generated by a public node to another public node. End-to-end messages (i.e. messages generated and interpreted by only the end exchanges of a call) belong to this message group.

2 Service information

The service information provides the highest level of discrimination between different sets of signalling messages. It contains the following components. (See also Note 1.)

2.1 *Service indicator*

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

2.2 *Network 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.

Note 1 – The service information octet and the label are not included in messages transferred between the telephone user part and the signalling connection control part (e.g. node to node messages).

3 Signalling information

3.1 *Label components*

In the case of the telephone signalling messages the label is used for message routing and, in general, identification of the concerned telephone circuit. The standard label structure consists of the following components.

3.1.1 *Destination point code*

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

3.1.2 *Originating point code*

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

3.1.3 *Circuit identification code*

Information identifying the telephone circuit among those interconnecting the destination point and originating point.

3.2 *Message format identifiers*

3.2.1 *Heading*

Information discriminating, as applicable, between different groups or 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 groups. The second level either discriminates between different message types or contains a signal.

3.2.2 *Field length indicator*

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

3.2.3 *Field indicator*

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

3.3 *Forward set-up telephone signals*

3.3.1 *Address signal*

A call set-up signal sent in the forward direction containing one element of information (digit 0, 1, 2, . . ., 9, Code 11 or Code 12) about the called party's number or the end-of-pulsing (ST) signal.

For each call, a succession of address signals is sent.

3.3.2 *End-of-pulsing (ST) signal*

An address signal sent in the forward direction indicating that there are no more address signals to follow.

3.3.3 *Nature-of-address indicator*

Information sent in the forward direction indicating whether the associated address or line identity is an international, national significant or subscriber number.

3.3.4 *Nature-of-circuit indicator*

Information sent in the forward direction about the nature of the circuit or any preceding circuit(s) already engaged in the connection:

- a satellite circuit, or
- no satellite circuit.

An international exchange receiving this information will use it (in combination with the appropriate part of the address information) to determine the nature of the outgoing circuit to be chosen.

3.3.5 *Outgoing echo suppressor indicator*

Information sent in the forward direction indicating whether or not an outgoing half-echo suppressor is included in the connection.

3.3.6 *Information international call indicator*

Information sent in the forward direction indicating that the call is an incoming international call.

3.3.7 *Calling-party's-category*

Information sent in the forward direction about the category of the calling party and, in case of semiautomatic calls, about the service language to be spoken by the incoming, delay and assistance operators.

The following categories are provided:

- operator,
- ordinary calling subscriber,
- calling subscriber with priority,
- data call,
- test call.

3.3.8 *Incomplete calling line identity indicator*

An indicator sent in the forward direction indicating that the calling line identity is incomplete.

3.3.9 *Continuity-check indicator*

Information sent in the forward direction indicating whether or not a continuity check will be performed on the circuit concerned or is being (has been) performed on a previous circuit in the connection.

3.3.10 *Calling line identity*

Information sent in the forward direction indicating the national significant number of the calling party.

3.3.11 *Calling line identity presentation indicator*

Information indicating whether or not the calling line identity presentation is restricted.

3.3.12 *Calling-line-identity-unavailable indicator*

Information sent in the forward direction indicating that the identity of the calling line is not available.

3.3.13 *Calling party's category unavailable indicator*

Information sent in the forward direction to indicate that the calling party's category is not available.

3.3.14 *Original called address not available indicator*

Information sent in the forward direction indicating that the original called address is not available.

3.3.15 *Continuity signal*

A signal sent in the forward direction indicating continuity of the preceding System No. 7 speech circuit(s) as well as of the selected speech circuit to the following international exchange, including verification of the speech path across the exchange with the specified degree of reliability.

3.3.16 *Continuity-failure signal*

A signal sent in the forward direction indicating failure of continuity of the System No. 7 speech circuit.

3.3.17 *Call forwarding indicator*

Information sent in the forward direction indicating that the call is a forwarded call.

3.3.18 *Original called address*

Information sent in the forward direction indicating the address towards which the call was previously routed (before the redirection occurred).

3.3.19 *All digital path required indicator*

Information sent in the forward direction indicating the type path required (64 kbit/s circuit switched connection-transparent).

3.3.20 *Signalling path indicator*

Information sent in the forward direction indicating that the signalling system used since the originating exchange is System No. 7.

3.3.21 *CCBS call indicator*

Information sent in the forward direction to indicate that the call is a CCBS call.

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

3.3.22.1 *Closed user group call indicator*

Information sent in the forward direction indicating whether or not the call involves a closed user group and whether or not outgoing access is allowed for the calling user.

3.3.22.2 *Interlock code*

Information sent in the forward direction identifying a closed user group to which the calling user belongs.

3.3.22.3 *Closed user group check successful indicator*

Information sent in the forward direction to indicate that the validation check has been performed successfully.

3.3.23 *Malicious call identification indicator*

Information sent in the forward direction indicating that the malicious call identification has been provided or not.

3.3.24 *Hold indicator*

Information sent in the forward direction indicating whether the requested holding of the connection is possible or not.

3.3.25 *Transit exchange identity type indicator*

Information sent in the forward direction indicating the type of information included as transit exchange identity.

3.3.26 *Transit exchange identity*

Information sent in the forward direction indicating the identity of the transit exchange by which the call is established such as signalling point code or a part of the calling line identity.

3.3.27 *Incoming trunk identity*

Information sent in the forward direction indicating the identity of the incoming trunk on which the call is established.

3.3.28 *Called line identity request indicator*

Information sent in the forward direction indicating whether or not the called party address should be returned.

3.3.29 *Signals related to charging facilities*

For further study.

3.3.30 *Charging information*

Information sent in the forward direction for charging and/or accounting purposes.

3.4 *Backward set-up telephone signals*

3.4.1 *Calling-line-identity-request indicator*

Information sent in the backward direction requesting transfer of the calling line identity from the originating exchange.

3.4.2 *Calling party's category request indicator*

Information sent in the backward direction requesting transfer of the calling party's category from the originating exchange.

3.4.3 *Original called address information request indicators*

Information sent in the backward direction requesting transfer of the original called address from the originating exchange.

3.4.4 *User facility information request indicator*

3.4.4.1 *Closed user group index request indicator*

Information sent in the backward direction requesting transfer of the closed user group index.

3.4.5 *Address-complete signal*

A signal sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received and that no called-party's-line-condition signals (electrical) will be sent.

3.4.6 *Address-complete signal, charge*

A signal sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received, that no called-party's-line-condition signals (electrical) will be sent and that the call should be charged on answer.

3.4.7 *Address-complete signal, no-charge*

A signal sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received, that no called-party's-line-condition (electrical) will be sent and that the call should not be charged on answer.

3.4.8 *Address-complete signal, coin-box*

A signal sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received, that no called-party's-line-condition (electrical) will be sent, that the call should be charged on answer and that the called number is a coin (box) station.

3.4.9 *Subscriber-free indicator*

Information sent in the backward direction indicating that the called party's line is free.

3.4.10 *Incoming echo suppressor indicator*

Information sent in the backward direction indicating that an incoming half-echo suppressor has been inserted or not.

3.4.11 *Call forwarding indicator*

Information sent in the backward direction indicating that the call has been forwarded to a different address.

3.4.12 *Signalling path indicator*

Information sent in the backward direction indicating that the signalling system used since the terminating exchange is Signalling System No. 7.

3.4.13 *Redirection address*

Information sent in the backward direction indicating the address towards which the call must be rerouted or has been forwarded.

3.4.14 *Connected party address*

Information sent in the backward direction indicating the complete telephone number of the user to which the call is connected to.

3.4.15 *Charging information signals*

Information sent in the backward direction for charging and/or accounting purposes.

3.4.16 *Outgoing echo suppressor request indicator*

Information sent in the backward direction requesting for the insertion of an outgoing suppressor.

3.4.17 *Index request indicator*

Information sent in the backward direction requesting the index for CUG validation.

3.4.18 *Hold request indicator*

Information sent in the backward direction indicating that the hold of the connection is requested. The release of the call will be controlled by the terminating exchange.

3.4.19 *Malicious call identification indicator*

Information sent in the backward direction indicating that a malicious call identification facility has been encountered.

3.4.20 *Switching-equipment-congestion signal*

A signal sent in the backward direction indicating the failure of the call set-up attempt due to congestion encountered at international switching equipment.

3.4.21 *Circuit-group-congestion signal*

A signal sent in the backward direction indicating the failure of the call set-up attempt due to congestion encountered on an international circuit group.

3.4.22 *National-network-congestion signal*

A signal sent in the backward direction indicating the failure of the call set-up attempt due to congestion encountered in the national destination network [excluding the busy condition of the called party's line(s)].

3.4.23 *Digital path not provided signal*

Information sent in the backward direction indicating that a routing which allows the complete digital path requested does not exist.

3.4.24 *Address-incomplete signal*

A signal sent in the backward direction indicating that the number of address signals received is not sufficient for setting up the call. This condition may be determined in the incoming international exchange (or in the national destination network):

- immediately after the reception of an ST signal, or
- on timeout after the latest digit received.

3.4.25 *Call-failure signal*

A signal sent in the backward direction indicating the failure of a call set-up attempt due to the lapse of a timeout or a fault not covered by specific signals.

3.4.26 *Called party's line condition signals*

3.4.26.1 *Unallocated-number signal*

A signal sent in the backward direction indicating that the received number is not in use (e.g. spare level, spare code, vacant subscriber's number).

3.4.26.2 *Subscriber-busy signal (electrical)*

A signal sent in the backward direction indicating that the line(s) connecting the called party with the exchange is (are) engaged. The subscriber-busy signal will also be sent in case of complete uncertainty about the place where the busy or congestions are encountered and in the case where a discrimination between subscriber-busy and national-network congestion is not possible.

3.4.26.3 *Line-out-of-service signal*

A signal sent in the backward direction indicating that the called party's line is out-of-service or faulty.

3.4.26.4 *Send-special-information-tone signal*

A signal sent in the backward direction indicating that the special information tone should be returned to the calling party. This tone indicates that the called number cannot be reached for reasons not covered by other specific signals and that the unavailability is of a long-term nature (see also Recommendation Q.35 [1]).

3.4.27 *Access barred signal*

Information sent in the backward direction indicating that the call is rejected because a compatibility check failed.

3.4.28 *Misdialled trunk prefix*

A signal sent in the backward direction indicating the erroneous inclusion of a trunk prefix (for national use).

3.5 *Call supervision signals*

3.5.1 *Forward-transfer signal*

A signal sent in the forward direction on semiautomatic calls when the outgoing international exchange operator wants the help of an operator at the incoming international exchange. The signal will normally serve to bring an assistance operator (see Recommendation Q.101 [2]) into the circuit if the call is automatically set up at the exchange. When a call is completed via an operator (incoming or delay operator) at the incoming international exchange, the signal should preferably cause this operator to be recalled.

3.5.2 *Answer signal, charge*

A signal sent in the backward direction indicating that the call is answered and subject to charge.

In semiautomatic working, this signal has a supervisory function. In automatic working, the signal is used:

- to start metering the charge to the calling subscriber (Recommendation Q.28 [3]), and
- to start the measurement of call duration for international accounting purposes (Recommendation E.260 [4]).

3.5.3 *Answer signal, no charge*

A signal sent in the backward direction indicating that the call is answered but is not subject to charge. It is used for calls to particular destinations only.

In semiautomatic working, this signal has a supervisory function. In automatic working, the reception of this signal shall not start the metering to the calling subscriber.

3.5.4 *Answer signal, unqualified* (basic national use)

A signal sent in the backward direction to indicate that the call is answered.

3.5.5 *Clear-back signal*

A signal sent in the backward direction indicating that the called party has cleared.

In semiautomatic working this signal has a supervisory function. In automatic working, the arrangements specified in Recommendation Q.118 [5] apply.

3.5.6 *Re-answer signal*

A signal sent in the backward direction indicating that the called party, after having cleared, again lifts his receiver or in some other way reproduces the answer condition, e.g. switch-hook flashing.

3.5.7 *Clear-forward signal*

A signal sent in the forward direction to terminate the call or call attempt and release the circuit concerned. This signal is normally sent when the calling party clears but also may be a proper response in other situations as, for example, when reset circuit is received.

3.5.8 *Calling party clear signal* (national option)

A signal sent in the forward direction, when the holding of the connection is provided, to indicate that the calling party has cleared.

3.6 *Circuit supervision signals*

3.6.1 *Release-guard signal*

A signal sent in the backward direction in response to a clear-forward signal, or if appropriate to the reset-circuit signal, when the circuit concerned has been brought into the idle condition.

3.6.2 *Reset-circuit signal*

A signal that is sent to release a circuit when, due to memory mutilation or other causes, it is unknown whether, for example, a clear-forward or clear-back signal is appropriate. If at the receiving end the circuit is blocked, this signal should remove that condition.

3.6.3 *Blocking signal*

A signal sent for maintenance purposes to the exchange at the other end of a circuit to cause engaged conditions of that circuit for subsequent calls outgoing from that exchange. An exchange receiving the blocking signal must be capable of accepting incoming calls on that circuit unless it also has sent a blocking signal. Under conditions covered later, a blocking signal is also a proper response to a reset circuit signal.

3.6.4 *Unblocking signal*

A signal sent to the exchange at the other end of a circuit to cancel in that exchange the engaged conditions of that circuit caused by an earlier blocking signal.

3.6.5 *Blocking-acknowledgement signal*

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

3.6.6 *Unblocking-acknowledgement signal*

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

3.6.7 *Continuity-check-request signal*

A signal sent requesting an independent circuit continuity test.

3.7 *Circuit group supervision messages*

3.7.1 *Maintenance oriented group blocking message*

A message sent for maintenance purposes to the exchange at the other end of a circuit group to cause an engaged condition on that circuit group or parts thereof for subsequent calls outgoing from that exchange. An exchange receiving the maintenance oriented group blocking message must be capable of accepting incoming calls on the blocked circuits of that circuit group unless it also has sent a blocking message.

3.7.2 *Maintenance oriented group unblocking message*

A message sent to the exchange at the other end of a circuit group to cancel in that exchange the engaged condition on that circuit group or parts thereof caused by an earlier maintenance oriented group blocking message.

3.7.3 *Hardware failure oriented group blocking message*

A message sent for reason of a hardware failure to the exchange at the other end of a circuit group to cause an engaged condition on that circuit group or parts thereof. An exchange receiving the hardware failure oriented group blocking message must be capable of accepting incoming calls on the blocked circuits of that circuit group unless it also has sent a blocking message.

3.7.4 *Hardware failure oriented group unblocking message*

A message sent to the exchange at the other end of a circuit group to cancel in that exchange the engaged condition on that circuit group or parts thereof caused by an earlier hardware failure oriented group blocking message.

3.7.5 *Software generated group blocking message (national option)*

A message sent for reason of a software generated alarm to the exchange at the other end of a circuit group to cause an engaged condition on that circuit group or parts thereof. An exchange receiving the software generated group blocking message must be capable of accepting incoming calls on the blocked circuits of that circuit group unless it also has sent a blocking message.

3.7.6 *Software generated group unblocking message (national option)*

A message sent to the exchange at the other end of a circuit group to cancel in that exchange the engaged condition on that circuit group or parts thereof caused by an earlier software generated group blocking message.

3.7.7 *Circuit group reset message*

A message that is sent to release a circuit group or parts thereof when, due to memory mutilation or other causes, it is unknown which of the clearing signals is appropriate for the particular circuits within that circuit group. If at the receiving end circuits are blocked, this message should remove that condition.

3.7.8 *Maintenance oriented group blocking-acknowledgement message*

A message sent in response to a maintenance oriented group blocking message indicating that the circuit group or parts thereof has/have been blocked.

3.7.9 *Maintenance oriented group unblocking-acknowledgement message*

A message sent in response to a maintenance oriented group unblocking message indicating that the circuit group or parts thereof has/have been unblocked.

3.7.10 *Hardware failure oriented group blocking-acknowledgement message*

A message sent in response to a hardware failure oriented group blocking message indicating that the circuit group or parts thereof has/have been blocked.

3.7.11 *Hardware failure oriented group unblocking-acknowledgement message*

A message sent in response to a hardware failure oriented group unblocking message indicating that the circuit group or parts thereof has/have been unblocked.

3.7.12 *Software generated group blocking-acknowledgement message (national option)*

A message sent in response to a software generated group blocking message indicating that the circuit group or parts thereof has/have been blocked.

3.7.13 *Software generated group unblocking-acknowledgement message (national option)*

A message sent in response to a software generated group unblocking message indicating that the circuit group or parts thereof has/have been unblocked.

3.7.14 *Circuit group reset-acknowledgement message*

A message sent in response to a circuit group reset message indicating that:

i) if the range field is not coded all zero, the circuits are reset; or

ii) if the range field is coded all zero, the reset of the circuit group has been started and the reset state of each circuit concerned will be reported by the appropriate call, circuit or circuit group supervision signal/message.

3.8 *Node to node signals*

Signals generated by a public node for another public node to perform enquiries or validation checks, to collect data so that the call can be established as required, or signals generated and interpreted by the end points of a call (end-to-end signals).

3.8.1 *Look ahead request signal*

For further study.

3.8.2 *Look ahead response signal*

For further study.

3.8.3 *CCBS request signal*

Signal sent in the forward direction to indicate to the terminating exchange that a CCBS facility is invoked.

3.8.4 *CCBS accepted signal*

Signal sent in the backward direction to indicate to the originating exchange that the CCBS facility requested has been accepted.

3.8.5 *CCBS rejected signal*

Signal sent in the backward direction to indicate to the originating exchange that the CCBS facility requested has been rejected.

3.8.6 *CCBS cancelled signal*

Signal sent in the forward direction to indicate to the terminating exchange that the calling party has deactivated the CCBS facility and that all the information related to the CCBS request can be erased.

3.8.7 *CCBS inhibited signal*

For further study.

3.8.8 *Called party free signal*

Information sent in the backward direction to indicate to calling exchange, when a CCBS facility has been invoked, the free condition of the called party.

3.8.9 *Calling party answer signal*

Information sent in the forward direction to indicate to the called exchange, when a CCBS facility has been invoked, that the calling party answered.

3.8.10 *Calling party clear signal*

A signal sent in the forward direction, in case of malicious call identification with hold, indicating that the calling party has cleared (national option).

3.8.11 *CUG selection and validation check request signal*

A signal sent from the originating or the redirecting exchange to a data base and requesting the selection and validation of CUG.

3.8.12 *CUG call indicator*

Information sent in the forward direction indicating whether or not the call involves a closed user group and whether or not outgoing access is allowed for the calling user.

3.8.13 *CUG check successful indicator*

Information sent in the forward direction to indicate that the validation check has been performed successfully.

3.8.14 *Interlock code*

Information sent in the forward direction identifying a closed user group to which the calling user belongs.

3.8.15 *Access barred signal*

Information sent from a data base to an originating exchange indicating that the validation check was not successful.

3.8.16 *Divergency signal*

A signal sent from a data base to an originating exchange indicating that there is a divergency between the CUG data stored in the local exchange and CUG data stored in the data base.

3.8.17 *CUG check successful signal*

A signal sent from a data base to the originating redirecting exchange or to a gateway exchange indicating that CUG checks were successful.

3.8.18 *Interlock code with outgoing access allowed*

A signal sent from a data base to the originating exchange including the interlock code and an outgoing access indicator. The call will be set up as a CUG call with outgoing access.

3.8.19 *Connected line indicator*

Information sent in the backward direction indicating if the connected line identity is available or not and if it is the case which type of address is provided.

3.8.20 *Connected line identity presentation indicator*

Information sent in the backward direction indicating if the presentation of the connected line identity is restricted or not.

3.8.21 *Connected line address*

Information sent in the backward direction indicating the identity of the connected line.

References

[1] CCITT Recommendation *Characteristics of the dial tone, ringing tone, busy tone, congestion tone, special information tone and warning tone*, Vol. VI, Fascicle VI.1, Rec. Q.35.

[2] CCITT Recommendation *Facilities provided in international semiautomatic working*, Vol. VI, Fascicle VI.1, Rec. Q.101.

[3] CCITT Recommendation *Determination of the moment of the called subscriber's answer in the automatic service*, Vol. VI, Fascicle VI.1, Rec. Q.28.

[4] CCITT Recommendation *Basic technical problems concerning the measurement and recording of call durations*, Vol. II, Rec. E.260.

[5] CCITT Recommendation *Special release arrangements and indication of congestion conditions at transit exchanges*, Vol. VI, Fascicle VI.1, Rec. Q.118.

FORMATS AND CODES

1 Basic format characteristics

1.1 *General*

The telephone user messages are carried on the signalling data link by means of signal units, the format of which is described in Recommendation Q.703, § 2.2.

The signalling information of each message constitutes the signalling information field of the corresponding 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 *indications*. Structure and function of the label are described in § 2; the heading codes and detailed message formats are described in § 3.

1.2 *The service information octet*

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.704, § 12.2).

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/Q.723.

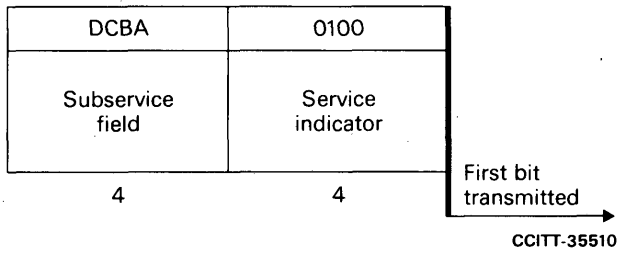

FIGURE 1/Q.723
Service information octet

The following codes are used in the fields of the service information octet:

a) The service indicator is coded 0100.

b) Subservice field.

bits B A Spare (see Note)

bits D C Network indicator
- 0 0 International network
- 0 1 Spare (for international use only)
- 1 0 National network
- 1 1 Reserved for national use

Note – The two unused bits in the service information octet are spare for possible future needs that may require a common solution for all international User Parts and Message Transfer Part level 3. The bits are coded 00.

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 either of fixed or variable length. For a given message type identified by a unique message heading, the presence of a given subfield may be either mandatory or optional. The various types of subfields are further defined below.

1.3.1 *Mandatory subfields*

Subfields which have been declared mandatory for a given message type appear in all messages of that type.

1.3.2 *Optional subfields*

Subfields which have been declared optional for a given message type only appear when required in messages of that type. The presence or absence of each optional field is indicated by the state of a field indicator located in an indicator field, which in this case is a mandatory subfield.

1.3.3 *Fixed length subfields*

Subfields which have been declared fixed length for a given message type, contain the same number of bits in all messages of that type.

1.3.4 *Variable length subfields*

For subfields which have been declared variable length for a given message type, the number of bits may vary between messages of that type. The size of a variable length subfield is indicated in an immediately preceding fixed length subfield in terms of a predefined unit such as bits, octets or half-octets.

1.3.5 *Order of subfield transmission*

For a given type of message the various types of subfields are transmitted in the following order:

a) mandatory subfields,

b) optional subfields.

Within each of these two classes, the order of subfield transmission is, in general, as follows:

1) fixed length subfields (with the exception of the indicator field and subfields indicating the size of a variable length subfield),

2) variable length subfields.

1.3.6 *Order of bit transmission*

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

1.3.7 *Coding of spare bits*

Spare bits are coded 0 unless indicated otherwise.

2 Label

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 Message Transfer Part 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, 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 messages which are related to circuits or calls, the transaction is conveniently identified by including the corresponding circuit identity in the label. In future the introduction of new subscriber services may require the transfer of call related messages between exchanges at a time when no circuit is associated with the call. Such messages could be carried using the services of the Signalling Connection Control Part [6]. In this case the standard access to the Signalling Connection Control Part is used.

Note – The service information octet, the routing label and the circuit identification code are not included in the information transferred between the Telephone User Part and the Signalling Connection control part.

One standard label format is specified (§ 2.2) for international use. The same standard label is applicable for national use; admitted deviations from the format of the standard label are described in § 2.3.

2.2 *Standard telephone label*

2.2.1 *Label format*

The *standard label* has a length of 40 bits and is placed at the beginning of the signalling information field. The label structure is as shown in Figure 2/Q.723.

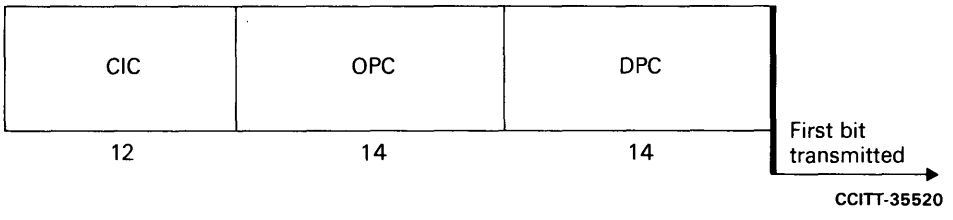

FIGURE 2/Q.723
Standard telephone label structure

The *destination point code* (DPC) indicates the signalling point for which the message is intended, while the *originating point code* (OPC) indicates the signalling point which is the source of the message. The *circuit identification code* (CIC) indicates one speech circuit among those directly interconnecting the destination and the originating points.

The portion of the label that consists of the destination point code and originating point code fields and of the four least significant bits of the circuit identification code field corresponds to the standard routing label specified in Recommendation Q.704, § 13.2.

2.2.2 *Destination and originating point codes*

The standard label structure requires that each telephone exchange in its role as signalling point is allocated a code from code plans 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 which apply to the international signalling network are for further study.

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

2.2.3 *Circuit identification code*

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

Allocation rules for certain applications are defined below:

a) 2048 kbit/s digital path

For circuits which are derived from a 2048-kbit/s digital path (Recommendations G.732 [1] and G.734 [2]) the circuit 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 speech circuit. The remaining bits in the circuit identification code are used where necessary, to identify one among several systems interconnecting an originating and destination point.

b) 8448 kbit/s digital path

For circuits which are derived from a 8448-kbit/s digital path (Recommendation G.744 [3] and G.746 [4]) the circuit identification code contains in the 7 least significant bits an identification of the channel which is assigned to the speech circuit. The codes in Table 1/Q.723 are used.

The remaining bits are used, where necessary, to identify one among several systems interconnecting an originating and destination point.

c) Frequency division multiplex (FDM) systems in networks using the 2048-kbit/s pulse code modulation standard

For frequency division multiplex systems existing in networks that also use the 2048-kbit/s pulse code modulation standard, the circuit identification code contains in the 6 least significant bits the identification of a channel within a group of 60 channels carried by 5 basic frequency division multiplex groups which may or may not be part of the same supergroup.

The codes in Table 2/Q.723 are used.

TABLE 1/Q.723

0000000	channel 1
0000001	channel 2
⋮	⋮
0011111	channel 32
0100000	channel 33
⋮	⋮
1111110	channel 127
1111111	channel 128

TABLE 2/Q.723

000000	unallocated	
000001	channel 1	1st basic (FDM) group
⋮	⋮	
001100	channel 12	
001101	channel 1	2nd basic (FDM) group
001110	channel 2	
001111	channel 3	
010000	unallocated	
010001	channel 4	
⋮	⋮	
011001	channel 12	
011010	channel 1	3rd basic (FDM) group
⋮	⋮	
011111	channel 6	
100000	unallocated	
100001	channel 7	
⋮	⋮	
100110	channel 12	
100111	channel 1	4th basic (FDM) group
⋮	⋮	
101111	channel 9	
110000	unallocated	
110001	channel 10	
110010	channel 11	
110011	channel 12	
110100	channel 1	5th basic (FDM) group
⋮	⋮	
111111	channel 12	

2.3 *Optional national labels*

For the purpose of satisfying the requirements imposed by specific characteristics of some national signalling networks, field sizes different from those specified for the standard label are admitted for the destination point code, originating point code and circuit identification code fields in national labels.

3 Telephone signal message formats and codes

3.1 *General*

All telephone signal messages contain a *heading* consisting of two parts, heading code H0 and heading code H1. Code H0 identifies a specific message group (see Recommendation Q.722, § 3.2.1) while H1 either contains a signal code or in case of more complex messages, identifies the format of these messages. The allocation of the H0 and H1 code is summarized in Table 3/Q.723 at the end of this Recommendation.

3.2 *Heading Code H0*

The *heading code* H0 occupies the 4-bit field following the label and is coded as follows:

0000	spare, reserved for national use
0001	forward address messages
0010	forward set-up messages
0011	backward set-up request messages
0100	successful backward set-up information messages
0101	unsuccessful backward set-up information messages
0110	call supervision messages
0111	circuit supervision messages
1000	circuit group supervision messages
1001	node-to-node messages
1010 to 1011	reserved for international and basic national use
1100 to 1111	reserved for national use

3.3 *Forward address messages*

The following types of *forward address messages* are specified and are each identified by a different heading code H1:

- Initial address message.
- Initial address message with additional information (see Note).
- Subsequent address message (with one or more address signals).
- Subsequent address message with one (address) signal.

Note – The initial address message with additional information is classified, for the time being, in the basic national category of messages. The use of this message in the international network is for further study.

3.3.1 *Initial address message*

The basic format of the *initial address message* is shown on Figure 3/Q.723.

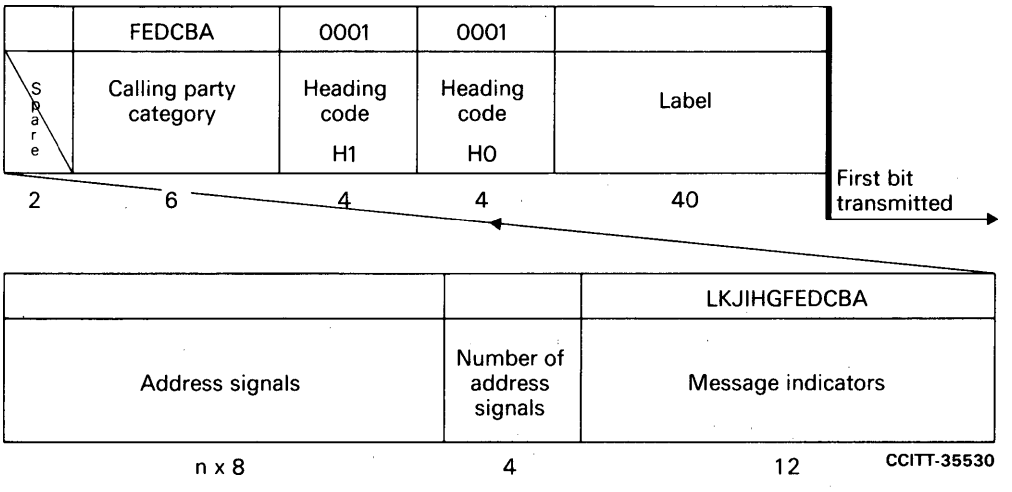

FIGURE 3/Q.723

Initial address message

The following codes are used in the fields of the initial address message.

a) Label: see § 2

b) Heading code H0 is coded 0001

c) Heading code H1 is coded 0001

d) Calling party category

bits F E D C B A

0 0 0 0 0 0	unknown source (Note 1)
0 0 0 0 0 1	operator, language French
0 0 0 0 1 0	operator, language English
0 0 0 0 1 1	operator, language German
0 0 0 1 0 0	operator, language Russian
0 0 0 1 0 1	operator, language Spanish
0 0 0 1 1 0 0 0 0 1 1 1 0 0 1 0 0 0	available to Administrations for selecting a particular language provided by mutual agreement
0 0 1 0 0 1	reserved (see Recommendation Q.104 [5]) (Note 2)
0 0 1 0 1 0	ordinary calling subscriber
0 0 1 0 1 1	calling subscriber with priority
0 0 1 1 0 0	data call
0 0 1 1 0 1	test call
0 0 1 1 1 0 to 1 1 1 1 1 1	spare

Note 1 – The calling party category "unknown source" is classified, for the time being, for basic national use. The use of this category in the international network is for further study.

Note 2 – In national networks code 001001 may be used to indicate that the calling party is a national operator.

e) Spare

The bits in this field are spare for international allocation.

f) Message indicators

bits B A: nature of address indicator

0 0	subscriber number
0 1	spare, reserved for national use
1 0	national (significant) number
1 1	international number

bits D C: nature-of-circuit indicator
- 0 0 no satellite circuit in the connection
- 0 1 one satellite circuit in the connection
- 1 0 spare
- 1 1 spare

bits F E: continuity-check indicator
- 0 0 continuity-check not required
- 0 1 continuity-check required on this circuit
- 1 0 continuity-check performed on a previous circuit
- 1 1 spare

bit G: echo-suppressor indicator
- 0 outgoing half echo suppressor not included
- 1 outgoing half echo suppressor included

bit H: incoming international call indicator
- 0 call other than international incoming
- 1 incoming international call

bit I: redirected call indicator
- 0 not a redirected call
- 1 redirected call

bit J: all-digital-path-required indicator
- 0 ordinary call
- 1 digital path required

bit K: signalling path indicator
- 0 any path
- 1 all signalling system No. 7 path

bit L: spare

Note – The spare indicator may be used, e.g. to provide the μ/A law conversion control, pending further study.

g) Number of address signals

A code expressing in pure binary representation the number of address signals contained in the initial address message.

h) Address signals

0000 digit 0
0001 digit 1
0010 digit 2
0011 digit 3
0100 digit 4
0101 digit 5
0110 digit 6
0111 digit 7
1000 digit 8
1001 digit 9
1010 spare
1011 code 11
1100 code 12
1101 spare
1110 spare
1111 ST

The most significant address signal is sent first. Subsequent address signals are sent in successive 4-bit fields.

i) Filler

In case of an odd number of address signals, the filler code 0000 is inserted after the last address signal. This ensures that the variable length field which contains the address signals consists of an integral number of octets.

3.3.2 *Initial address message with additional information*

The basic format of the *initial address message with additional information* is shown in Figure 4/Q.723.

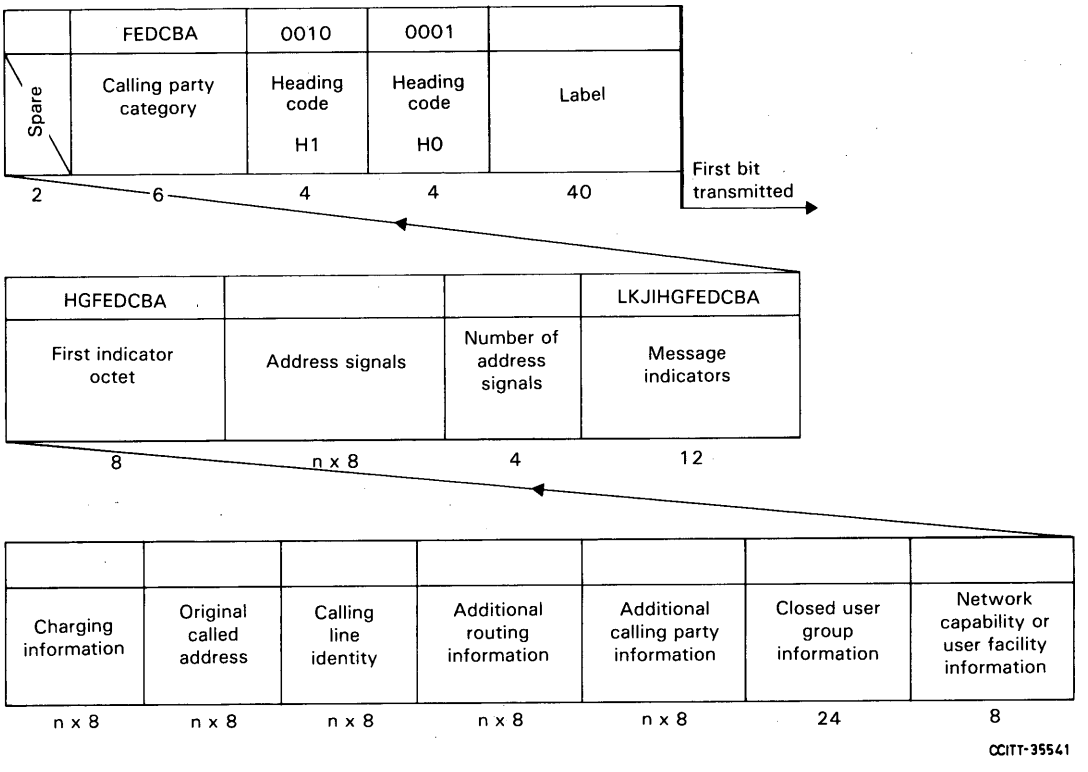

FIGURE 4/Q.723

Initial address message with additional information

The following codes are used in the initial address message with additional information:

a) Label: see § 2

b) Heading code H0 is coded 0001

c) Heading code H1 is coded 0010

d) Calling party category indicator: [see § 3.3.1 d)]

e) Message indicators: [see § 3.3.1 f)]

f) Number of address signals: [see § 3.3.1 g)]

g) Address signals: [see § 3.3.1 h)]

h) First indicator octet

bit A: network capability or user facility information indicator
0 network capability or user facility information not included
1 network capability or user facility information included

bit B: closed user group information indicator
0 closed user group information not included
1 closed user group information included

bit C: additional calling party information indicator
0 additional calling party information not included
1 additional calling party information included

bit D: additional routing information indicator
0 additional routing information not included
1 additional routing information included

bit E: calling line identity indicator
0 calling line identity not included
1 calling line identity included

bit F: original called address indicator
0 original called address not included
1 original called address included

bit G: charging information indicator
0 charging information not included
1 charging information included

bit H: spare, reserved for indicating the presence or absence of a second indicator octet

i) Network capability or user facility information

The basic format of the network capability or user facility information is shown in Figure 4a/Q.723.

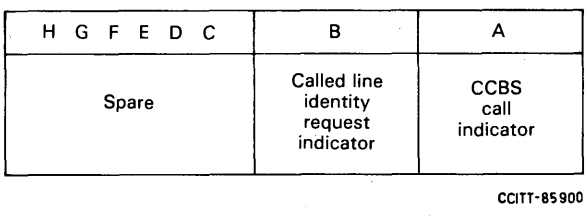

FIGURE 4a/Q.723

Network capability or user facility information field

The following codes are used in the network capability or user facility information field.

bit A: CCBS call indicator
0 no indication
1 CCBS call

bit B: called line identity request indicator
0 called line identity not requested
1 called line identity requested

bits C-H: spare

j) Closed user group information

The basic format of the closed user group information field is shown in Figure 4b/Q.723.

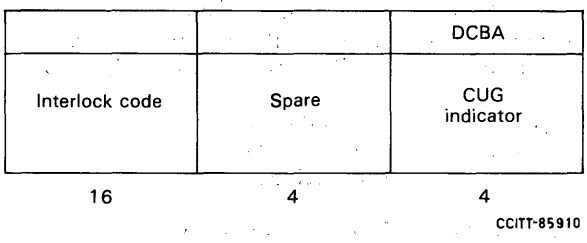

FIGURE 4b/Q.723

Closed user group information field

The following codes are used in the subfields of the closed user group information field.

– bits B A: CUG call indicator
  0 0 ordinary call
  0 1 successful check
  1 0 outgoing access allowed
  1 1 outgoing access not allowed

  bits C D: spare

– Interlock code

  A code identifying the closed user group involved in the call. The nature of this code is for further study.

k) Additional calling party information: for further study. (This optional field is of fixed length and will indicate additional information concerning the calling party, which is not carried by the calling party's category indicator.)

l) Additional routing information: for further study. (This optional field is of fixed length and will indicate that the call has to be routed in some particular way, due for example to additional customer services.)

m) Calling line identity

The basic format of the calling line identity field is shown in Figure 4c/Q.723.

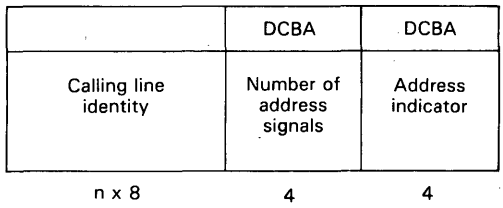

FIGURE 4c/Q.723

Calling line identity field

The following codes are used in the subfields of the calling line identity field.

– Address indicators:

  bits B A: nature of address indicator
  0 0 subscriber number
  0 1 spare, reserved for national use
  1 0 national significant number
  1 1 international number

  bit C: calling line identity presentation indicator
  0 calling line identity presentation not restricted
  1 calling line identity presentation restricted

  bit D: in complete calling line identity indicator
  0 no indication
  1 incomplete calling line identity

– Number of address signals

  bits D C B A
  0 0 0 0 calling line identity not available indicator

  0 0 0 1 to 1 1 1 1 a code expressing in pure binary representation the number of address signals.

– Calling line address signals

  Each signal is coded as indicated in § 3.3.1 h) as applicable.

n) Original called address

The basic format of the original called address field is shown in Figure 4d/Q.723.

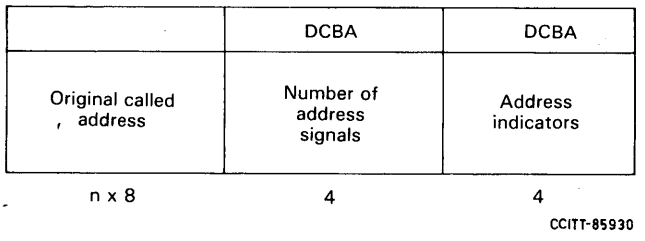

FIGURE 4d/Q.723

Original called address field

The following codes are used in the subfields of the original address field:

– Address indicator

bits B A: nature of address indicator
0 0 subscriber number
0 1 spare, reserved for national use
1 0 national (significant) number
1 1 international number

bits D C: spare

– Number of address signals

bits D C B A
0 0 0 0 original called address not available

0 0 0 1 to 1 1 1 1 a code expressing in pure binary representation the number ofaddress signals

– Original called address signals

Each signal is coded as indicated in § 3.3.1 h) as applicable.

o) Charging information: for further study. (This optional field will contain information to be sent to a successive exchange for charging and/or accounting purposes.)

3.3.3 *Subsequent address message*

The basic format of the *subsequent address* message is shown in Figure 5/Q.723.

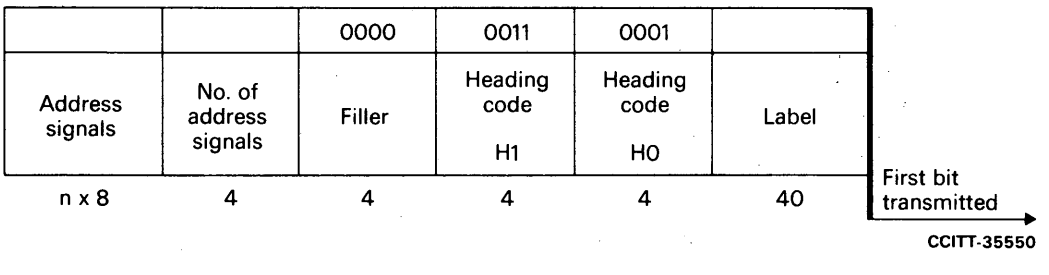

FIGURE 5/Q.723

Subsequent address message

The following codes are used in the fields of the subsequentaddress message (SAM):

a) Label: see § 2

b) Heading code H0 is coded 0001

c) Heading code H1 is coded 0011

d) Address signal is coded as indicated in § 3.3.1 h) as applicable.

e) Number of address signals: a code expressing in pure binary representation the number of address signals contained in the subsequent address message.

3.3.4 *Subsequent address message with one signal*

The basic format of the *subsequent address message with one signal* is shown in Figure 6/Q.723.

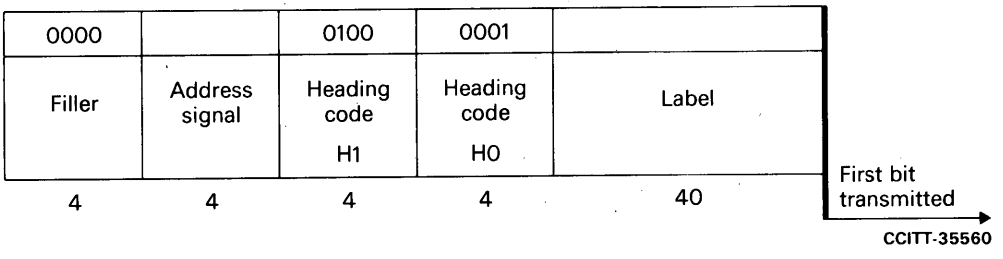

FIGURE 6/Q.723

Subsequent address message with one signal

The following codes are used in the fields of the subsequent address message with one signal:

a) Label: see § 2

b) Heading code H0 is coded 0001

c) Heading code H1 is coded 0100

d) Address signal is coded as indicated in § 3.3.1 h) as applicable.

3.4 *Forward set-up messages*

The following types of forward set-up messages are specified and are each identified by a different heading code H1:

– general forward set-up information message,

– continuity-check message.

Unallocated H1 codes in this message group are spare.

3.4.1 *General forward set-up information message*

The basic format of the general forward set-up information message is shown in Figure 7/Q.723.

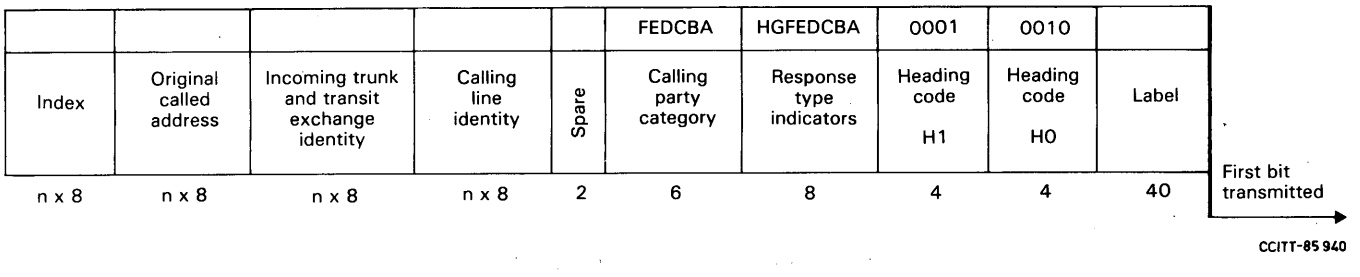

FIGURE 7/Q.723

General forward set-up information message

The following codes are used in the fields of the general forward set-up information message:

a) Label: see § 2

b) Heading code H0 is coded 0010

c) Heading code H1 is coded 0001

d) Response type indicator

bit A: calling party category indicator
0 calling party category not included
1 calling party category included

bit B: calling line identity indicator
0 calling line identity not included
1 calling line identity included

bit C: incoming trunk and transit exchange: identity indicator
0 incoming trunk and transit exchange identity not included
1 incoming trunk and transit exchange identity included

bit D: original called address indicator
0 original called address not included
1 original called address included

bit E: outgoing echo suppressor indicator
0: outgoing half echo suppressor not included
1: outgoing half echo suppressor included

bit F: malicious call identification indicator
0 malicious call identification not provided
1 malicious call identification provided

bit G: hold indicator
0 hold not provided
1 hold provided

bit H: index indicator
0 index not provided
1 index provided

e) Calling party category:

bits F E D C B A
0 0 0 0 0 0 unknown source/calling party category unavailable indicator

0 0 0 0 0 0 to 1 1 1 1 1 1 (see § 3.3.1 d)

f) Calling line identity:

Format and codes are the same as used in the calling line identity contained in the initial address message with additional information (see § 3.3.2).

g) Incoming trunk and transit exchange identity:

The basic format of the incoming trunk and transit exchange identity field is shown in Figure 8/Q.723.

	DCBA			DCBA	DCBA
Incoming trunk identity	Field length indicator	Spare	Transit exchange identity	Exchange identity length indicator	Identity type indicator
n x 8	4	4	n x 8	4	4

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FIGURE 8/Q.723

Incoming trunk and transit exchange identity field

The following codes are used in the subfields of the incoming trunk and transit exchange identity field:

– Identity type indicator

bits B A:
0 0 spare
0 1 signalling point code
1 0 available part of calling line identity
1 1 spare

bits D C: spare

– Exchange identity length indicator

A code expressing in pure binary representation the number of address signals included in the transit exchange identity subfield for the case when part of the calling line identity is used for this purpose.

When the transit exchange is identified by the signalling point code, this subfield is coded 0000.

– Transit exchange identity

A code consisting of either:

i) the signalling point code of the exchange, or

ii) a part of the calling line identity, in which case each address digit contained in this identity is coded as indicated in § 3.3.1 h) where applicable.

– Field length indicator

A code indicating in pure binary representation the number of octets in the incoming trunk identity field.

Code 0000 indicates that the incoming trunk identity is not provided.

– Incoming trunk identity

A code contained in a maximum of 15 octets, identifying the incoming trunk. The encoding of the incoming trunk identity is for further study.

h) Original called address

See § 3.3.2 n).

i) Index

For further study.

3.4.2 *Continuity-check message*

The basic format of the *continuity-check* message is shown in Figure 9/Q.723.

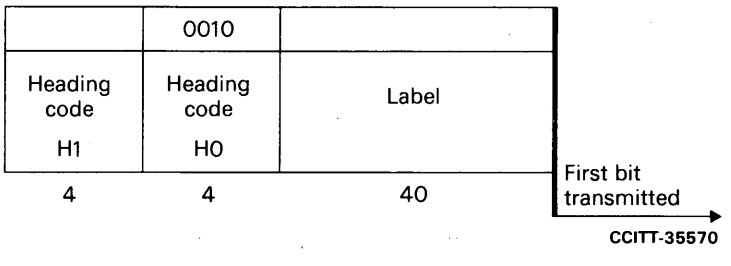

FIGURE 9/Q.723
Continuity-check message

The following codes are used in the fields of the continuity-check message:

a) Label: see § 2

b) Heading code H0 is coded 0010

c) Heading code H1 contains signal codes as follows:

0011 continuity signal
0100 continuity-failure signal

3.5 *Backward set-up request message*

The following type of backward set-up request message is specified and is identified by one of the heading codes H1. The other H1 codes in this message group are spare.

3.5.1 *General request message*

The basic format of the general *request* message is shown in Figure 10/Q.723.

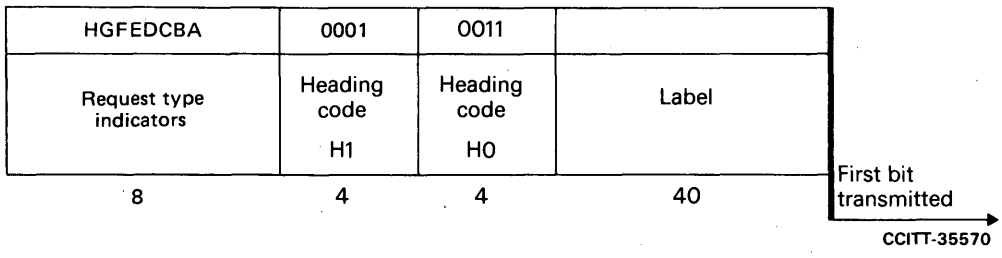

FIGURE 10/Q.723

General request message

The following codes are used in the fields of the general request message:

a) Label: see § 2

b) Heading code H0 is coded 0011

c) Heading code H1 is coded 0001

d) Request type indicators

bit A: calling party category request indicator
0 no calling party category request
1 calling party category request

bit B: calling line identity request indicator
0 no calling line identity request
1 calling line identity request

bit C: original called address request
0 no original called address request
1 original called address request

bit D: malicious call identification indicator (national option)
0 no malicious call identification encountered
1 malicious call identification encountered

bit E: hold request indicator
0 hold not requested
1 hold requested

bit F: echo suppressor request indicator
0 no outgoing half echo suppressor requested
1 outgoing half echo suppressor requested

bit G: index request indicator
0 index not requested
1 index requested

bit H: spare

3.6 *Successful backward set-up information message*

The following types of successful backward set-up information messages are specified and are each identified by a different heading code H1:

- address-complete message
- charging message

3.6.1 *Address-complete message*

The basic format of the *address-complete* message is shown in Figure 11/Q.723.

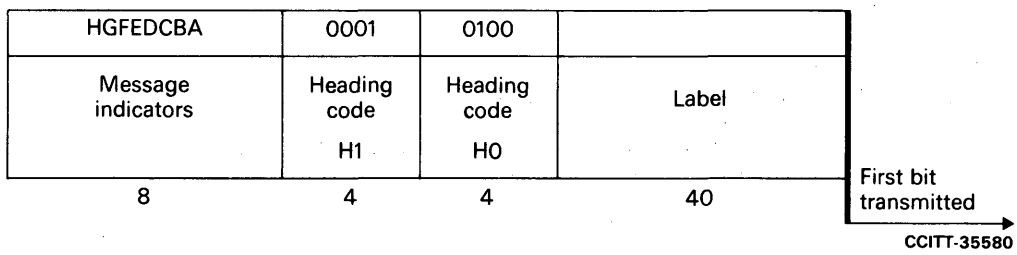

FIGURE 11/Q.723

Address-complete message

The following codes are used in the fields of the address-complete message:

a) Label: see Section 2

b) Heading code H0 is coded 0100

c) Heading code H1 is coded 0001

d) Message indicators

bits B A: type of address-complete signal indicators
- 0 0 address-complete signal
- 0 1 address-complete signal, charge
- 1 0 address-complete signal, no charge
- 1 1 address-complete signal, coin box

bit C: subscriber-free indicator
- 0 no indication
- 1 subscriber-free

bit D: incoming echo suppressor indicator
- 0 no incoming half echo suppressor included
- 1 incoming half echo suppressor included

bit E: call forwarding indicator
- 0 call not forwarded
- 1 call forwarded

bit F: signalling path indicator
- 0 any path
- 1 all signalling system No. 7 path

bits G H: spare, for national use (may be used to indicate call redirection, holding of the connection or the end-to-end signalling method to be used).

Note – The address-complete signal without qualification is classified for the time being in the basic national category of signals. The use of this signal in the international network is for further study.

3.6.2 *Charging message* (see Note)

The basic format of the *charging* message is shown in Figure 12/Q.723.

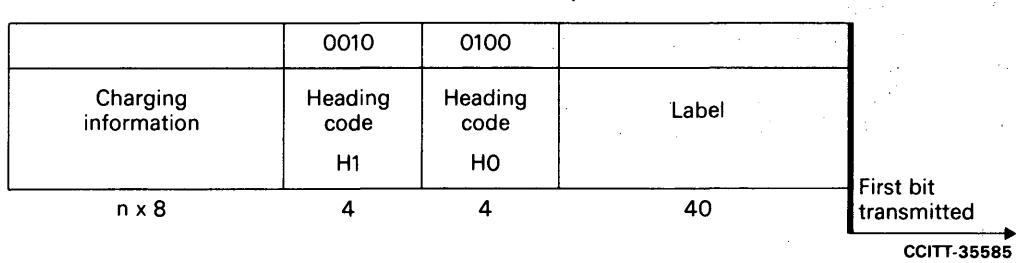

FIGURE 12/Q.723

Charging message

The following codes are used in the fields of the charging message:

a) Label: see § 2

b) Heading code H0 is coded 0100

c) Heading code H1 is coded 0010

d) Charging information

(Possible formats and codes of the charging information field are shown in Annex A.)

Note – The charging message is classified, for the time being, in the basic national category of messages. The use of this message in the international network is for further study.

3.7 *Unsuccessful backward set-up information message*

3.7.1 *Simple unsuccessful backward set-up information message*

The basic format of the simple unsuccessful backward set-up information message is shown in Figure 13/Q.723.

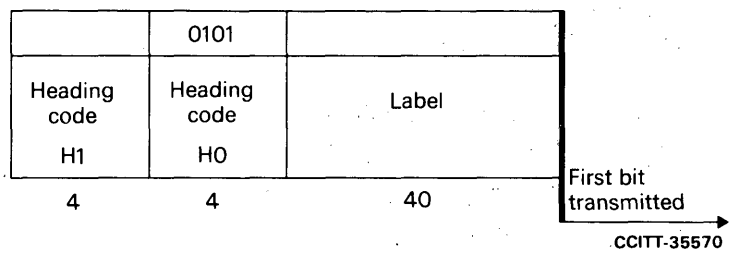

FIGURE 13/Q.723

Simple unsuccessful backward set-up information message

The following codes are used in the fields of the simple unsuccessful backward set-up information message.

a) Label: see § 2

b) Heading code H0 is coded 0101

c) Heading code H1 contains signal codes as follows:

0000	spare
0001	switching-equipment-congestion signal
0010	circuit-group-congestion signal
0011	national-network-congestion signal
0100	address-incomplete signal
0101	call-failure signal
0110	subscriber-busy signal (electrical)
0111	unallocated-number signal
1000	line-out-of-service signal
1001	send-special-information-tone signal
1010	access barred signal
1011	digital path not provided signal
1100	misdialled trunk prefix signal (for national use)
1101 to 1110	spare

3.7.2 *Extended unsuccessful backward set-up information message*

The basic format of the extended unsuccessful backward set-up information message is shown in Figure 13a/Q.723.

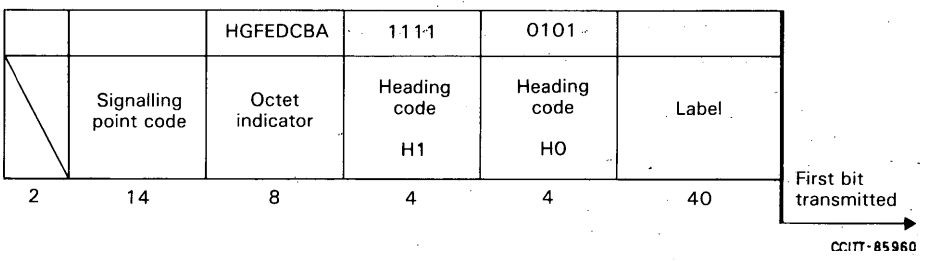

FIGURE 13a/Q.723

Extended unsuccessful backward set-up information message

The following codes are used in the fields of the extended unsuccessful backward set-up information message:

a) Label: see § 2

b) Heading code H0 is coded 0101

c) Heading code H1 contains signal code 1111

d) Octet indicator

bits DCB A: unsuccessful indicator
0 0 0 0 spare
0 0 0 1 subscriber busy

0 0 1 0 to 1 1 1 1 spare

bits HGF E: spare.

e) Signalling point code

The point code of the signalling point in which the message is originated.

3.8 *Call supervision message*

The basic format of the *call supervision* message is shown in Figure 14/Q.723.

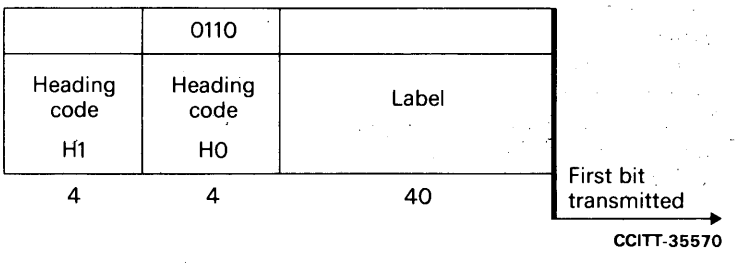

FIGURE 14/Q.723

Call supervision message

The following codes are used in the fields of the call supervision message:

a) Label: see § 2

b) Heading code H0 is coded 0110

c) Heading code H1 contains signal codes as follows:

0000	answer signal, unqualified
0001	answer signal, charge
0010	answer signal, no charge
0011	clear-back signal
0100	clear-forward signal
0101	re-answer signal
0110	forward-transfer signal
0111	calling party clear signal (national option)
1000 to 1110	spare
1111	extended answer message indication

3.9 *Circuit supervision message*

The basic format of the *circuit supervision* message is shown in Figure 15/Q.723.

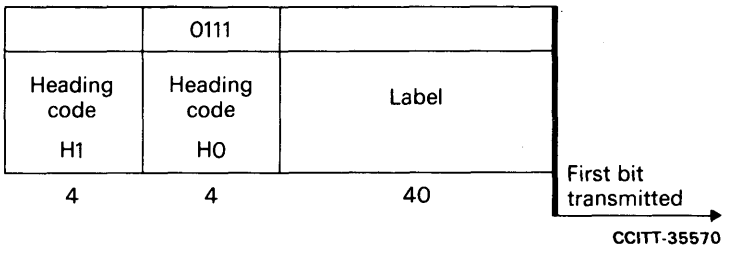

FIGURE 15/Q.723
Circuit supervision message

The following codes are used in the fields of the circuit supervision message:

a) Label: see § 2

b) Heading code H0 is coded 0111

c) Heading code H1 contains signal codes as follows:

0000	spare
0001	release-guard signal
0010	blocking signal
0011	blocking-acknowledgement signal
0100	unblocking signal
0101	unblocking-acknowledgement signal
0110	continuity-check-request signal
0111	reset-circuit signal
1000 to 1111	spare

3.10 *Circuit group supervision message*

The basic format of the circuit group supervision message is shown in Figure 16/Q.723:

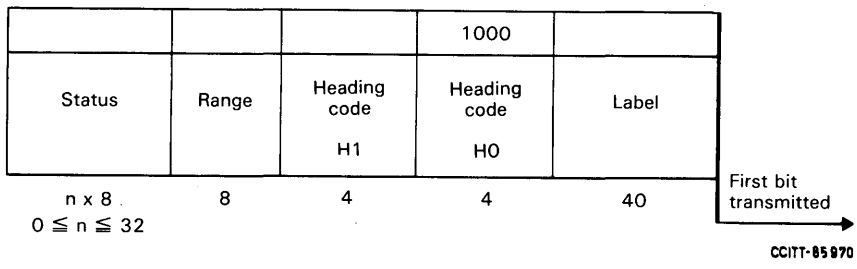

FIGURE 16/Q.723

Circuit group supervision message

The following codes are used in the fields of the circuit group supervision message:

a) Label: see § 2

The following interpretations apply to the CIC given in the label:

i) If the range field is not coded all zero the CIC given in the label is the first CIC within the circuit group or the first CIC within that part of the circuit group.

ii) If the range field is coded all zero the CIC given in the label is a representative CIC within the circuit group.

b) Heading code H0 is coded 1000

c) Heading code H1 contains message codes as follows:

0000 spare
0001 Maintenance oriented group blocking message
0010 Maintenance oriented group blocking-acknowledging message
0011 Maintenance oriented group unblocking message
0100 Maintenance oriented group unblocking-acknowledgement message
0101 Hardware failure oriented group blocking message
0110 Hardware failure oriented group blocking-acknowledge message
0111 Hardware failure oriented group unblocking message
1000 Hardware failure oriented group unblocking-acknowledge
1001 Circuit group reset message
1010 Circuit group reset-acknowledgement message
1011 Software generated group blocking message (national option)
1100 Software generated group blocking-acknowledgement message (national option)
1101 Software generated group unblocking message (national option)
1110 Software generated group unblocking-acknowledgement message (national option)
1111 spare

d) Range: two in principle different codings are possible

i) not all zero: The message is related to a whole circuit group or a part thereof, and includes a status field unless the message is the circuit group reset message. The number of consecutive circuits to be handled is indicated by the value contained in the range field increased by 1. The CIC of the first circuit to be handled is given in the label. The number of circuits to be indicated is 2 (range value 1) to 256 (range value 255).

ii) all zero: The message is related to a pre-determined circuit group. No status field is included. In this case the circuit group is addressed by means of a representative CIC within the circuit group.

Note – In national networks, the range field may not be used if only the concept of pre-determined circuit group applies.

e) Status field

All circuit group supervision messages except the circuit group reset message include a status field containing status indicator bits when the range field is not coded all zero. The number of status indicator bits is indicated by the value given in the range field increased by one.

The status field contains up to 256 one bit status indicators. The first status indicator bit is related to the circuit indicated by the CIC contained within the label, the second one is related to the circuit address by the CIC contained in the label increased by 1.

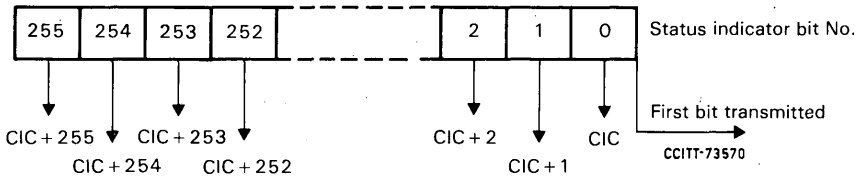

FIGURE 17/Q.723

Status indicator field

The CIC of the last circuit concerned is obtained by adding the value given in the range field to the CIC in the label. The status field consists of an integral number of octets. Bits within the last octet that are not used as status indicators are filled with zeros.

The status indicator bits are coded as follows:

- in all group blocking messages (MGB, HGB, SGB)

  1 blocking
  0 no blocking

- in all group blocking-acknowledgement messages (MGB, HBA, SBA)

  1 blocking acknowledgement
  0 no blocking acknowledgement

- in all unblocking messages (MGU, HGU, SGU)

  1 unblocking
  0 no unblocking

- in all group unblocking-acknowledgement messages (MUA, HUA, SUA)

  1 unblocking acknowledgement
  0 no unblocking acknowledgement

- in the circuit group reset-acknowledgement message

  1 blocking for maintenance reasons
  0 no blocking for maintenance reasons

3.11 *Node-to-node messages*

The following types of node-to-node messages are specified, each identified by a specific heading code H1:

- CCBS facility message
- called party free message
- calling party answer
- closed user group selection and validation check-request message
- closed user group validation check message
- closed user group selection and validation response message
- called line identity message

3.11.1 *CCBS facility message*

The basic format of the CCBS facility message is shown in Figure 18/Q.723.

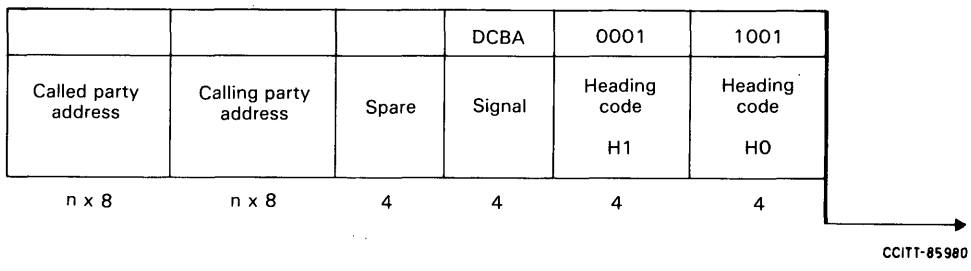

FIGURE 18/Q.723

CCBS facility message

The following codes are used in the fields of the CCBS facility message:

a) Heading code H0 is coded 1001

b) Heading code H1 is coded 0001

c) Signal:

bits D C B A

0 0 0 0	spare
0 0 0 1	request signal
0 0 1 0	accepted signal
0 0 1 1	rejected signal
0 1 0 0	cancelled signal
0 1 0 1 0 1 1 0 0 1 1 1 1 0 0 0 1 0 0 1	spare
1 0 1 0 to 1 1 1 1	spare

d) Calling party address is coded as in § 3.3.2.1

e) Called party address is coded as in § 3.3.2 n)

3.11.2 *Called party free message*

The basic format of the called party free message is shown in Figure 19/Q.723.

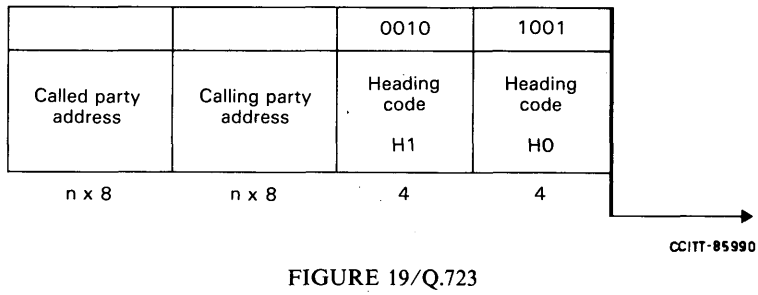

FIGURE 19/Q.723

Called party free message

The following codes are used in the fields of the called party free message:

a) Heading code H0 is coded 001
b) Heading code H1 is coded 0010 and is the code for the called party free signal
c) Calling party address is coded as in § 3.3.2.1
d) Called party address is coded as in § 3.3.2 n)

3.11.3 *Calling party answer*

Format and codes of the calling party answer are the same as for the called party free message (see § 3.11.2) with the heading code H1 coded 0011.

3.11.4 *Closed user group selection and validation check-request message*

Format and codes of the closed user group selection and validation check request message are the same as for the called party free message (see § 3.11.2) with the heading code H1 coded 0100.

3.11.5 *Closed user group validation check message*

The basic format of the closed user group validation check message is shown in Figure 20/Q.723.

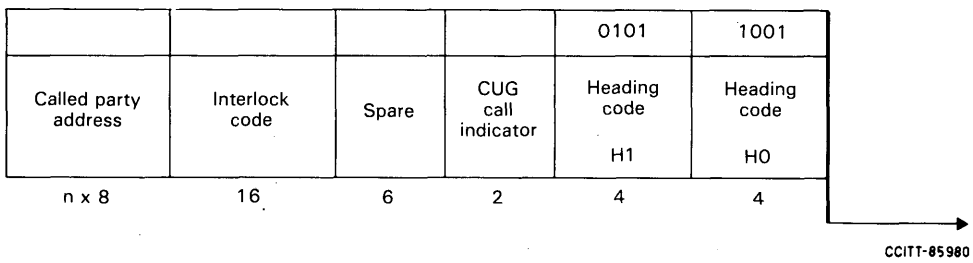

FIGURE 20/Q.723

Closed user group validation check message

The following codes are used in the fields of the closed user group validation check message:

a) Heading code H0 is coded 1001
b) Heading code H1 is coded 0101
c) CUG call indicator is coded as in § 3.3.2 j)
d) Interlock code is coded as in § 3.3.2 j)
e) Called party address is coded as in § 3.3.2 n)

3.11.6 *Closed user group selection and validation response message*

The basic format of the closed user group selection and validation response message is shown in Figure 21/Q.723.

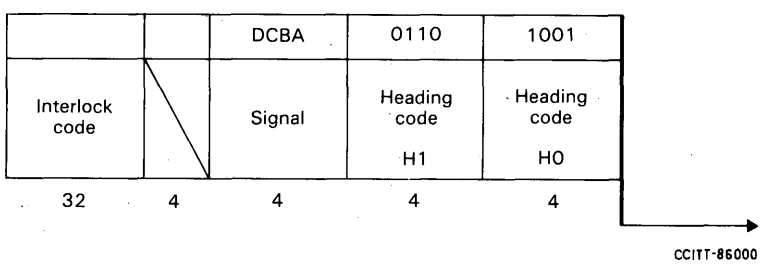

FIGURE 21/Q.723

Closed user group selection and validation response message

The following codes are used in the fields of the closed user group selection and validation response message:

a) Heading code H0 is coded 1001

b) Heading code H1 is coded 0110

c) Signal

bits DCB A:

0 0 0 0	spare
0 0 0 1	spare
0 0 1 0	divergency signal
0 0 1 1	CUG check successful signal
0 1 0 1	interlock code with outgoing access allowed
0 1 1 0 to 1 0 0 1	spare
1 0 1 0	access barred signal
1 0 1 1 to 1 1 1 1	spare

d) Interlock code is coded as in Recommendation Q.741 § 3.3.2.11.

In the case where there is no interlock code to be sent, the interlock code field is coded all zero.

3.11.7 *Connected line identity message*

The basic format of the connected line identity message is shown in Figure 22/Q.723.

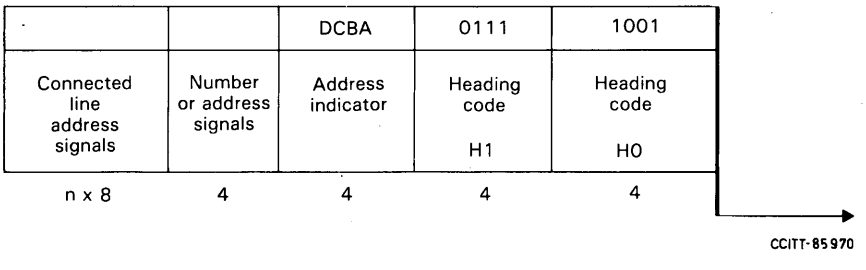

FIGURE 22/Q.723

Connected line identity message

The following codes are used in the fields of the called line identity message:

a) Heading code H0 is coded 1001

b) Heading code H1 is coded 0111

c) Address indicator:

bits B A: connected line identity indicator

0 0	connected line identity not available
0 1	connected line identity included without country code
1 0	connected line identity included with country code
1 1	country code only included

bit C: connected line identity presentation indicator

0	connected line identity presentation not restricted
1	connected line identity presentation restricted

bit D: spare

d) Number of address signals:

A code expressing in pure binary representation the number of address signals contained in the called line address field.

If the connected line identity is not available, the number of address signals is coded 0000.

e) Connected line address signals:

Each signal is coded as indicated in § 3.3.1 h) as applicable.

TABLEAU 3/Q.723

Heading code allocation

Message group	H1 / H0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
	0000	← Spare, reserved for national use →															
FAM	0001		IAM	IAI	SAM	SAO											
FSM	0010		GSM		COT	CCF											
BSM	0011		GRQ														
SBM	0100		ACM	CHG													
UBM	0101		SEC	CGC	NNC	ADI	CFL	SSB	UNN	LOS	SST	ACB	DPN	MPR			EUM
CSM	0110	ANU	ANC	ANN	CBK	CLF	RAN	FOT	CCL								EAM
CCM	0111		RLG	BLO	BLA	UBL	UBA	CCR	RSC								
GRM	1000		MGB	MBA	MGU	MUA	HGA	HBA	HGU	HUA	GRS	GRA	SGB*	SBA*	SGU*	SUA*	
NNM	1001		CFM	CPM	CPA	CSV	CVM	CRM	CLI								
	1010	Spare, reserved for international and basic national use															
	1011																
	1100																
	1101	Spare, reserved for national use															
	1110																
	1111																

* National option

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Abbreviations used in Table 3/Q.723

ACB	Access barred signal
ACM	Address complete message (note)
ADI	Address incomplete signal
ANC	Answer signal, charge
ANN	Answer signal, no charge
ANU	Answer signal, unqualified
BLA	Blocking-acknowledgement signal
BLO	Blocking signal
BSM	Backward set-up message
CBK	Clear-back signal
CCF	Continuity-failure signal
CCL	Calling party clear signal
CCM	Circuit supervision message
CCR	Continuity-check-request signal
CFL	Call-failure signal
CFM	CCBS facility message
CGC	Circuit-group-congestion signal
CHG	Charging message
CLF	Clear-forward signal
CLI	Connected line identity message
COT	Continuity signal
CPA	Calling party answer
CPM	Called party free message
CRM	Closed user group selection and validation response message
CSM	Call supervision message
CVS	Closed user group selection and validation check request message
CVM	Closed user group validation check message
DPN	Digital path not provided signal
EAM	Extended answer message indication
EUM	Extended unsuccessful backward set-up information message
FAM	Forward address message
FOT	Forward-transfer signal
FSM	Forward set-up message
GRA	Circuit group reset-acknowledgement message
GRM	Circuit group supervision messages
GRQ	General request message
GRS	Circuit group reset message
GSM	General forward set-up information message
HBA	Hardware failure oriented group blocking-acknowledgement message
HGB	Hardware failure oriented group blocking message
HGU	Hardware failure oriented group unblocking message
HUA	Hardware failure oriented group unblocking-acknowledgement message
IAI	Initial address message with additional information
IAM	Initial address message
LOS	Line-out-of-service signal
MBA	Maintenance oriented group blocking-acknowledgement message
MGB	Maintenance oriented group blocking message
MGU	Maintenance oriented group unblocking message
MPR	Misdialled trunk prefix
MUA	Maintenance oriented group unblocking-acknowledgement message
NNC	National-network-congestion signal
NNM	Node-to-node message
RAN	Reanswer signal
RLG	Release-guard signal
RSC	Reset-circuit signal
SAM	Subsequent address message
SAO	Subsequent address message with one signal
SBA	Software generated group blocking-acknowledgement message
SBM	Successful backward set-up information message
SEC	Switching-equipment-congestion signal
SGB	Software generated group blocking message
SGU	Software generated group unblocking message
SSB	Subscriber-busy signal (electrical)
SST	Send-special-information tone signal
SUA	Software generated group unblocking-acknowledgement
UBA	Unblocking-acknowledgement signal
UBL	Unblocking signal
UBM	Unsuccessful backward set-up information message
UNN	Unallocated-number signal

Note – Each address complete message contains one of the following signals:

– ADC Address-complete, charge

– ADN Address-complete, no charge

– ADX Address-complete, coin box

– AFC Address-complete, charge subscriber free

– AFN Address-complete, no charge, subscriber free

– AFX Address-complete, coin box, subscriber free

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Rec. G.732.

[2] CCITT Recommendation *Characteristics of 2048-kbit/s frame structure for use with digital exchanges*, Vol. III, Rec. G.734.

[3] CCITT Recommendation *Second order PCM multiplex equipment operating at 8448 kbit/s*, Vol. III, Rec. G.744.

[4] CCITT Recommendation *Characteristics of 8448-kbit/s frame structure for use with digital exchanges*, Vol. III, Rec. G.746.

[5] CCITT Recommendation *Language digit or discriminating digits*, Vol. VI, Rec. Q.104.

[6] CCITT Recommendation *Signalling Connection Control Part*, Recs. Q.711-Q.714.

ANNEX A

(to Recommendation Q.723)

Charging messages

A.1 *Introduction*

The application of Signalling System No. 7 in national networks was recognized from the beginning of the discussions about the signalling system. The result of this can be found throughout the specifications especially in those Recommendations dealing with the TUP. One of the points which is particularly of interest for an Administration is the possibility of transfer of charging information. Signalling System No. 7 allows for such a feature for charging a calling subscriber by defining a specific charging message as indicated in Recommendation Q.723, § 3.6.2. However, the detailed format, coding and related procedures are not given, mostly because this matter is very dependent on the circumstances within a specific national network. The following examples illustrate a particular implementation in a national network for telephony without exclusion of other possible solutions.

A.2 *Starting points*

Before describing in detail the messages involved, a number of starting points have to be adopted.

a) The first No. 7 exchange performs metering according to all possible tariffs.

b) The determination of a particular tariff is performed in a point somewhere in the network.

c) The receipt of messages containing charging information should be acknowledged within the call control procedures.

d) At dedicated moments the actual charging should be adapted.

e) A variety of charging possibilities should be available.

The effect of these starting points is:

a) the actual generation of charging units according to a particular tariff is always performed at the lowest level of the national public telephone network (local exchange);

b) the determination of tariffs for local and trunk calls is carried out in the local exchange and for international calls in the international exchange; however, also the use of a centre for determination of all kinds of tariffs is possible;

c) the transmission of charging information is assured at the highest level of the call control procedures and possibly inhibits call completion without receipt of charging information;

d) calls of long duration can be subject to different charging rates;

e) the application of charge free calls, specific charge on answer, time dependent charging during a call, additional (specific) charge during a call and a combination of these.

A.3 *Messages and procedures*

To meet all the above mentioned requirements a number of messages are defined.

A.3.1 *Charging message*

This message has to be sent for any call, charge free or not. In the procedure this is covered by the fact that the charging message has to be received during call set up before receipt of the address complete message.

If not, then the call should be cleared immediately.

The content of the message will vary depending on the actual tariff and this is indicated by a number of indicators indicating the presence of certain fields in the message.

Possible contents:

a) charge band

The indication of a certain charge band should allow the receiving exchange to charge a call according to a certain tariff including possible switchover times to higher or lower rates. This method results in a simple message but requires the receiving exchange to have all the information available related to all possible charge bands, national and international.

b) explicit charging indication

In this case the message contains explicit indications of details of the tariff viz.
- number of charging units on answer (packet)
- time dependent tariff(s)
- possible switchover time.

This method results in a more complex message but does not require the permanent storage of any charging information.

A.3.2 *Change message*

A consequence of the adoption of the method with explicit charging indication (§ A.3.1 b)) is the necessity to allow for tariff switchover for calls of very long duration or for calls which are answered just after the switchover time given in the message described in § A.3.1 b). The content of such at message is rather simple because it only contains the new applicable tariff and the actual switch-over time.

The procedure to acknowledge the receipt of the message cannot be found in the normal call control procedure, therefore an acknowledgement message (see § A.3.5) in the forward direction is used. If this acknowledgement message is not received within a certain time the change message has to be repeated.

A.3.3 *Collection charging*

For a variety of reasons it might be necessary to charge a subscriber during the call a certain amount. For this purpose a message is used indicating the number of charging units related to the amount for which the subscriber has to be charged.

The procedure to assure the receipt of this message is the same as described in § A.3.2 above. A possible further collection charging message should not be sent before receipt of the acknowledgement message and the charging confirmation message (see § A.3.4 charging confirmation).

A.3.4 *Charging confirmation*

In relation with the message described in § A.3.3 a message in the forward direction is required indicating how many charging units actually are charged to the subscriber. This number should match to the number given in the collection charging message, otherwise it must be concluded that for some reason the order is not executed, e.g. a certain service should now be withheld to be furnished to the subscriber.

Again the procedure is the one as described in § A.3.2 above but in the opposite direction.

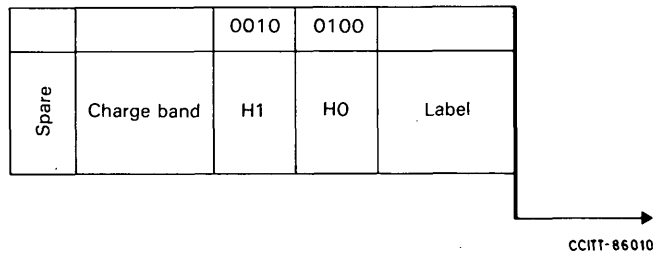
A.3.5 *Acknowledgement*

To acknowledge the receipt of the messages described in §§ A.3.2, A.3.3 and A.3.4 an acknowledgement message is used in both directions only indicating the receipt of the related message.

A.4 *Formats and codes*

A.4.1 *Charging messages*

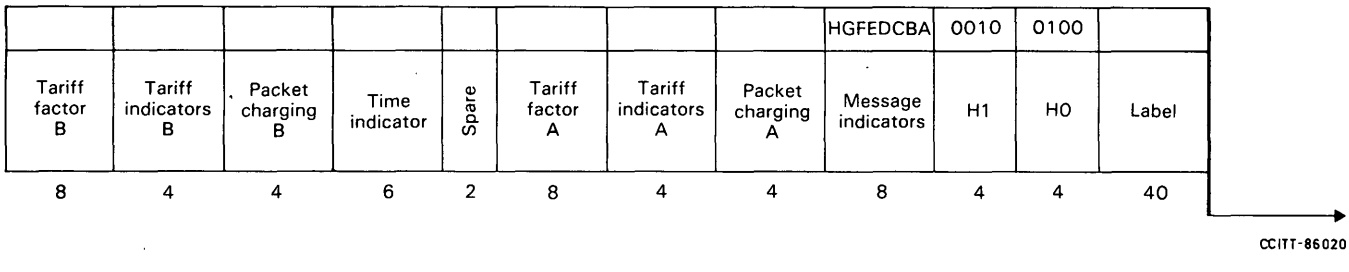
A.4.1.1 *Charge band*



– Charge band

A charge indicates the combination of tariffs including switch-over times which is applicable for a certain period (e.g. day or week).

A.4.1.2 *Explicit charging indication*



– Message indicators

bit A: tariff indicator current tariff (A)
0 packet charging field and tariff indicators current tariff (A) not present
1 packet charging field and tariff indicators current tariff (A) present

bit B: tariff factor current tariff (A)
0 tariff factor field current tariff (A) not present
1 tariff factor field current tariff (A) present

bit C: tariff indicator next tariff (B)
0 packet charging field and tariff indicators next tariff (B) not present
1 packet charging field and tariff indicators next tariff (B) present

bit D: tariff factor next tariff (B)
0 tariff factor field next tariff (B) not present
1 tariff factor field next tariff (B) present

bit H-F spare

– Packet charging field

0000
| number of charging units on answer
1111

– Tariff indicators

0000	tariff scale 0	(no time dependent tariff)
0001	tariff scale I	
|	|	every scale indicates a certain step in seconds or parts thereof
1111	tariff scale XV	

– Tariff factors

If a call is charge free (A = B = C = D = 0) only the message indicator octet is present.

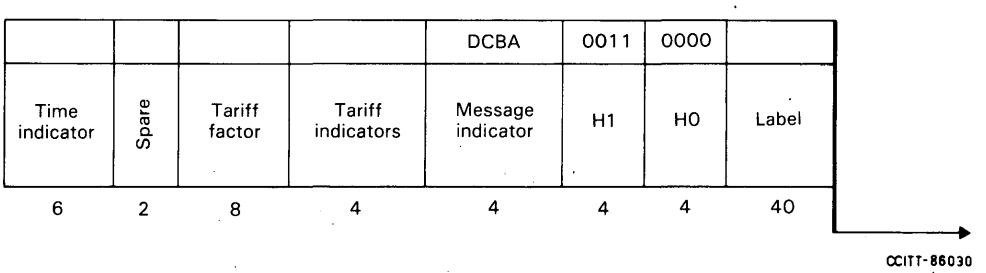
If a call is charge free from the start but may become chargeable (A = 1, B = 0, C = 1, D = 0/1), the packet charging field for the current tariff is 0000 and the tariff indicator for the current tariff indicates scale 0.

If a call is chargeable from the start but may become charge free (A = 1, B = 0/1, C = 1, D = 0) the packet charging field for the next tariff is 0000 and the tariff indicator for the next tariff indicates scale 0. If a call is chargeable according to only one tariff (A = 1, B = 0/1, C = 0, D = 0), also the time indicator is not present in the message. The actual tariff is determined by multiplication of the step indicated by the tariff indicator with the tariff factor which gives then a specific charging unit interval in seconds.

– Time indicator

000000	spare
000001	00.30 h
000010	01.00 h
|	|
110000	24.00 h

A.4.2 *Tariff change message*



– Message indicator

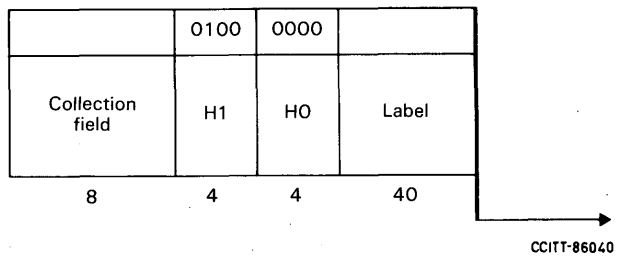
Bit A: tariff factor next tariff
0: tariff factor field next tariff not present
1: tariff factor field next tariff present

Bits D-B: spare

– Tariff indicator, tariff factor and time indicator: see § A.4.1.2

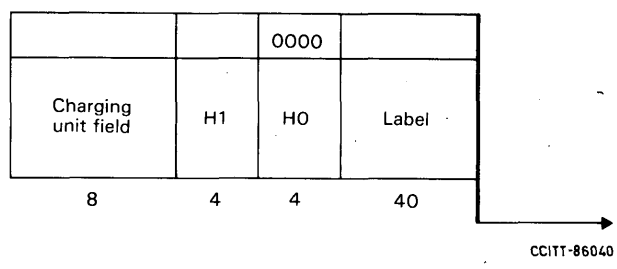
– Time indicator: see § A.4.1.2

A.4.3 *Collection charging message*



The collection field contains the number of charging units which are to be charged to the calling subscriber. The field has a length of 8 bits so a maximum of 256 units is possible.

A.4.4 *Charging confirmation message*



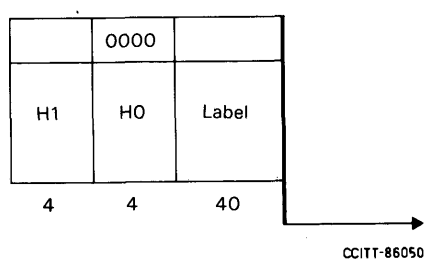
- Heading code H1

  H1 = 0101 confirmation of packet charging
  H1 = 0110 confirmation of collection charging

- Charging unit field

  Number of charging units which actually are charged to the calling party

A.4.5 *Acknowledgement message*



- Heading code H1

  H1 = 1000 acknowledgement receipt of tariff review, collection charging or charging confirmation message

SIGNALLING PROCEDURES

1 Normal call set-up

In this Recommendation the signalling procedures are described for the normal call set-up of an international call. The messages and signals are defined in Recommendation Q.722 and the format and content are given in Recommendation Q.723.

1.1 *Initial address message*

An *initial address message* which is sent as the first message of a call set-up generally includes all of the information required by the next international exchange to route the call. The seizing function is implicit in the reception of this initial address message.

The sending sequence of address information will be the country code (not sent to an incoming international exchange) followed by the national (significant) number. For calls to operator positions (code 11 and code 12), refer to Recommendation Q.107 [1].

All digits required for routing the call through the international network will be sent in the initial address message. On calls with a country code in the address (except in the case of calls to special operators), the initial address message will contain a minimum of 4 digits and should contain as many digits as are available. All digits of the address may be included; however, the initial address message can contain one digit in specific circumstances, e.g. national applications.

Selection of the outgoing national circuit normally can start at the incoming international exchange on receipt of the initial address message and signalling can proceed on the first national link.

When no echo suppressor or nature-of-circuit indication is received from a preceding circuit using a signalling system with fewer facilities, the indicators will be considered as received *no* unless positive knowledge is available.

1.2 *Subsequent address message*

The remaining digits, if any, of the address may be sent individually in one-digit messages or in groups in multidigit messages. Efficiency can be gained by grouping together as many digits as possible.

However, to prevent an increase in post-dialling delay in those cases where overlap operation with subscribers' dialling is used, it may be desirable to send the last few digits individually. With reference to the withholding of digits, sufficient digits should be withheld to avoid the operation at subsequent exchanges of the short 4-6 second timeout which may be used in certain cases to determine the address complete condition. (See Recommendation Q.608, § 8.2.1).

Subsequent address messages can be sent on the national network as they are received. If a continuity-check has to be performed on one or more of the international circuits involved in the connection, appropriate measures [e.g. by withholding the last digit(s) of the national number] must be taken at the last common channel exchange to prevent ringing the called subscriber or alerting the operator until the continuity of such speech circuits has been verified.

1.3 *End-of-pulsing (ST) signal*

The *end-of-pulsing* (ST) signal is always sent in the following situations:

a) semiautomatic calls,

b) test calls, and

c) when the end-of-pulsing signal is received from a preceding circuit.

In automatic working, the end-of-pulsing signal will be sent whenever the outgoing international exchange is in a position to know, by digit analysis, that the final digit has been sent. Digit analysis may consist of an examination of the country code and counting the maximum (or fixed) number of digits of the national number. In other cases, the end-of-pulsing signal is not sent and the end-of-address information is determined by the receipt of one of the address-complete signals from the incoming international exchange.

1.4 *Continuity-check of the telephone circuits*

Because the signalling in Signalling System No. 7 does not pass over the speech path, facilities should be provided for making a *continuity-check* of the speech path in the circumstances described below.

The application of the continuity-check depends on the type of the transmission system used for the telephone circuit.

For transmission systems having some inherent fault indication features giving an indication to the switching system in case of fault, a continuity-check is not required. This situation occurs when fully digital circuits are applied.

For analogue circuits with pilot supervision it is sufficient to perform the continuity-check on a statistical basis or by test calls (see § 7.5)[1]. For analogue circuits not using pilot supervision and for mixed circuits, i.e. analogue and digital circuits, the continuity-check should be performed on a per call basis. Within mixed connections, i.e. connections composed of circuits with and without continuity-check on a per call basis, it shall be ensured that the continuity signal be forwarded to the destination point although no continuity-check may have been performed on one or more parts of the end-to-end connection.

The continuity-check is not intended to eliminate the need for routine testing of the transmission path.

The continuity-check of the speech circuit will be done, link-by-link, on a per call basis or by a statistical method prior to the commencement of conversation. Procedures and requirements are specified in § 7.

The actions to be taken when pilot supervision is used are described in § 9.

1.5 *Cross-office check*

For digital exchanges the requirements mentioned in Recommendation Q.504 [2] shall be met. For other exchanges Administrations shall ensure the reliability of a connection through a switching machine (cross-office check) either on a per call basis or by a statistical method. With either method, the probability of the connection being established with an unacceptable speech path transmission quality should not exceed 10^{-5} as the long-term average.

1.6 *Address-complete signals*

An *address-complete* signal will not be sent until the continuity signal has been received and the cross-office check made, if they are applicable.

If the succeeding network does not provide electrical called-party's-line-condition signals, the last Signalling System No.7 exchange shall originate and send an address-complete signal when the end of address signalling has been determined:

a) by receipt of an end-of-pulsing signal;

b) by receipt of the maximum number of digits used in the national numbering plan;

c) by analysis of the national (significant) number to indicate that a sufficient number of digits has been received to route the call to the called party;

d) by receipt of an end-of-selection signal from the succeeding network (e.g. number received signal in Signalling System No. 4); or

e) exceptionally, if the succeeding network uses overlap signalling and number analysis is not possible, by observing that 4 to 6 seconds have elapsed since the last digit was received, and that no fresh information has been received; in such circumstances, transmission to the national network of the last digit received must be prevented until the end of the waiting period which causes an address-complete signal to be sent over the international circuit. In this way, it is ensured that no national answer signal can arrive before an address-complete signal has been sent.

Specifically, in cases d) and e) above, the address-complete charge signal should be sent.

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[1] The application to the international circuits and the quantitative aspects (in particular, the frequency of performing the continuity-check) are for further study.

If in normal operation, delay in the receipt of an address-complete or equivalent signal from the succeeding network is expected, the last common channel signalling exchange will originate and send an address-complete signal 15 to 20 seconds after receiving the latest address message. This time-out condition is an upper limit considering the clauses of § 6.4.1 (20 to 30 seconds for outgoing international exchanges in abnormal release conditions).

On receipt of an address-complete signal, the first Signalling System No. 7 exchange will through-connect the speech path of the interconnected circuit[2].

After an address-complete signal, only the following signals relating to the call set-up may be sent in the backward direction:

a) in normal operation, one of the answer or release-guard signals;

b) call-failure signal; or

c) the national network congestion signal; or

d) the circuit group congestion signal.

Note – Cases a) and c) can only occur after an address complete signal without subscriber free.

Any further information about the called-party's-line-condition will be transmitted to the calling subscriber or operator as audible tones or announcements.

The address-complete signal with the subscriber-free indication is sent when it is known that the called subscriber's line is free (not busy). It must be originated in the called subscriber's exchange, and therefore cannot be followed by one of the unsuccessful backward set-up information signals.

1.7 *Address-incomplete signal*

The determination that the proper number of digits has not been received can be made at once if the end-of-pulsing signal is received or by receipt of an *address-incomplete* signal (or equivalent) from the national network. When overlap working is used and the end-of-pulsing signal has not been received, the address-incomplete signal will be sent by the last common channel Signalling exchange 15 to 20 seconds after receipt of the latest digit.

Each Signalling System No. 7 exchange on receipt of the address-incomplete signal will send the signal to the preceding Signalling System No. 7 exchange, if any, and clear forward the connection. The first Signalling System No. 7 exchange will send a suitable signal on the preceding circuit if the related signalling system permits to do so; otherwise the appropriate tone or announcement for the national network concerned will be sent to the calling party.

1.8 *Congestion signals*

As soon as the congestion condition is detected one of the *congestion* signals (see Recommendation Q.722, § 3.4) is sent without waiting for the completion of a possible continuity-check sequence.

Reception of a congestion signal at any Signalling System No. 7 exchange will cause the clear-forward signal to be sent and cause an appropriate signal to be sent to the preceding exchange if the signalling system allows this or an appropriate tone or announcement to be sent to the originating subscriber or operator.

1.9 *Called-party's-line-condition signals*

The *called-party's-line-condition* signals (see Recommendation Q.722, § 3.4) will be sent when the appropriate electrical signals are received at the incoming international exchange from the national network.

The *called-party's-line-condition* signals will be sent without waiting for the completion of a possible continuity check. On receipt of one of these signals, the first Signalling System No. 7 exchange (or the outgoing international exchange) will clear forward the connection and cause an appropriate signal to be sent to the preceding exchange if the signalling system allows this or an appropriate tone or announcement to be sent to the originating subscriber or operator.

Each Signalling System No. 7 exchange on receipt of one of these signals has to clear forward the connection.

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[2] It is envisaged that in the future evolution of the Telephone User Part (e.g. in the context of an integrated services digital network) the through-connection immediately after sending of the initial address message may become a mandatory requirement.

1.10 *Answer signals*

The signals *answer, charge* and *answer, no charge* are sent as received from the national network or from the succeeding international link.

The signals answer, charge and answer, no charge are used only as a result of the first off-hook signal from the called party.

1.11 *Clear-back signal*

A *clear-back* signal must not disconnect the speech path at a Signalling System No. 7 exchange. The requirements for the release of a connection in the event that a clear-forward signal is not received are given in Recommendation Q.118 [3].

1.12 *Reanswer and clear-back signal sequences*

Subsequent off-hook, on-hook signals from the called party, such as will result from switch-hook flashing, will cause the following sequence of signals to be sent:

- clear-back,
- reanswer,
- clear-back,
- reanswer,
- etc.

It is necessary that a flashing sequence be retransmitted to the operator (or the preceding link) and that the final condition of the circuit represents the final position of the called party's switch hook.

1.13 *Forward-transfer signal*

The *forward-transfer* signal may be sent in semiautomatic working in either of the following two cases:

a) following a call switched automatically to a subscriber, or following a call established via a special operator, the controlling operator wishes to call in an assistance operator. On receipt of the forward-transfer signal at the incoming international exchange, an assistance operator is called in;

b) following a call via code 11 and 12, the controlling operator wishes to recall the incoming operator at the incoming international exchange. Receipt of the forward-transfer signal at the incoming international exchange recalls the incoming operator on calls completed via the operator positions at the exchange.

1.14 *Clear-forward and release-guard sequence*

The *clear-forward* signal is overriding and all exchanges must be in a position to respond by releasing the circuit and sending a *release-guard* signal at any time during the progress of a call and even if the circuit is in the idle condition. If sent while a circuit is blocked it will not result in unblocking the circuit concerned (see § 5). The fact that the circuit is blocked will not delay the transmission of the release-guard signal.

1.15 *Reset of circuits and circuit groups*

In systems which maintain circuit status in memory there may be occasions when the memory becomes mutilated. In such a case the circuits must be reset to the idle condition in both exchanges to make them available for new traffic. Since the exchange with the mutilated memory does not know whether the circuits are idle, busy outgoing, busy incoming, blocked, etc., reset-circuit signals or a circuit group reset message should be sent as appropriate for the affected circuits. The reset-circuit signal may also be sent, in certain cases, when a signalling fault occurs (see §§ 6.2 and 6.5).

1.15.1 *Reset-circuit signal*

If only a few circuits are concerned a reset-circuit signal should be sent for each affected circuit.

On receipt of a reset-circuit signal the unaffected exchange will:

a) accept the signal as a clear-forward signal and respond by sending a release-guard signal, after the circuit has been made idle, if it is the incoming exchange on a connection in any state of call set-up or during a call;

b) accept the signal as a clear-back or call-failure signal, whichever is appropriate, and respond by sending a clear-forward signal immediately if it is the outgoing exchange on a connection;

c) accept the signal as a clear-forward signal and respond by sending a release-guard signal if the circuit is in the idle condition;

d) if it has previously sent a blocking signal, or if it is unable to release the circuit as described above, respond by the blocking signal. If an incoming or outgoing call is in progress, this call should be disconnected and the circuit returned to the idle (blocked) state. A clear-forward or release-guard signal may be sent. The blocking signal should be acknowledged by the affected exchange. If the acknowledgement is not received, the repetition procedure specified in § 6.4.4 should be followed;

e) if it had previously received the blocking signal, respond by disconnecting any connected call, remove the blocked condition and restore the circuit to the idle state. If an outgoing call had been in progress, respond with a clear-forward or, in all other cases, a release-guard signal;

f) if a reset-circuit signal is received after the sending of an initial address message but before receipt of a backward signal relating to that call, clear the circuit and make an automatic repeat attempt on another circuit if appropriate.

g) if a reset-circuit signal is received after having sent a reset-circuit signal, respond by a release-guard signal. The circuit should be restored to traffic;

h) send an appropriate clearing signal on an interconnected circuit (e.g., clear-forward, or a suitable backward signal).

The affected exchange will then reconstruct its memory according to the received acknowledgement to the reset-circuit signal, and respond to the signals received in the normal way, i.e. release-guard in response to a clear-forward, blocking-acknowledgement in response to a blocking signal.

In addition, an interconnected circuit may be cleared by the use of an appropriate signal. If no acknowledgement to the reset-circuit signal is received before 4-15 seconds, the reset-circuit signal should be repeated. If an acknowledgement for the signal is not received within 1 minute after the sending of the initial reset-circuit signal, maintenance personnel should be notified to permit manual restoration procedures. However, the sending of the reset-circuit signal should continue at 1-minute intervals until maintenance intervention occurs.

1.15.2 *Circuit group reset message*

If a considerable number of circuits or all circuits are affected by the memory mutilation, circuit group reset messages should be used to make these circuits available for new traffic.

Since the effect of erroneous circuit group reset messages generated by undetected errors may seriously affect the quality of service, each circuit group reset message has to be sent twice.

On receipt of two circuit group reset messages with 5 seconds for the same group or parts thereof the unaffected exchange will:

i) If the range field is not coded all zero:

   a) restore the circuits involved to the idle state;

   b) send the appropriate group blocking message(s) if it had previously sent a hardware failure oriented and/or software generated group blocking message;

   c) respond by a circuit group reset-acknowledgement message in which the status indicator bits of the circuits available for service or blocked for reasons of hardware failure or a software generated alarm are coded 0 and the status indicator bit of all circuits blocked for maintenance reasons are set to 1.

ii) If the range field is coded all zero:

   a) send the appropriate group blocking message(s) if it had previously sent a hardware oriented and/or a software generated group blocking message;

b) start the restoration of the circuits on a per circuit basis in the same way as after receipt of a reset circuit for each circuit within the group (see § 1.15.1);

c) respond by a circuit group reset-acknowledgement message indicating that the restoration of the circuits concerned was started.

iii) Independent from the coding of the range field the following actions should take place in the unaffected exchange after receipt of two circuit group reset signals within 5 seconds:

a) if it had previously received (a) blocking signal(s) or (a) blocking message(s) for one or more of the circuit(s) involved the blocked condition will be removed and the circuits will be made available for service;

b) if a circuit group reset message is received after having sent a circuit group reset message or (a) reset circuit signal(s) the circuits involved in both the sent and the received message/signal(s) are made available for service;

c) appropriate signals should be sent on interconnected circuits to release them.

The affected exchange will then reconstruct its memory according to the possibly received blocking messages and the received circuit group reset-acknowledgement message. It will respond to the possibly received group blocking messages in the normal way.

If no acknowledgement to a circuit group reset message is received before 4-15 seconds the circuit group reset message should be repeated (twice). If acknowledgement for the message is not received within 1 minute after sending the initial circuit group reset message maintenance personnel should be notified to permit manual restoration procedures. However, the sending of the circuit group reset message should continue at 1 minute intervals until maintenance intervention occurs.

1.16 *Analysis of digit information for routing*

(See Recommendation Q.107 *bis*.)

1.17 *Diagrams showing signal sequence*

In the following some examples of call set-up sequences are shown diagrammatically (Tables 1/Q.724 and 2/Q.724).

2 Dual seizure with both-way operation

2.1 *Dual seizure*

Since Signalling System No. 7 circuits have the capability of *both-way* operation, it is possible that the two exchanges will attempt to seize the same circuit at approximately the same time.

2.2 *Unguarded interval*

Considering that with Signalling System No. 7:

a) signalling data link propagation time may be relatively long,

b) there may be significant delay due to retransmissions,

c) quasi-associated operation may add extra message transfer time(s) at signalling transfer points,

the unguarded interval during which *dual seizure* can occur may be relatively long in some instances. The exchange must therefore detect dual seizure and take action as defined in § 2.5.

2.3 *Detection of dual seizure*

A dual seizure is detected by an exchange from the fact that it receives an initial address message for a circuit for which it has sent an initial address message (see also § 7.5.1).

TABLE I/Q.724

Semiautomatic (SA) and automatic (A) terminal traffic
(error-free operation assumed)

Outgoing international exchange		Incoming international exchange
Normal call to a free subscriber (using continuity-check)		
Address signals from the national network are analysed.		
The outgoing circuit is seized.		
The initial address message is sent: – all address signals including ST in "en bloc" operation, or – all available address signals in overlap operation (a minimum of 4 digits).	Initial address message [a] →	The address message is analysed to determine: – the circuit to be seized – country code not included – nature-of-circuit (satellite or terrestrial) – echo suppressor control – calling-party's-category – continuity-check control.
The echo suppressor, if present, is disabled so that the speech path continuity-check may be performed.		The echo-suppressor, if present, is disabled so that the speech path continuity-check may be performed. The loop for the speech path continuity-check is attached to the incoming circuit.
The transceiver for the speech path continuity-check is attached, and the check-tone is transmitted on the outgoing circuit.	Check-tone [a] →	Set-up the call in the national network begins when enough address signals are received for routing (overlap operation).
When the speech path continuity-check and cross-office check have been completed, and if the incoming circuit is used with common channel signalling, when the continuity signal has been received from the national network, the continuity signal is sent, and the transceiver is removed. (When the continuity-check fails, the continuity-failure signal is sent forward. An automatic repeat attempt is made.) The echo suppressor, if present, is enabled as appropriate. The remaining address signals are sent forward in overlap operation.	← Check-tone Continuity → Subsequent address messages →	The check-loop is removed and the echo suppressor, if present, is enabled. Address signals are passed into the national network. The speech path is switched through. The address messages are analysed to determine that all the required address signals have been received (where applicable) [b]. Set-up of the speech path is completed. Subsequent supervisory signals are handled by the processor as appropriate.
On receipt of the address-complete signal, registers (if any) are released and the speech path through-connected, the address signals are erased. Subsequent supervisory signals are handled by the processor as appropriate.	← Address-complete	
The operator (SA), or the calling subscriber (A) hears ringing tone.	← Audible ringing tone	Ringing tone of the country of destination is sent back.
On receipt of the answer signal, charging [c] measurement of call duration and conversation begin.	← Answer	Signals from the national network are passed to the outgoing international exchange as follows. The called subscriber answers (charge or no charge).
"Clear-back" is recognized.	← Clear-back	The called subscriber hangs up.
SA: A clearing supervisory signal to given to the controlling operator. A: After 1-2 min., if there is no clear-forward signal, the international connection is released and charging and measurement of the call duration are ceased.		SA and A: After 2-3 min., if there is no clear-forward signal, the national part of the connection is released.
The outgoing operator (SA) or the calling subscriber (A) clears. When the outgoing equipment is released, the clear-forward signal is sent.	Clear-forward →	"Clear-forward" is recognized. The connection is released, and "clear-forward" is sent to the national network of destination.
"Release-guard" is recognized, and the outgoing circuit is made available for new traffic.	← Release-guard	When the incoming equipment has released, a release-guard signal is sent back. The circuit is made available for new traffic.

[a] Solid arrows denote common channel signals; dotted arrows are tones sent via the speech path (check-tone and audible tones).
[b] Address-complete signal may come from the national network.
[c] Unless a no-charge answer or address-complete signal has been received.

TABLE 2/Q.724

Semiautomatic (SA) and automatic (A) transit traffic
(error-free operation assumed)

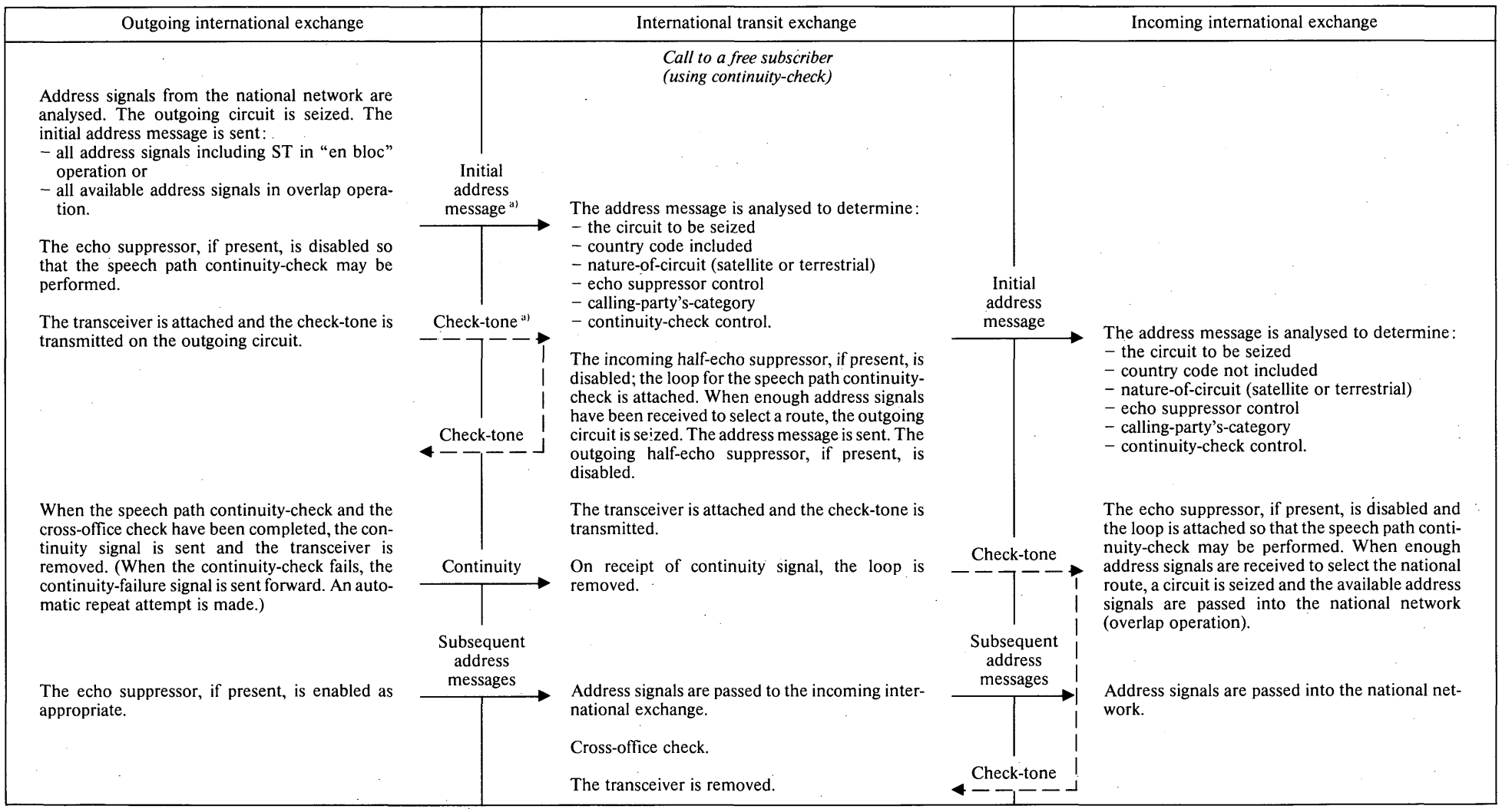


TABLE 2/Q.724 *(continued)*

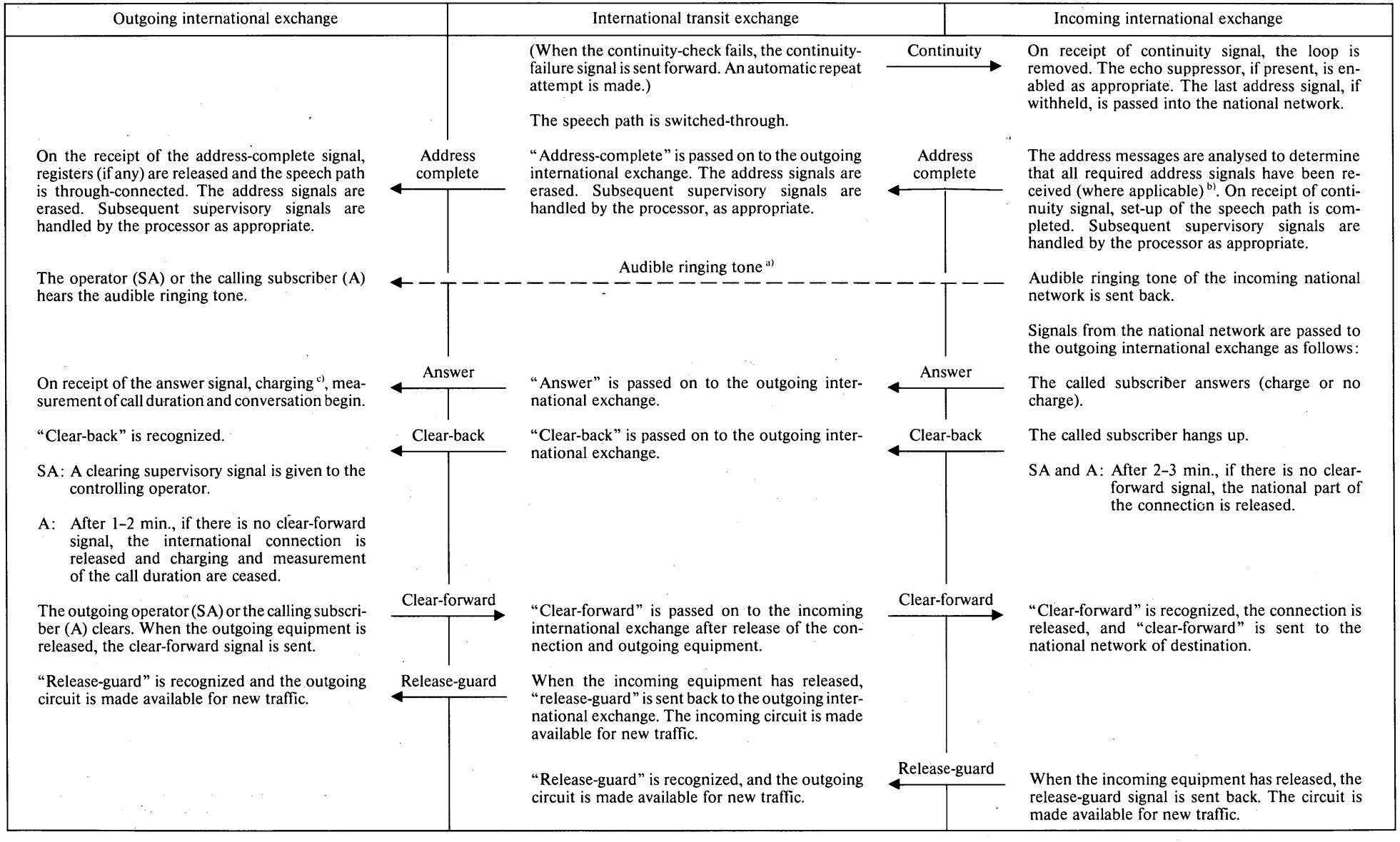


TABLE 2/Q.274 *(continued)*

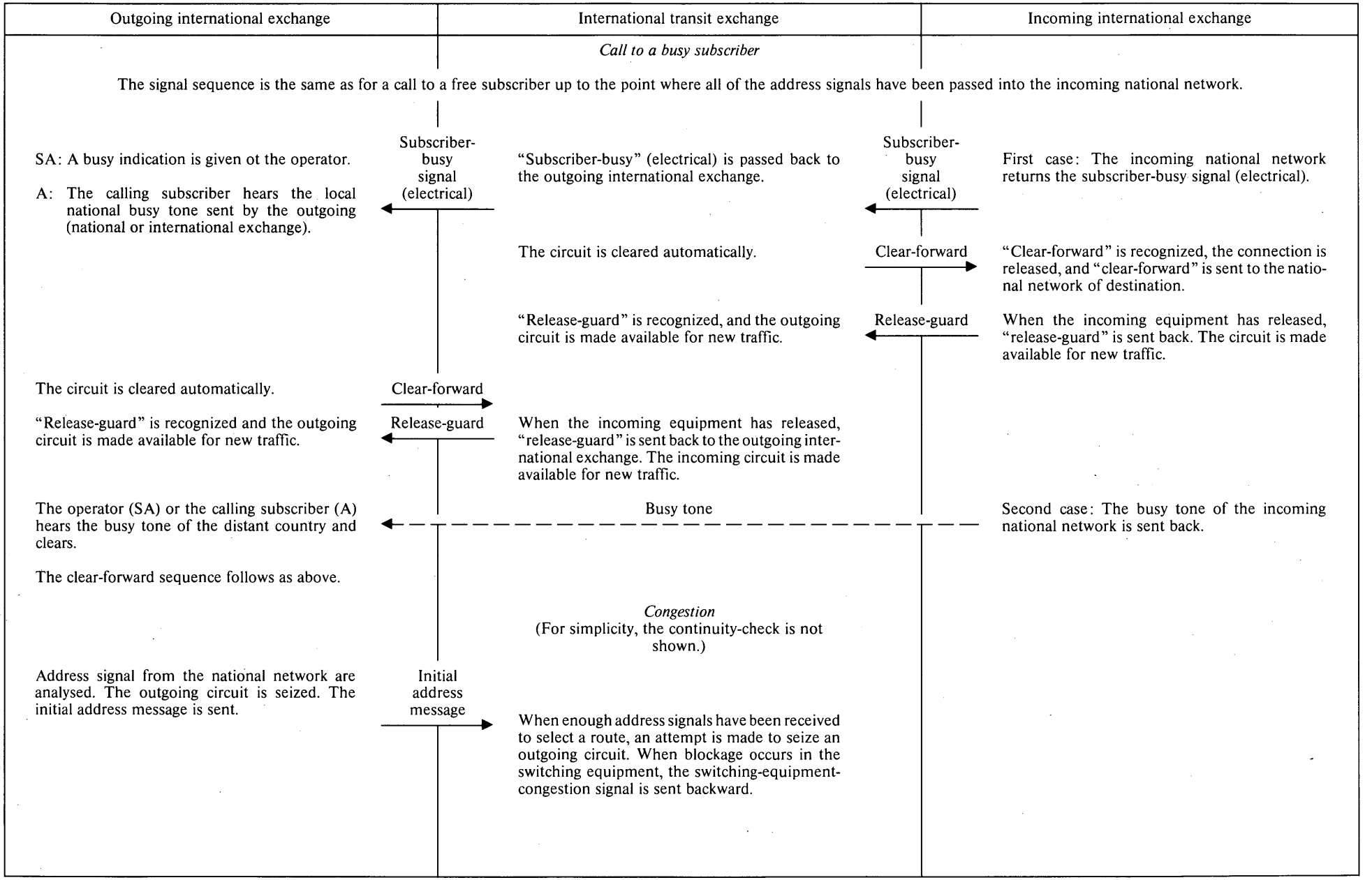
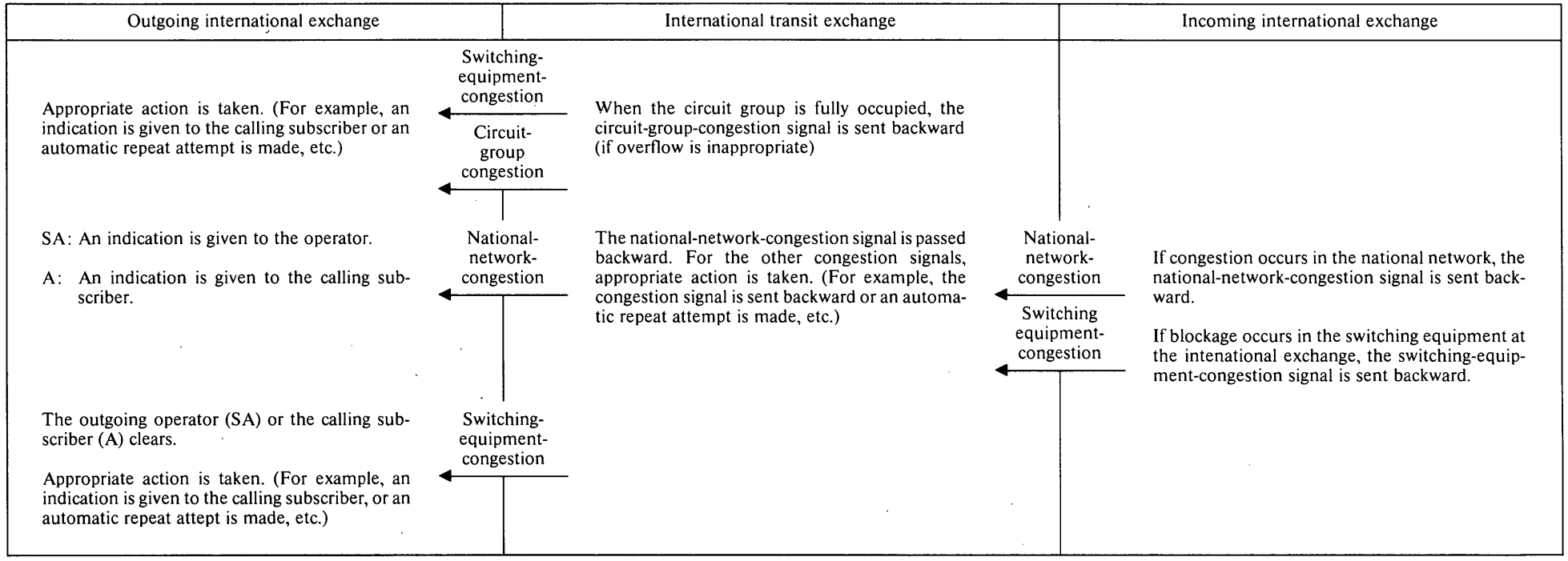


TABLE 2/Q.724 *(end)*



[a] Solid arrows denote common channel signals; dotted arrows are tones sent via the speech path (check-tone, audible tones, busy tone).
[b] The address-complete signal may come from the national network.
[c] Unless a no-charge answer or address-complete signal has been received.

2.4 *Preventive action*

Different methods for circuit selection can be envisaged to minimize the occurrence of dual seizure. In the following, two methods are described. Further study is required to determine the field of application of each method and to ensure that the two methods do interwork satisfactorily.

Other methods for circuit selection may also be used provided that they give the same degree of protection against dual seizure also when one of the methods specified is used at the other end.

Method 1

An opposite order of selection is used at each terminal exchange of a both-way circuit group.

Method 2

Each terminal exchange of a both-way circuit group has priority access to the group of circuits which it is controlling (see § 2.5). Of this group the circuit which has been released the longest is selected *(first-in - first-out).* In addition each terminal exchange of a both-way circuit group has nonpriority access to the group of circuits which it is noncontrolling. Of this group the latest released circuit is selected *(last-in - first-out).*

For call control purposes a both-way circuit group can be subdivided into subgroups in an exchange.

It is necessary to take preventive action in cases where Signalling System No. 7 uses a signalling data link with long propagation time.

2.5 *Action to be taken on detection of dual seizure*

Each exchange will control one half of the circuits in a both-way circuit group. On detection of a dual seizure, the call being processed by the control exchange for that circuit will be completed and the received initial address message will be disregarded.

Under these conditions, the call being processed by the control exchange will be allowed to complete although, when continuity-check has to be performed, the continuity of the circuit may have been checked in the direction from noncontrol to control only. The call being processed by the noncontrol exchange will be backed off, switches released, the continuity-check transceiver removed, and the check-loop connected unless or until a continuity signal has been received from the control exchange. A clear-forward signal will not be sent. The noncontrol exchange will make an automatic repeat attempt on the same or on an alternative route.

For the purpose of resolution of dual seizure on both-way circuits, the exchange with the higher signalling point code will control all even-numbered circuits (circuit identification code) and the other exchange the odd-numbered circuits. The designation of control may also be used for maintenance control purposes.

3 Automatic repeat attempt

Automatic repeat attempt, as defined in Recommendation Q.12 [4], is provided in Signalling System No. 7.

An automatic repeat attempt will be made:

- upon failure of the continuity-check (see § 7.3);
- on detection of dual seizure (at the noncontrol exchange) (see § 2.5);
- on receipt of the blocking signal after sending an initial address message and before any backward signal has been received (see § 6);
- on receipt of a reset-circuit signal after sending an initial address message and before a backward signal has been received;
- on receipt of unreasonable signalling information after sending an initial address message and before one of the backward signals required for call set-up has been received.

4 Speed of switching and signal transfer in international exchanges

4.1 *Outgoing international exchange*

At the outgoing international exchange:

- if overlap operation is used, the sending of the initial address message shall take place as soon as sufficient digits are received and analyzed to permit the selection of an outgoing circuit;
- if "en bloc" operation is used, the initial address message should be sent as soon as all the digits of the address including the end-of-pulsing signal are available and the outgoing circuit has been chosen.

4.2 *International transit exchange*

At the international transit exchange, the selection of an outgoing circuit should begin as soon as the digits necessary to determine the routing have been received and analyzed.

4.3 *Incoming international exchange*

At the incoming international exchange:

- if overlap operation is used in the national network, the setting-up of the national part of the connection should start as soon as a sufficient number of digits has been received for routing;
- if "en bloc" operation is used in the national network, the setting-up of the national part of the connection should start as soon as all the digits of the address including the end-of-pulsing signal have been received.

5 Blocking and unblocking of circuits and circuits groups

The circuit blocking (unblocking) signal and the group blocking (unblocking) message are provided to permit the switching equipment or maintenance personnel to remove from (and return to) traffic, the distant terminal(s) at a circuit or circuit group because of fault or to permit testing. Specific conditions for automatic sending of blocking and unblocking signals and messages by the switching equipment in case of use of the interruption control on interexchange circuits appear in § 9.

Since circuits served by Signalling System No. 7 have both-way capability, the blocking signal or a group blocking message can be originated by either exchange. The receipt of the blocking signal or a group blocking message will have the effect of prohibiting calls on the relevant circuit(s) outgoing from that exchange until an unblocking signal or the appropriate group unblocking message is received, but will not in itself prohibit calls incoming to that exchange. Acknowledgement sequences are always required for the blocking and unblocking signals as well as for the group blocking and group unblocking messages, using the blocking-acknowledgement signal, the unblocking-acknowledgement signal, the appropriate group blocking-acknowledgement message and the appropriate group unblocking-acknowledgement message, respectively. The acknowledgement is not sent until the appropriate action, either blocking or unblocking, has been taken. The clear forward signal should not override a blocking condition and return circuits to service which might be faulty. (A) blocked circuit(s) will be returned to service on transmission of the unblocking-acknowledgement signal or the appropriate group unblocking-acknowledgement message at one exchange and on receipt of the unblocking-acknowledgement signal or the appropriate group unblocking-acknowledgement message at the other exchange.

5.1 *Other actions on receipt of a blocking signal*

In the event of the receipt of a blocking signal:

- after an initial address message has been sent, and
- before a backward signal relating to that call has been received,

an automatic repeat attempt will be made on another circuit. The exchange receiving the blocking signal should clear forward the original attempt in the normal manner after sending the blocking-acknowledgement signal.

If the blocking signal for a circuit is received:

- in the outgoing exchange after at least one backward signal relating to a call has been received, or
- in the incoming exchange after at least one backward signal relating to a call has been sent,

the exchange will not seize that circuit for subsequent calls.

The fact that the circuit is engaged on a call will not delay transmission of the blocking (unblocking)-acknowledgement signal.

If a blocking signal is sent and subsequently an initial address message is received in the opposite direction, the following action is taken:

- for test calls, the call should be accepted, if possible. In the case where the test call cannot be accepted, the blocking signal must be returned;
- for calls other than test calls, the blocking signal must be returned.

Blocking of a circuit that has not been withdrawn from service by use of the blocking signal should not exceed five minutes, after which an alarm should be given at each terminal of the circuit. Should a call be in progress on the circuit involved, the five minutes time will commence when that call is cleared. If the work on the circuit must exceed five minutes, the circuit should be withdrawn from service.

5.2 *Group blocking and unblocking messages*

The following group blocking (unblocking) messages and the appropriate acknowledgement messages are provided:

- Maintenance oriented group blocking (unblocking) message.
- Hardware failure oriented group blocking (unblocking) message.
- Software generated group blocking (unblocking) message (national option.)

The range of circuits to be blocked (unblocked) is dependent on the coding of the range field:

- If the range field is not coded all zero, the circuits indicated in the status field have to be blocked (unblocked).
- If the range field is coded all zero all circuits of the predetermined circuit group have to be blocked (unblocked).

The same rule applies to the acknowledgements.

Since the effect of erroneous group blocking (unblocking) messages generated by undetected errors may seriously affect the quality of service, each group blocking (unblocking) message has to be sent twice. Therefore, at the receiving exchange actions only take place after a blocking (unblocking) message was received twice within 5 seconds.

For the circuits blocked for maintenance reasons the same conditions apply and the same actions have to be taken as described in § 5.1.

For the circuits blocked for reasons of hardware failure or software generated alarm, the following actions will be taken:

- the maintenance personnel has to be alerted;
- all interconnected circuits have to be released by the appropriate signals;
- the affected circuits are set to the condition idle/hardware or software blocked without any exchange of clearing signals.

6 Release of international connections and associated equipment

6.1 *Normal release conditions*

Connections are normally released in the forward direction as a result of the receipt of a clear-forward signal from the preceding exchange.

In addition, the normal release of connections (or circuits) occurs as follows:

- on continuity-check failure (see § 7.3);
- on receipt of an address-incomplete signal (see § 1.6);
- on receipt of one of the congestion signals (see § 1.7);
- on receipt of one of the called-party's-line-condition signals (see § 1.8);
- on receipt of the blocking signal or the maintenance oriented group blocking message after sending an initial address message and before a backward signal relating to that call has been received (see § 5);
- on receipt of unreasonable signalling information after sending an initial address message and before one of the backward signals required for call set-up has been received (see § 6.5).

If the conditions for the normal release of connections as described above are not fulfilled, release is provided as follows:

- in the release under abnormal conditions (see § 6.4);
- on receipt of a call-failure signal (see § 6.3);
- on failure to receive a clear-forward signal after sending a clear-back signal (see § 6.4);
- on failure to receive an answer signal (see § 6.4);
- on receipt of a reset-circuit signal or circuit group reset message (see § 1.15).

Address and routing information are released from memory in each of the exchanges of a connection as described in the following subsections.

6.1.1 *Outgoing international exchange*

Address and routing information stored at the outgoing international exchanges can be erased on receipt of one of the following backward signals:

a) one of the address-complete signals,
b) the address-incomplete signal,
c) one of the congestion signals,
d) one of the called-party's-line-condition signals,
e) the call-failure signal,

or when the connection is cleared earlier and no automatic repeat attempt has to be made.

6.1.2 *Incoming international exchange*

Address and routing information stored at the incoming international exchange can be erased on receipt of one of the backward signals indicated in § 6.1.1 (or equivalent) from a national signalling system, or when one of the following signals has been originated and sent to the outgoing international exchange:

a) one of the address-complete signals,
b) the address-incomplete signal,
c) one of the congestion signals,
d) the call-failure signal,
e) the reset-circuit signal, or circuit group reset message,

or on receipt of a clear-forward signal.

6.1.3 *International transit exchange*

Address and routing information stored at an international transit exchange can be erased on receipt of one of the backward signals indicated in § 6.1.1, on receipt of a clear-forward signal, or when one of the congestion signals is originated in that exchange.

6.2 *Abnormal release conditions – Clear-forward, release-guard sequences*

6.2.1 *Inability to release in response to a clear-forward signal*

If an exchange is unable to return the circuit to the idle condition in response to a clear-forward signal, it should remove the circuit from service and send the blocking signal. Upon receipt of the blocking-acknowledgement signal, the release-guard signal is sent in acknowledgement of the original clear-forward signal.

6.2.2 *Inability to release in response to a backward signal*

If an exchange is unable to release a circuit in response to an address-incomplete, congestion, called-party's-line-condition or call-failure signal, it should remove the circuit from service by sending the blocking signal. Upon receipt of the blocking-acknowledgement signal, the clear-forward signal should be sent in reply to the original backward signal.

6.2.3 *Failure to receive a release-guard signal in response to a clear-forward signal*

If a release-guard signal is not received in response to a clear-forward signal before 4-15 seconds, the clear-forward signal will be repeated.

If, after sending a clear-forward signal, a release-guard signal is not received within a period of one minute after the first clear-forward signal, the maintenance personnel shall be alerted. The repetition of the clear-forward signal is ceased, and circuit reset is initiated.

6.3 *Call-failure signal*

The *call-failure* signal is sent as the result of time-out situations, described in § 6.4 and whenever a call attempt fails and other specific signals do not apply, viz:

- the address-incomplete signal,
- the congestion signals, or
- the called-party's-line-condition signals.

Reception of the call-failure signal at any Signalling System No. 7 exchange will cause the clear-forward signal to be sent and, if the signalling system permits to do so, the appropriate signal to be sent to the preceding exchange or the appropriate tone or announcement to be sent to the national network.

Failure to receive a clear-forward signal within 4-15 seconds of sending a call-failure signal causes the latter to be repeated. If no clear-forward signal is received within 1 minute of sending the call-failure signal, repetition of the call-failure signal is ceased, maintenance personnel is alerted and circuit reset initiated.

6.4 *Abnormal release condition – other sequences*

If the conditions for normal release as covered in § 6.1 are not fulfilled, release will take place under the following conditions.

6.4.1 *Outgoing international exchange*

An outgoing international exchange shall:

a) release all equipment and clear forward the connection on failure to meet the conditions for normal release of address and routing information as covered in § 6.1.1 before 20-30 seconds after sending the latest address message;

b) release all equipment and clear forward the connection on failure to receive an answer signal within the interval specified in Recommendation Q.118 [3];

c) release all equipment and clear forward the connection on failure to receive a clear-forward signal from the national network after having received a clear-back signal within the interval specified in Recommendation Q.118 [3].

6.4.2 *Incoming international exchange*

An incoming international exchange shall:

a) release all equipment, clear forward the connection into the national network and send back a call-failure signal in the following cases:
   - on failure to receive a continuity or continuity-failure signal if applicable (see Recommendation Q.723, § 3.3.1) before 10-15 seconds after receipt of the initial address message; or
   - on failure to receive one of the backward signals indicated in § 6.1.1 (or equivalent) from a national network (where expected) before 20-30 seconds after receipt of the latest address message, unless the timing for sending the address-incomplete signal (see § 1.7) is provided; or
   - on receipt of an address-incomplete signal after an address-complete signal has been generated;

b) send the call-failure signal on failure to receive a clear-forward signal for the incoming circuit before 4-15 seconds after sending an address-incomplete, congestion, call-failure or a called-party's-line-condition signal indicating inability to complete the call.

   If a clear-forward signal is not received within a period of one minute after sending the call-failure signal, the repetition of the call-failure signal should be ceased, maintenance personnel should be alerted, and a reset-circuit signal should be sent for the concerned circuit.

c) release all equipment and clear forward the connection into the national network on failure to receive a clear-forward signal after sending a clear-back signal within the interval specified in Recommendation Q.118 [3].

6.4.3 *International transit exchange*

An international transit exchange shall:

a) release all equipment, clear forward the connection and send back the call-failure signal in the following cases:
   - on failure to receive a continuity or continuity-failure signal if applicable (see Recommendation Q.723, § 3.3.1) before 10-15 seconds after receipt of the initial address message; or
   - on failure to meet the conditions for normal release as covered in § 6.1.3 before 20-30 seconds after sending the latest address message; or

b) send the call-failure signal on failure to receive a clear-forward signal for the incoming circuit before 4-15 seconds after sending an address-incomplete, congestion, call-failure or a called-party's-line-condition signal indicating inability to complete the call.

   If a clear-forward signal is not received within a period of one minute after sending the call-failure signal, the repetition of the call-failure signal should be ceased, maintenance personnel should be alerted, and a reset-circuit signal should be sent for the concerned circuit.

6.4.4 *Failure in the blocking/unblocking sequence*

An exchange will repeat the blocking (unblocking) signal or the group blocking (unblocking) messages on failure to receive the appropriate acknowledgement in response to one of these signals/messages before 4-15 seconds (see § 5).

If an acknowledgement is not received within a period of one minute after sending the initial blocking (unblocking) signal or group blocking (unblocking) messages, maintenance personnel should be alerted, the repetition of the blocking (unblocking) signal or group blocking (unblocking) messages should be continued at one minute intervals.

6.5 *Receipt of unreasonable signalling information*

The Message Transfer Part of the signalling system will avoid mis-sequencing, or double delivery, of messages with a high reliability (Recommendation Q. 706, § 2). However, undetected errors at the signalling link level and exchange malfunctions may produce signalling information in messages that is 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 clear-forward signal is received relating to an idle circuit it will be acknowledged with a release-guard signal;

b) if a release-guard signal is received relating to a circuit for which a clear-forward signal has not been sent, the following actions will be undertaken:
   - if the circuit is idle, the release-guard signal is discarded;
   - if the circuit is seized by a call, the release-guard signal is considered as an ordinary unreasonable information (see item g));

c) if a blocking signal is received for a blocked circuit, a blocking-acknowledgement signal will be sent;

d) if an unblocking signal is received for an unblocked circuit, an unblocking-acknowledgement signal will be sent;

e) if a blocking-acknowledgement signal for which no blocking signal has been sent is received:
   - relating to a circuit blocked by sending a blocking signal, the blocking-acknowledgement signal will be discarded,
   - relating to a circuit which is not blocked by sending a blocking signal, an unblocking signal will be sent;

f) if an unblocking-acknowledgement signal for which no unblocking signal has been sent, is received:

- relating to a circuit blocked by sending a blocking signal, the blocking signal will be sent,
- relating to a circuit which is not blocked by sending a blocking signal, the unblocking-acknowledgement signal will be discarded;

g) if other unreasonable signalling information is received, the following actions will be undertaken:

- if the circuit is idle, the reset-circuit signal is sent;
- if the circuit is seized by a call, after receipt of a backward signal required for the call set-up, the unreasonable signalling information is discarded;
- if the circuit is seized by a call, before receipt of a backward signal required for the call set-up, the reset-circuit signal is sent. If the circuit is seized by an incoming call, the call will be released. If the circuit is seized by an outgoing call, an automatic repeat attempt is provided on another circuit."

7 Continuity-check for 4-wire speech circuits

7.1 *General*

This specification relates only to that part of a 4-wire connection served by Signalling System No. 7. The part of the speech path to be checked may include a circuit with speech interpolation. As the presence of active echo suppressors in the circuit would interfere with the continuity-check, it is necessary to disable the suppressors during the check and to re-enable them, if required, after the check has been completed.

The *transceiver* (check-tone transmitter and receiver) is connected to the *go* and *return* paths of the outgoing circuit at the first and each succeeding exchange, excluding the last exchange, in that part of the connection served by Signalling System No. 7. The *check-loop* should be connected to the *go* and *return* paths of the incoming circuit at each exchange except the first in that part of the connection served by Signalling System No. 7. A continuity-check is considered successful when a tone is sent on the *go* path and is received on the *return* path within acceptable transmission and timing limits.

7.2 *Transmission requirements*

7.2.1 *Transmitting equipment*

The *check-tone* frequency will be 2000 ± 20 Hz. For international application the sending level of the check-tone will be −12 ± 1 dBm0.

7.2.2 *Check-loop*

The check-loop will have a loss of 0 dB, taking into account any difference between the relative levels of the two paths at the point of attachment.

7.2.3 *Receiving equipment*

The check-tone receiver will have the following characteristics:

a) *Operating requirements*

Check-tone frequency: 2000 ± 30 Hz

Check-tone level range for international application:

The absolute power level N of the check-tone shall be within the limits $(-18 + n) \leqslant N \leqslant (-6 + n)$ dBm where n is the relative power level at the receiver input.

Recognition time: 30-60 ms

The frequency and level range tolerances allow for variations at the sending end and for variations in line transmission that are considered acceptable.

b) *Non-operating requirements*

Signal frequency: outside the frequency band 2000 ± 200 Hz

Signal level for international application: below or equal to $-22 + n$ dBm.

The limit is 10 dB below the nominal absolute level of the check-tone at the input of the receiver. If the level falls below this point, transmission is considered unacceptable.

Signal duration: shorter than 30 ms

The level range of $(-18 + n) \leqslant N \leqslant (-6 + n)$ dBm will serve as a Go/No-go check on the links in that part of the international connection served by Signalling System No. 7.

c) *Release requirements*

If the receiver is used to test for the removal of check-tone (see § 7.3):

- after recognition of tone, interruptions of up to 15 ms shall be ignored; this will prevent switching through the speech path prematurely;
- the indication of tone removal should not be delayed more than 40 ms; and
- the release level of the receiver should be lower than $-27 + n$ dBm for international application.

7.3 *Continuity-check procedure*

Decision on whether continuity-check should be performed or not on a given circuit should be made by an outgoing exchange according to the criteria described in § 1.4. The outgoing exchange will indicate whether continuity-check is required or not by the continuity-check indicator in the initial address message (Recommendation Q.723, § 3.3.1). If it is required, the outgoing exchange will connect a transceiver to the speech circuit when it sends an initial address message. If continuity-check is not required either on the incoming circuit or on the outgoing circuit, the outgoing exchange can switch-through the speech path immediately after having sent the initial address message.

A description of the procedure using the specification and description language is given in the state transition diagrams in Figures 4/Q.724 and 5/Q.724. The Signalling System No. 7 exchange will send forward the continuity signal after completion of all the following actions:

- the continuity-check performed on the outgoing circuit is completed;
- the speech path across the exchange has been checked and found correct (see § 1.4); and
- if the continuity-check indicator in the received initial address message indicates that continuity-check is being (has been) performed on previous circuit(s), receipt of a continuity signal from the preceding exchange.

The speech path may be switched through at an international transit or incoming exchange and the transceiver disconnected after the continuity-check of the circuit has been successfully completed. However, the switching through of the speech path should be delayed until the residual check-tone has propagated through the return path of the speech circuit.

This determination may be made by timing, or by using the check-tone receiver to test for the removal of the check-tone, or other appropriate means.

As a national option the following single report procedure may be used to assure that on terrestrial circuits a complete check of both directions of transmission in the face of high noise and in the double seizing situations. With this procedure, the continuity check is not considered successful until the check tone is recognized and its subsequent removal recognized within the continuity check timing interval. On tone recognition it must be ensured that at least 60 ms of continuity check tone has been sent. In the double seizing case, this procedure will ensure that both ends will recognize the check tone if both directions of transmission are within acceptable transmission limits. The end originating the continuity check and in the case of double seizing the control end, the continuity signal is sent on successful completion of the check. The exchange at the other end of circuit removes the loop (or transceiver in the case of double seizing) on receipt of the continuity signal. If this exchange is the last common channel signalling exchange, the address-complete signal is not returned until either the loop (or transceiver or in the double seizing case) is disconnected.

With the single report continuity check procedure, the first exchange that has initiated the continuity check must delay through-connect until receipt of an address complete signal to avoid the potential hazards associated with delayed loop removal.

On receipt of the continuity signal in the following international exchange, the continuity-check loop will be removed if inserted. Also, any digits of the national number which were withheld may be released (see § 1.2).

At the Signalling System No. 7 exchange, on failure of the outgoing circuit to satisfy the continuity-check:

- the continuity-check transceiver will be removed and an automatic repeat attempt will be made on another circuit,
- a continuity-failure signal will be sent to the following exchange.

A repeat of the continuity-check of the speech path will be made on the failed outgoing circuit within 1-10 seconds of detection of the continuity-check failure.

The second continuity-check will be initiated by the Signalling System No. 7 exchange detecting the failure using the continuity-check-request signal.

If the repeated check passes on this call, the speech circuit will be returned to idle with a clear-forward/release-guard sequence. If the second check fails, the maintenance staff will be alerted that a failure has occurred and the check will be repeated at intervals of 1-3 minutes. The repeated continuity-check will only be finished when continuity is detected.

According to transmission maintenance requirements, Signalling System No. 7 may provide for:

a) a print-out each time a second continuity-check is started. In such cases, the circuit involved should be identified;

b) a print-out each time a continuity-check results in a warning being given to maintenance personnel.

Since a continuity-check failure can be caused by a faulty transceiver, precautions should be taken to ensure a low probability of selecting a faulty one for both the initial continuity-check and the second check, e.g. by ensuring the selection of a different transceiver for each of the checks.

7.4 *Continuity-check timing*

7.4.1 *Time-out period*

The continuity-check is considered to have failed if the receiver has not responded within a period determined by the Administration concerned. This period should not exceed two seconds.

The time-out period of the continuity-check should always exceed the continuity recognition time, T_{CR}, given by:

$$T_{CR} = 2T_P + T_{IAM} + T_{TC} + T_L + T_R - T_T$$

where

T_P One-way propagation time of the speech circuit and the signalling link (where these times are the same),

T_{TC} Speech interpolation clip time for two speech interpolation systems in series (for connections not using speech interpolation $T_{TC} = 0$),

T_R Receiver response time,

T_L Loop connecting time (maximum),

T_T Transceiver connecting time (minimum),

T_{IAM} Emission time of the longest initial address message.

If retransmission of an initial address message is to be included in T_{CR}, the following formula may be used:

$$T_{CR} = 4T_P + 2T_{IAM} + T_{FISU} + 2T_X + T_L + T_R - T_T$$

where

T_{FISU} Emission time of a fill-in signal unit (length of a fill-in signal unit),

T_X Time between receiving an initial address message and emitting a signal unit containing an acknowledgement for that initial address message, or

time between receiving a signal unit asking for retransmission and emitting the initial address message to be retransmitted.

7.4.2 *Switching of continuity-check equipment*

The connection and disconnection of the equipment used for the continuity-check and also the disabling and subsequent enabling of echo suppressors should be related to the following stages of progress in the establishment of the connection:

a) *Preparation at Signalling System No. 7 exchange applying the transceiver* – Action should be initiated when the initial address message is available for transmission in the Message Transfer Part.

b) *Preparation at Signalling System No. 7 exchange connecting the check-loop* – Action should be initiated at the moment of recognition of the initial address message received.

c) *Disconnection at Signalling System No. 7 exchange connecting the check-loop* – Action follows the receipt of the continuity signal, the continuity-failure signal or the clear-forward signal, or the emission of signals indicating that the call cannot be established, e.g. circuit-group-congestion signal.

d) *Disconnection at Signalling System No. 7 exchange applying the transceiver* – Action should be initiated on the successful completion or the failure of the continuity-check.

Exceptionally, if disconnection has not previously occurred, action should be initiated at the moment of recognition of the address-complete signals, the answer signals, signals indicating that the call cannot be established, or on the emission of a clear-forward signal.

It is recommended that the mean time, both for the connection and for the disconnection, is less than 100 ms. A mean time of 200 ms should not be exceeded.

7.5 *Continuity-check test calls*

7.5.1 The following procedure may be used in the cases when continuity-check is performed by test calls. This procedure is used to test a single interexchange circuit, which must be idle when the procedure is initiated.

7.5.2 When the outgoing Signalling System No. 7 exchange intends to initiate the procedure, it sends to the following exchange a continuity-check-request message and it connects the transceiver to the outgoing speech circuit. On receipt of the continuity-check-request message, the following exchange connects the loop to the involved circuit. On detection of the backward tone within the time-out specified in § 7.4.1, the outgoing exchange will disconnect the transceiver and the circuit will be returned to idle with a clear-forward/release-guard sequence.

7.5.3 In the case that no backward tone is detected within the specified time-out, the same actions apply as in the case of continuity-check failure during normal call set-up, see § 7.3 (the clause referring to the repeat attempt is not relevant in this case).

7.5.4 If an exchange will receive an initial address message relating to a circuit for which it has sent a continuity-check-request message (i.e. in case of collision on a both-way operated circuit), it will abort the continuity-check test call, disconnect the transceiver and complete the incoming call.

An exchange receiving a continuity-check-request message after having sent an initial address message, will ignore it and continue the call set-up procedure.

8 Continuity-check for 2-wire speech circuits

In general the same procedure as described in § 7 is used for the continuity-check of 2-wire speech circuits except the check-loop which has to be replaced by a transponder and the fact that in the backward direction the frequency 1780 ± 20 Hz is used. A more detailed specification of this particular case needs further study.

9 Interruption control for multiplex systems

9.1 *Digital circuits*

When fully digital circuits are applied between two exchanges, which have some inherent fault indication features giving an indication to the switching system in case of fault (cf. § 1.4), the switching system should inhibit new local seizures of the concerned circuits when the fault indication arises and for as long as it persists.

9.2 *FDM circuits*

9.2.1 *General*

Interruption of the pilot in frequency-division multiplex systems corresponds to loss of continuity of speech circuits or a considerable reduction of level. Therefore a switching equipment monitoring this indication (see § 1.4) should inhibit local seizure of the concerned speech circuits in case of interruption. Moreover, seizure by the remote exchange should be prevented, as long as the interruption persists, by sending blocking and unblocking signals as specified in § 9.2 below.

When interruption control is implemented, possible use of the specifications contained in Recommendation Q. 416 [5] could be applied.

9.2.2 *Blocking and unblocking of speech circuits*

Blocking signals are sent to the other end, with regard to the relevant speech circuits, whenever an interruption is detected which lasts more than 4-15 seconds (provisional values).

When an interruption indicated terminates, unblocking signals are sent to the other end after 4-15 seconds (provisional value), provided that blocking signals were previously sent on occurrence of the interruption.

10 Supplementary services

In this part the signalling procedures related to a number of supplementary services are described. The additional messages and signals are defined in Recommendation Q.722 and the format and the content are given in Recommendation Q.723.

10.1 *Closed User Group*

10.1.1 *General*

The Closed User Group (CUG) facilities enable users to form groups with different combinations of restrictions for access from or to the users having one or more of these facilities. The following CUG facilities are standardized:

a) Closed user group – this is the basic facility that enables a user to belong to one or more CUGs.

b) Closed user group with outgoing access – this is an extension to a) which also enables to user to make outgoing calls to the open part of the network, and to users having the incoming access capability see c) below.

c) Closed user group with incoming access – this is a variant of a) which also enables the user to receive incoming calls from the open part of the networks, and from users having the outgoing access capability see b) above.

d) Incoming calls barred within the closed user group – this is a supplementary facility to a), b) or c) which, when used, applies per user per CUG.

e) Outgoing calls barred within the closed user group – this is a supplementary facility to a), b) or c) which, when used, applies per user per CUG.

A user may belong to one or more CUGs. In the case where a user belongs to more than one CUG, one of these is nominated as the preferential CUG of that user. Each user belonging to at least one CUG has either the closed user group facility or one or both of the closed user group with outgoing access and the closed user group with incoming access facilities. For each CUG to which a user belongs, either or none of the incoming calls barred within the closed user group or outgoing calls barred within the closed user group facilities may apply for that user. Different combinations of CUG facilities may apply for different users belonging to the same CUG.

The realization of the CUG facilities is done by the provision of interlock codes and is based on various validation checks at call set-up, determining whether or not a requested call to or from a user having a CUG facility is allowed. In particular, a validation check is performed by verification that both the calling and called partys belong to the same CUG as indicated by interlock codes.

The data for each CUG that a user belongs to, can either be stored, associated to the user at the local exchange to which the user is connected to (decentralized administration of CUG data) or in dedicated point(s) in the network. (Centralized administration of CUG data.)

The validation checks at call set-up when using decentralized administration of the CUG data are performed in the originating and destination exchange. When using centralized administration of CUG data most of the validation checks are made in the dedicated point(s), and a minimum of the CUG data is stored in the local exchanges.

In § 10.1.2 the call set-up procedures based on decentralized administration of CUG data is specified.

In § 10.1.3 the call set-up procedures based on centralized administration of CUG data is specified.

The call control procedure specified in § 10.1.2 based on decentralized administration of CUG data is recommended for national and international use.

The call control procedure specified in § 10.1.3 based on centralized administration of CUG data is recommended for national use.

10.1.2 *Call set-up procedure with decentralized adminsitration of CUG data*

10.1.2.1 *Originating exchange*

The actions at the originating exchange at call set-up from a user belonging to a CUG depends on whether the user belongs to one or more CUGs and on the combination of CUG facilities that applies. See also Figure Q.724/1.

a) CUG selection

For each CUG that a user belongs to, the interlock code assigned to the CUG is stored, associated to the user at the local exchange. In the case where a user belongs to more than one CUG, a selection of the CUG concerned, and thus of the corresponding interlock code, is required at call set-up. This selection is made on the following criteria.

In the case where the calling party makes a facility request including an index identifying a particular CUG, this CUG is selected by the originating exchange.

In the case where the calling party makes no facility request identifying a particular CUG, the originating exchange selects the preferential (or only) CUG.

Thus in the case where the calling party belongs to a CUG, no facility request concerning CUG facilities is made in the case:

i) where the user belongs to one CUG only;

ii) where a user who belongs to more than one CUG (with or without outgoing access) makes a call within the preferential CUG;

iii) where a user having the closed user group with outgoing access facility makes an outgoing access call.

A facility request is always required for a call within any CUG other than the preferential CUG.

b) Call set-up from a user having the closed user group or the closed user group with incoming access facility

In this case the CUG selection is performed in accordance with § 10.1.2.1 a).

The case where a user has both the closed user group with incoming access and closed user group with outgoing access facilities is handled in accordance with § 10.1.2.1 c).

In the case where the outgoing calls barred within the closed user group facility does not apply for the selected CUG, the call is set-up at the originating exchange. The initial address message forwarded to the next exchange then includes the interlock code of the selected CUG together with an indication that the call is a CUG call.

In the case where the outgoing calls barred within the closed user group facility applies for the selected CUG, the call is rejected and the access barred signal is returned to the calling party.

c) Call set-up from a user having the closed user group with outgoing access facility

In this case the call is regarded as either an outgoing access call or a call within the preferential (or only) CUG, unless the calling party makes a facility request identifying a particular CUG for the call.

In the case where the outgoing calls barred within the closed user group facility does not apply for the selected CUG, the call is set up at the originating exchange. The initial address message forwarded to the next exchange then includes the interlock code of the selected CUG together with an indication that the call is a CUG for which outgoing access is allowed.

In the case where the outgoing calls barred within the closed user group facility applies for the preferential (or only) CUG, the call is regarded as an outgoing access call. In this case the call is set up at the originating exchange and no interlock code or CUG call indication is included in the initial address message forwarded to the next exchange.

In the case where the calling party makes a facility request identifying a particular CUG and the outgoing calls barred within the closed user group applies for this CUG, the call is rejected and an access barred signal is sent to the calling party.

10.1.2.2 *Transit exchange*

With the possible exception of some gateway exchanges, each transit exchange sets up a CUG call as an ordinary call. The information related to the CUG facilities received from the preceding exchange, i.e. an interlock code, a CUG call indication and possibly an indication that outgoing access is allowed, is forwarded to the succeeding exchange.

In the case of an international CUG call, no special functions are required at the gateway exchange provided that the international interlock code assigned to the international CUG concerned is used in the national network. However, in the case where a national interlock code other than the applicable international interlock code is used within a national network, interlock code conversion is required at the gateway (or corresponding) exchange.

10.1.2.3 *Destination exchange*

At the destination exchange a validation check of the acceptability of a call is made where either the calling party (as indicated by a CUG call indication in the initial address message received) or the called party belongs to CUG. The call is connected only in cases where the information received checks with the information stored at the destination exchange, as specified in the following. In cases where a call is rejected because of incompatible CUG information a call supervision message including the access barred signal is sent towards the originating exchange.

The conditions for acceptance or rejection of calls because of the CUG facilities are illustrated in Figure 2/Q.724.

a) Calls to a user having the closed user group or the closed user group with outgoing access facility

In this case an incoming call is accepted only when:

i) it is a CUG call, including the case where outgoing access is allowed, and

ii) correspondence is found between the interlock code received and an interlock code associated with the called party, and

iii) the incoming calls barred within the closed user group facility does not apply for the CUG identified by the interlock code received.

If all the above conditions are not met, the call is rejected.

b) Calls to a user having the closed user group with incoming access facility

In this case an incoming call is accepted when it is:

i) an ordinary call;

ii) a CUG call for which outgoing access is not allowed, if both conditions specified in § 10.1.2.4 a), ii) and iii) are met;

iii) a CUG call for which outgoing access is allowed.

c) CUG calls to a user not belonging to any CUG

In the case where the incoming call is:

i) a CUG call for which outgoing access is allowed, it is accepted;

ii) a CUG call for which outgoing access is not allowed, it is rejected.

10.1.3 *Call set-up procedure with centralized administration of CUG data*

In the local exchange an indication is stored, showing whether the user has either none or one of the closed user group or closed user group with incoming access facility.

10.1.3.1 *Originating exchange*

The actions at the originating exchange depend on whether the user has the CUG facility and whether the user belongs to more than one closed user group.

The actions performed in the originating exchange are illustrated in Figure 3/Q.724.

a) Normal call set-up

In the case where the calling party has a closed user group facility indication, a request for CUG selection and validation is sent in a node-to-node message from the originating exchange to the dedicated point(s), where the additional CUG data, which belongs to the user, is stored.

The request includes the calling party address, the called party address and an index (if applicable). The index is forwarded to the local exchange in a facility request.

The actions at the originating exchange and the information forwarded to the next exchange depend on the information received in the end-to-end message including the response of the CUG selection and validation.

i) Access barred signal: indicating that the validation check was not successful. When receiving this signal the call is rejected and the access barred signal is sent to the calling party in accordance with the network-user interface protocol.

ii) Divergency signal: indicating that there is divergency between the CUG data associated with the user, stored in the local exchange and the CUG data associated with the user, stored at the dedicated point(s). When receiving this signal the originating exchange sets up the call and an indication is given to the maintenance personnel. In this case the initial address message includes no information related to the CUG facility.

iii) Closed user group check successful indication: indicating that the validation check, performed by the dedicated point(s) was successful. When receiving this signal the originating exchange sets up the call. The initial address message forwarded to the next exchange then includes an indication that the call is a CUG call for which the validation check was successful.

iv) Normal call indication: indicating that the validation check performed by the dedicated point(s) was successful. When receiving this signal the originating exchange sets up the call. In this case the initial address message includes no information related to the CUG facility.

v) Interlock code signal CUG call with outgoing access indicator including the international interlock code of the selected closed user group, and an indication that the user has the outgoing access facility. When receiving this signal the originating exchange sets up the call towards the gateway exchange. The initial address message forwarded to the next exchange then includes the international interlock code of the selected CUG together with an indication that the call is a CUG call for which outgoing access is allowed.

vi) Interlock code signal with CUG call indicator: including the international interlock code of the selected CUG. When receiving the signal the originating exchange sets up the call towards the gateway exchange. The initial address message forwarded to the next exchange then includes the international interlock code of the selected CUG together with an indication that the call is a CUG call.

b) Abnormal situation

When sending the request a timer T is started. In the case of not receiving the response before the timer T expires, the originating exchange repeat the sending of the request and restarts the timer T.

In the case of not receiving the response before the timer T expires, the call is rejected and an out of order signal is returned to the calling party in accordance with the user-network protocol.

10.1.3.2 *Dedicated point(s)*

At the dedicated point(s) the following items are stored for each user in the network having the closed user group facility.

i) The interlock code of CUGs to which the user belongs.

ii) In the case where the user belongs to more than one CUG an indication showing which CUG is preferential, and a table showing the relation between the index, and the concerned CUG.

iii) Whether the user has the closed user group with outgoing access facility.

iv) Indication for each closed user group, to which the user belongs, if either none, one or both of the incoming calls barred within the closed user group or outgoing calls barred within the closed user group facility applies.

a) Normal call set-up

The actions performed at the dedicated point(s) is illustrated in Figures 4/Q.724 and 5/Q.724.

When receiving the request for CUG selection and validation the dedicated point(s) makes the CUG selection and validation checks.

When receiving the validation request the dedicated point(s) makes the validation checks.

The CUG selection is made in accordance with the criteria as specified in § 10.1.2.1 a) and validation checks are made in accordance with the criteria as specified in § 10.1.2.

Depending on which CUG facilities the calling and called party have and, whether the calling and the called party belong to the same network and on the result of the validation checks, the following information is included in the response.

i) Closed user group check successful indicator: this signal is returned to the originating exchange if the following conditions are fulfilled:

- The calling and the called party belong to the same network; and
- correspondence is found between the interlock code selected from the information received in the request and an interlock code associated with the called party; and
- neither the calling party does apply the outgoing call barred within CUG facility nor the called party applies the incoming call barred within CUG facility for this particular CUG.

ii) Normal call indication: this signal is returned to the originating exchange.

- When the calling party has the closed user group with outgoing access facility and
- makes a call to the open part of the network to which the calling party belongs to;
- applies the outgoing calls barred facility within the closed user group, for the preferential or only CUG;
- the calling and called party belongs to the same network, and the interlock code check is not successful or the called party applies the incoming call barred within the closed user group selected by the user.

iii) Access barred signal: this signal is returned back to the originating exchange in the case where:

- when the calling party has the closed user group facility and
- makes a call to the open part of the network, to which the calling party belongs to;
- applies the outgoing call barred within the closed user group, selected from the information received in the request;
- the interlock code check between the interlock code, selected from the information received in the request does not correspond with an interlock code associated with called party;
- the called party applies the incoming call barred within the closed user group facility for the CUG selected from the information received in the request;

When the calling party has the closed user group with outgoing access facility, and applies the outgoing call barred within the closed user group, given by the index received in a facility request.

iv) Interlock code signal with the CUG call indicator. This signal is returned to the originating exchange in the case where the called and the calling party do not belong to the same network. The calling party has the closed user group facility, and the calling party does not apply the outgoing call barred within the closed user group for the selected CUG.

v) Interlock code signal with CUG call outgoing call access indicator. This signal is returned to the originating exchange in the case where the called and calling party do not belong to the same network. The calling party has the closed user group with outgoing access facility, and the calling party does not apply the outgoing call barred within the closed user group for the selected CUG.

b) Abnormal situation

In the case where there is no correspondence between the data associated with a user stored in the local exchange and data associated with the same user stored in the dedicated point(s). It is assumed that the data stored in the dedicated point(s) is more correct than the data stored in the local exchange. As a consequence of this a divergency signal is sent to the originating exchange in the case where there is no CUG data associated with user stored in the dedicated point(s) and a request is received for that concerned user.

10.1.3.3 *Transit exchange*

a) Normal call set-up

With the possible exception of some gateway exchanges, each transit exchange sets up CUG call as an ordinary call. The information related to the CUG facilities received from the preceding exchange, i.e. CUG call indication is forwarded to the next exchange.

In the case of an incoming international CUG call, the initial address message includes, i.e. interlock code, CUG call indications and possibly an indication that outgoing access is allowed, the gateway exchange will forward the information received in the initial address message to the dedicated point(s) in a request for CUG validation. As an answer to the request for CUG validation a response is received from the dedicated point(s).

The request for, and the response to, the CUG validation is included in an end-to-end message.

The response includes one of the signal i), ii) and iii), specified in § 10.1.3.1 a). The validation checks performed at the dedicated point(s) is outlined in § 10.1.3.2.

Depending on the signal received in the response different action will be taken by the gateway exchange.

i) In the case of receiving the access barred signal, the call is rejected and a call supervision message including the access barred signal is sent to the originating gateway exchange.

ii) In the case of receiving the closed user group check successful indicator, the gateway exchange sets up the call into the national network. The initial address message forwarded to the next exchange includes an indication that the call is a CUG call for which the closed user group check was successful.

iii) In the case of receiving the normal call set-up indicator or divergency signal, the gateway exchange set up the call into the national network. The initial address message does not include any information, related to the CUG facilities.

b) Abnormal situation

When sending the validation request in an end-to-end message a timer is started. In the case of not receiving the response before the timer T, expires, the gateway exchange restarts the timer T and repeats the sending of the request.

In the case of not receiving the response before the timer expires the call is rejected and a call supervision message including out of service signal is returned to the originating gateway exchange.

10.1.3.4 *Destination exchange*

The actions performed at the destinating exchange are outlined in Figure 6/Q.724.

a) Normal call set-up

At the destination exchange a validation check of the acceptability of a call is made where either the calling party (as indicated by a CUG call indication in the initial address message received) or the called party belongs to a CUG. The call is connected only in cases where the information received checks with the information stored in the local exchange as specified in the following:

i) Calls to a user having the closed user group facility. In this case an incoming call is accepted only when it is a CUG call for which the closed user group check was successful.

In all other cases the call is rejected and a call supervision message including the access barred signal is returned to the originating exchange.

ii) Calls to user having the closed user group with incoming access facility and to a user not belonging to any CUG. In this case all CUG calls are accepted.

b) Abnormal situtation

In the case of a CUG call arriving at a user which does not have any CUG facilities, the call is accepted (see § 10.1.3.2 b)) but an indication is given to maintenance personnel, while there is divergency between the data stored in the dedicated point(s) associated with a user and the data stored in the local exchange associated with the user.

10.1.4 *International interlock code*

Each international CUG is assigned a unique International CUG number (ICN) according to the administrative rules defined in Recommendation X.180.

10.2 *Users access to the calling line identification*

10.2.1 *General*

Users access to the calling line identification is a user facility that enables a user to be informed at incoming calls of the identity of the calling line. When provided, the facility applies to all incoming calls except when the calling party has the calling line identity presentation restricted facility or when the complete identity of the calling line is not available at the destination exchange.

The calling line identity is the telephone number of the calling party.

The calling line identity presentation restricted facility enables a user to prohibit the forwarding of the calling line identity to the called party.

In the case where a national network does not always provide the calling line identity facility, the calling line identity is the known part of the telephone number at the interworking point (e.g. Trunk Code).

In the case where the calling is a PABX the network will send the telephone number of the PABX or, in alternative the full DDI number. The latter case is possible if the PABX provides the calling line identification facility to the network.

The information indicating that a user has the calling identity or the calling line identity presentation restricted facility is available in the exchange to which the user is connected.

10.2.2 *Call set-up procedure*

The call control procedure and the information included in call control messages vary depending on whether the calling party has indicated to use the calling line identity presentation restricted facility for this call and whether the calling line identity is included in the initial address message.

Two different call control procedures can be used to provide the calling line identity facility. Both procedures are specified for international use.

10.2.2.1 *The calling line identity is included in the initial address message*

In the case where the calling party has indicated the calling line identity restricted facility, the initial address message includes the calling line identity restricted request indicator.

In the case where the complete identity of the calling party is not available or not allowed to be forwarded outside the network.

a) In international network no information regarding the calling line identity is included.

b) In national networks, the known part of the calling line identity could be included. In this case an incomplete calling line identity indicator is included in the message.

The calling party address is sent to the called party.

In the case where the destination exchange receives the calling party address restricted request indicator or a calling party incomplete address indicator, the calling line identity is not forwarded to the called party.

10.2.2.2 *The calling line identity is not included in the initial address message*

In the case where the called party has the user access to the calling line identification facility, a request is sent towards the originating exchange.

The request is either included in a general information request message or an end-to-end message.

When receiving the request for calling line identity the originating/interworking exchange sends a response including the calling line identity. In the case where the calling party has the calling line identity presentation restricted facility the response sent from the originating exchange includes the calling line identity presentation restricted request indicator. The response is either included in a general forward set-up information message or an end-to-end message. The information included in the response in addition to the calling line identity presentation restricted indicator (where applicable) is:

a) in the case where the complete identity of calling line is known, the originating exchange includes the complete telephone number of the calling party;

b) in the case where the complete identity of the calling party address is not available or is not allowed to be forwarded outside the network, the response includes:

i) In international networks the calling line identity unavailable signal.

ii) In national networks, in addition to the calling line identity unavailable signal the response can include the known part of the calling line identity. In this case the response includes the incomplete calling line identity indicator.

The calling party address is sent to the called party.

In the case where the destination exchange receives the calling party address restricted request indicator or a calling party incomplete address indicator, the calling line identity is not forwarded to the called party.

The destination exchange must not connect through until the complete calling line identity has been sent to the called party or the called party has been notified that the calling line address identity will not be forwarded.

10.3 *Users access to called line identification*

10.3.1 *General*

Called line identification is a user facility that enables a user to be informed at outgoing calls of the identity of the user to which the call has been connected. When provided, the facility applies to all outgoing calls.

The called line is the telephone number of the user to which the call has been connected. In the case where the networks, needed for establishing the call, do not provide the called line identity facility, the called line identity is the telephone number at the interworking point (e.g. Country Code, Trunk Code).

The information indicating that a subscriber has the called line identification facility is available at the exchange to which the user is connected.

In the case where the called party is a PABX, the called line identity is either the number of the PABX or the DDI number of the extension to which the call is connected. In the latter case the PABX provides the called line identification facility.

10.3.2 *Call set-up procedure*

In the case of a call from a user having the called line identification facility, the call control information forwarded by the originating exchange at call set-up includes a request for called line identification. The request is included in the initial address message.

When the destination/interworking exchange receives the request for called line identification, the destination/interworking exchange returns a response, including the called line identity. The response is included in a node-to-node message.

a) In the case where the networks needed to establish the call, provide the called party address identification facility, the called party address identity is the complete telephone number of the user to which the call is connected to.

b) In the case where the networks needed to establish the call do not provide for the called line identification facility, the response includes the identity of the network at the interworking point and an indication that the called line identity is not complete.

10.4 *Redirection of calls*

10.4.1 *General*

The redirection of calls facility enables a user to have calls to a telephone number, for which the facility is subscribed, redirected to another predetermined number during periods when the facility is activated.

The redirection of calls rejected facilities enables a user to have redirected calls to his telephone number automatically rejected during periods when the facility is activated.

The redirection of calls information prohibited facility enables the user, who has activated the redirection of calls facility to prevent the calling party from being informed that the call is redirected.

Depending on the possibilities offered by the Administration facility, activation and deactivation may be made:

a) by the user by means of user controlled activation and deactivation procedures;

b) by the network at predetermined times;

c) by the Administration on request of the user.

User controlled procedures for inquiry of the status of the facility (i.e. whether the facility is activated or deactivated) may also be provided.

A call may only be redirected once. Redirected calls are subject to the same restrictions as other calls where a closed user group is involved.

10.4.2 *Call set-up procedure not involving other facilities affecting the procedure*

Information that a user has the redirection of calls rejected facility is stored at the exchange to which the user is connected. When a redirected call arrives at such a user, the call is rejected in the same manner as if this user had activated the redirection of calls facility.

Information that a user has the redirection of calls information prohibited facility is stored at the exchange, where the user is connected, together with the redirection address.

Information that a subscriber has the redirection of calls facility activated is stored together with the redirection address, at the exchange to which the user is connected. When such a user is called, the call is set up to the redirection address in accordance with the following.

10.4.2.1 *The redirection address is at the same exchange*

In this case the destination exchange connects the call to the redirection address and returns an address complete message including the call forwarding indicator. In the case where the called party has the redirection of calls information prohibited facility activated the address complete message includes the redirection of calls information prohibited indicator. When receiving the call forwarding indicator the originating exchange sends a signal to inform the calling party that the call has been redirected, except for the case, when the address complete message includes the redirection of calls information prohibited indicator. In this case no information related to the redirection of calls facility is sent to the calling party.

In the case where the user at the redirection address has the redirection of calls or the redirection of calls rejected facility activated, the destination exchange rejects the call and returns an indication in an unsuccessful backward set-up message.

10.4.2.2 *The redirection address is at another exchange*

In this case the call is set-up to the redirection address in accordance with the following procedure. The use of the call rerouting procedure is for further study.

The call forwarding procedure is based on the principle that the connection is extended forward from the destination exchange to the new destination exchange.

i) The first destination exchange sets up the forward connection to the redirection address. The initial address message forwarded includes a call forwarding indicator and the redirection address and redirection of calls information prohibited indicator (if applicable). In national networks the first called party address and the called line identity (if applicable) and the calling line identity presentation prohibited indicator (if applicable) could also be included in the initial address message.

ii) Upon receipt of the redirected call the new destination exchange connects or rejects the call in accordance with § 10.4.2.1. The call forwarding indicator received is used to prevent a further redirection. The first called party address could be used for special acceptance tests, or be sent to the calling party.

iii) In the case where the call is connected to the redirection address the destination exchange will send an address complete message including the call forwarding indicator and the redirection of calls information prohibited indicator (if applicable). The call forwarding indicator is used to inform the originating/controlling exchange, that the first destination exchange performs the charging for the redirected call. It could also be used to indicate to the calling party that the call is redirected. Except for the case, when the address complete message includes the redirection of calls information prohibited indicator. In this case no information relating to the redirection of calls facility is sent to the new called party.

iv) When the first destination exchange receives a message, e.g. request for calling line identity from the new destination exchange, it sends it further backwards to the originating exchange.

10.4.3 *Calls involving other facilities affecting the procedure*

10.4.3.1 *Calls involving a closed user group facility*

Redirected calls are subject to the restrictions applying for the closed user group (CUG) facilities.

- In the case where the call is a CUG call, or the originally called party has a CUG facility, the call is rejected before redirection unless the validation check requirements applying for the CUG facility(ies) concerned are satisfied.
- In the case where the call is a CUG call, or the user at the redirection address has a CUG facility, the call is rejected unless the validation check requirements applying for the CUG facility(ies) concerned are satisfied.

a) Call set-up procedures for decentralized administration of CUG data

In the case where:

i) the call is a CUG call and,

ii) the redirection address is at an exchange other than the first destination exchange, and

iii) the procedure for setting up the call to the redirection address is in accordance with § 10.4.2.2 (i.e. call forwarding procedure). The first destination has to send the CUG information received (e.g. the CUG call indication and the interlock code) forward to the new destination exchange in the initial address message.

b) Call set-up procedures for centralized administration of CUG data

In the case where a CUG call arrives at a user which has activated the redirection of calls facility, the same request-response procedure is used between the first destination exchange and the dedicated point(s) as between the originating exchange and the dedicated point(s) described in § 10.1.3. Before initiating the request-response procedure the destination exchange must have the calling party address and the index available.

In the case where the calling party address is included in the initial address message, the first destination exchange sends a request for the index to the originating exchange.

In the case where the calling party address is not included in the initial address message the first destination exchange sends a request for the index and the calling party address to the originating exchange.

The request is either included in a general information message or in an end-to-end message.

The response to the request for calling party address (if required) and the index (if applicable) is sent in a general information message or in an end-to-end message.

When all information is available at the first destination the request for CUG selection and validation is made to the dedicated exchange point(s).

The request includes the new destination address the calling party address and an index (if applicable).

In the case where an access barred signal is received in the response message by the first destination exchange, a call supervision message including the access barred signal is sent towards the originating exchange. In other cases the call set-up procedures for the redirected call is in accordance with § 10.4.2.2.

The initial address message forwarded to the new destination exchange always includes the call forwarding indicator; redirection address; none, one or more of the following items: CUG check successful indication, CUG call indication, CUG call indication with outgoing access and the interlock code.

10.4.3.2 *The calling party has the called party address identification facility*

In the case where a call from a user that has the called line identification facility is redirected, the called party address sent to the calling party is the ISDN number of the redirection address.

10.4.3.3 *The redirection address has the user's access to the calling party identification*

In the case where a redirected call arrives at a user, who has the users access to the calling party address identification facility, the succeeding actions at the redirection exchange depend on if the calling party address is available at the original called exchange.

In the case where the calling party address is not available, a request for the calling party address is sent to the preceding exchange(s) in accordance with § 10.2.2.2. When the new destination exchange has the calling party address available, it sends it to the new called party unless the calling party address presentation restricted indicator is received at the new destination exchange.

10.4.3.4 *The redirection address has the malicious call identification capability*

In the case where a call arrives at a user marked as an MCI user, the call set-up procedure depends on whether the calling party address and/or the original called party address is included in the initial address message and if the hold option should apply for the call.

a) The hold option does not apply for the call. In this case the call control procedure depends on whether the calling party address and/or the original called party address is included in the initial address.

   In the case where one or both of the addresses are not available, a request is sent to the preceding exchange(s). The request will indicate which address(es) are requested.

   As a response the preceding (e.g. the originating or the original called) exchange will include the concerned address(es), which has been requested.

b) The hold options applies for the call. In this case the call set-up procedure depends on whether the calling party address and/or the original called party address is included in the initial address message. In this case a request is sent to the preceding exchange(s) indicating that the holding of the circuit is required.

   In the case where one or both of the address(es) are not available, a request is sent to the preceding exchange(s).

   In their response the preceding (e.g. original called or originating) include the addresses concerned, which have been requested and apply the holding of circuit.

   In the case of interworking, the interworking exchange will send in addition to the information specified in § 10.6.3, the original called party address.

   When the original called exchange receives the request when both addresses are not available in this exchange, it repeats the request to the originating exchange. When the original called exchange receives the response it repeats the response towards the destination exchange. When the original exchange receives the delayed release message, it sends it forward to the destination exchange.

10.5 *Completion of calls to busy subscriber*

10.5.1 *General*

The completion of calls to busy subscriber (CCBS) facility enables the calling party, encountering busy condition for a call to complete the call automatically, when the called party becomes free without repeated dialling.

The calling party activates the user facility by making a request to the exchange to which the calling party is connected. When the service is activated the line(s) of the called party is continuously tested by its local exchange. When the line becomes free the calling party is called and when the calling party answers, the called party is alerted. The time during which the line is tested is limited.

The facility can be deactivated by the calling party.

The number of CCBS requests stored in a local exchange are limited.

10.5.2 *Normal call set-up procedures at the originating exchange*

The originating exchange is notified that the called party is busy either by receiving a response message to a previous sent look ahead message or by receiving a call supervision message including the subscriber busy or extended subscriber busy signal. If a signalling point code is received it is temporarily stored for later possible use in a future facility request. The normal release procedure for the concerned circuit is initiated (if applicable).

In the case where the calling party activates the facility, a facility request is sent to the destination exchange. The facility request, sent in a node-to-node message, includes the calling and called party addresses and the CCBS request signal.

Two different signals, CCBS accepted signal or the called party free signal, can be received as a response to the CCBS request. In the normal case the CCBS accepted signal is received before the called party free signal.

When the originating exchange receives the facility accepted signal, an indication of service activation is sent to the calling party and a timer T1 is started. The timer T1 measures the time the CCBS request will stay active.

When receiving the called party free signal, indicating that the called party had become free, the timer T2 is stopped, (if applicable) the calling party is blocked for outgoing and incoming call, and a CCBS call is set up. The CCBS call is set up as an ordinary call except that a CCBS call indicator is included in the initial address message together with the signalling path indicator. The calling party is alerted when the originating exchange receives the address complete message.

In the case where the calling party answers the calling party answer signal is sent together with the called party address to the destination exchange in a node-to-node message.

10.5.3 *Abnormal situations at the originating exchange*

10.5.3.1 *Timers*

T1 is time during which the facility is allowed to stay active. At the expiration of the timer T1 the CCBS cancelled signal together with the calling and the called party address is sent in a node-to-node message to the destination exchange. The information related to the request is then erased at the originating exchange.

T2 is the time during which the calling party is alerted. In the case where the timer T2 expires, the calling party is unblocked and the normal release procedure is initiated.

10.5.3.2 *Signals*

In the case where the originating exchange receives a CCBS rejected signal, indicating that the destination exchange is unable to effect the facility request, the originating exchange erases any stored data associated with the request and the calling party is informed.

In the case where the calling party deactivates the CCBS facility, the originating exchange sends the CCBS cancelled signal together with the calling and called party address in a node-to-node message to the destination exchange. The exchange will then erase all information related to the CCBS request.

If the calling party is found busy, when receiving the called party free signal, or if the CCBS call attempt fails, e.g. encountering congestion, the originating exchange erase any information related to the request. The need for making another action (e.g. make a repeat attempt or send a signal to indicate the condition) when the calling party is found busy or the CCBS call fails is for further study.

10.5.4 *Call set-up procedure at an intermediate exchange*

The call set-up procedure at the intermediate exchange is not affected by the CCBS facility with one exception.

In the case where an intermediate exchange receiving a call supervision message, including the extended subscriber busy signal, interworks with signalling system that does not provide the extended subscriber busy signal, it treats the extended subscriber busy signal in the same way as the subscriber busy signal.

10.5.5 *Normal call set-up procedure at the destination exchange*

When the destination exchange finds the called party busy, it sends a call supervision message or a response to a look ahead message including the subscriber busy signal or the extended subscriber busy signal.

In the case where the destination exchange receives the facility request signal for CCBS a check is made whether the request can be accepted or not.

Reasons for rejecting the request could be that the maximum number of CCBS requests activated at the same time is already reached, or the called party has activated the CCBS inhibited facility.

In the case where the request is accepted, the destination exchange marks the called party as a CCBS participant, and a check is made whether the called part is free or busy. In the case where the called party is busy the destination exchange sends the facility accepted signal. The calling party's request is placed in an appropriate position in the queue for CCBS request for the called subscriber together with the calling and called party addresses. In the case where the called party is free, the message will include the called party free signal together with the calling and called party addresses. It will be sent to the originating exchange.

In the case where the CCBS participant clears the call, the following actions take place:

i) The timer T3 is started and the called subscriber is blocked for incoming calls.

ii) In the case where the CCBS participant makes a call attempt, the timer T3 is stopped and the call attempt can proceed as normal.

iii) When the timer T3 expires the CCBS participant is blocked for outgoing and incoming calls except for the CCBS call. The destination exchange will also send a message including the CCBS called party free signal, called and calling party address to the concerned originating exchange. The timer T4 is started.

iv) In the case where the destination exchange receives an incoming call to a user marked as CCBS participant, a check is made whether the incoming call is the expected CCBS call. The CCBS call is indicated by a CCBS call indicator in the initial address message. In the case where the check is successful an address complete message is sent towards the originating exchange and T4 is stopped.

The CCBS call is handled in the same way as an ordinary call except that the called party is not alerted.

v) In the case where the calling party answer signal is received at the destination exchange the called party is alerted.

10.5.6 *Abnormal situations at the destination exchange*

a) In the case where the destination exchange receives the signal, CCBS cancelled addressed to a subscriber marked as CCBS participant, it erases the request for CCBS from the queue, and the checking for free status is ceased (if applicable), or the timer T4 is stopped (if applicable).

b) In the case where T4 expires, any information related to this CCBS request is erased. In the case where there are no other CCBS requests, the called party is available for incoming and outgoing calls. In the case where there are other requests in the queue, the destination exchange will send the CCBS called party free signal to the exchange associated with the next request in the queue.

c) In the case where the destination exchange receives a release signal for the circuit used for a CCBS call, before receiving the party answer signal, the destination exchange will continue the release procedure, unblock the called party and erase any information associated with the CCBS call.

In the case where there are request(s) in the queue, the destination exchange will send the called party free signal to the exchange associated with the next request in the queue.

d) When a normal call arrives at a called party marked as a CCBS participant a busy signal is sent to the calling party.

10.5.7 *Service interrogation*

During the time the service is activated it should be possible to check if the request is still activated. Two different options are possible:

a) the check is only made in the exchange to which the calling party is connected;

b) the check is made in both exchanges.

In the latter case a facility information request signal is sent together with the calling and called party addresses in a node-to-node message. A facility information response message is sent as a reply to the facility information request message.

10.6 *Network access to the calling line identification*

10.6.1 *General*

The network access to the calling line identification is a network capability which enables a network to obtain the calling party address inside or outside their own network. The capability is used for example for malicious call identification, charging, etc.

10.6.2 *Malicious call identification* (MCI)

The malicious call identification gives the possibility to obtain by an appropriate request the identification of the calling line and the original called party (in the case of a redirected call). The identification request provokes in the destination exchange, the print-out of the following items:

- called line identity;
- calling line identity and possibly the original called line identity;
- time and date of the call.

The same print-out may be, optionally, obtained in the originating exchange.

The identification request can either be activated before, during or after the conversation phase.

Two different options of the utility are defined namely:

a) MCI with hold;

b) MCI without hold.

One or both options should be provided in a national network.

In case a), the holding of the connection is requested in addition to the identification of the calling party. In case b), only the identification of the calling line is requested.

In case a), the clearing of the connection is subject to called party clearing.

10.6.3 *Call set-up procedure*

In case of an incoming call to a user having the MCI facility the call set-up procedure depends on whether the calling line identity is included in the initial address message and which options, without hold or with hold, the called party has been assigned:

a) The calling line identity is included in the initial address message:
   - in the case where the called party has the MCI without hold indication, the calling party address and possibly the original called address is stored in the destination exchange;
   - in the case where the called party has the MCI with hold indication, the calling party address and possibly the original called party address is stored at the destination exchange, and a request for holding of the circuit is sent to the originating exchange.

b) The calling line identity is not included in the initial address message:
   - in the case where the called party has the MCI without hold indication, a request is sent to the originating exchange containing the calling line identity request;
   - in the case where the called party has the hold indication, the request will include requests for the holding of the circuit and for calling line identity.

In addition to the information mentioned above the request will also include the MCI facility encountered indicator. The request will be sent in a general request message.

When receiving the MCI request transit exchange normally repeats the request. However, in two cases the transit exchange acts in another way:

- In the case of interworking with networks that do not provide the calling line identification facility, the relevant transit exchange will send a response including the identity of the transit exchange. The identity of the transit exchange could either be the known part of the calling party address in that exchange or, in national networks, the signalling point code of the transit exchange. In addition to the identity of the transit exchange the response can also include the identity of the incoming trunk. The interworking exchange may also arrange the holding of the incoming trunk even if not explicitly requested (i.e. also in the option "MCI without hold"). In the case where the MCI request also includes the hold request the transit exchange will make the clearing of circuit subject to the called party clearing.
- In the case where the MCI cannot operate (due to administrative or technical reason), the relevant exchange includes in the MCI response message the MCI not provided indicator.

At the receipt of the MCI request, the originating exchange sends a general forward set-up information message containing the calling line identity and the hold indicator. If holding of the connection is provided the clearing of the circuit will be subject to the called party clearing (i.e. subject to the receipt of the clear-back signal). When the identification request is made the destination exchange produces the print-out of the related MCI information and sends backwards, optionally, the *MCI print-out request* (for further study) message to obtain the print-out of the same information in the originating exchange.

10.6.4 *Clearing procedures*

In the case where no holding of the circuit is requested, the normal release procedure will apply.

In the case where the holding of the circuit is requested, the following procedures apply at the originating exchange and the destination exchange:

a) In the case where the calling party hangs up first, the originating exchange will apply the hold of the connection and stop the charging (if applicable). Moreover, the originating exchange may send forward the optional "calling party clear signal".

   When receiving the calling party clear signal an intermediate charging point stops the charging (if applicable) and forwards the calling party clear signal to the succeeding exchange.

   When receiving the calling party clear signal the destination exchange starts a timer T1, if the identification request is not received.

   The value of T is a national option.

b) In the case where the identification request is made before the called party disconnects, no clear-back signal will be sent until appropriate action has been taken (e.g. maintenance action). If applicable T1 is stopped when the identification request is received.

c) When the called party disconnects the destination exchange may start a timer T2 to allow for making the identification request after the conversation is terminated.

The succeeding actions at the destination exchange will depend on whether an identification request has been made or not.

In the case where the request was not made identification request, the expiration of the timer T2 will result in sending of the clear-back message. The timer T1 is stopped (if applicable).

In the case where the called party makes the request for identification is made before the timer T2 expires, no clear-back signal will be sent until appropriate actions have been taken. The timers T2 and T1 (if applicable) are stopped when receiving the identification request is made.

10.7 *Digital connectivity*

10.7.1 *General*

The digital connectivity is a user facility that enables a user to establish a fully digital path at 64 kbit/s user-to-user. It is an optional facility assigned to the user and provided on a call request basis or specific category.

10.7.2 *Call set-up procedure*

In the case of a call for which the digital connectivity is required, the IAM/IAI message includes *the all digital path required* indicator.

On recognition of this request each exchange (originating/transit) makes a check on the possibility to route the call on a digital path:

- if the check is positive the call is routed and the request of this facility is forwarded to the succeeding exchange;
- if negative, the call is rejected and one of the following unsuccessful signals is sent backwards:
  - *congestion* or *call-failure signal* in case where a digital path exists but it is not possible to complete the call due to congestion or failure (see Recommendation Q.722, § 3.4).
  - *digital path not provided* in case where a routing that allows a complete digital path doesn't exist.

In the destination exchange, at the reception of an incoming call with the digital connectivity request, the appropriate validation check is made and, if positive, the call is completed using the standard procedures. In the negative case the call is rejected and the *access barred* signal is sent backwards.

11 Echo suppressor control

11.1 *General*

The echo suppressor control signalling procedure is used on per call basis to convey information between exchanges about the demand and ability to insert echo suppressors.

The procedure is mainly intended to be used in the case where the echo suppressors are provided in pools.

The procedure is initiated by the exchange which upon analysis of an initial address message of a call realizes that the call is to be routed on a connection for which echo suppressor is necessary, and no indication is received that an outgoing half-echo suppressor is already included (Note).

The exchange shall always be able to insert outgoing half-echo suppressors.

One of the exchanges succeeding the above-mentioned exchange shall always be able to insert incoming half-echo suppressors.

The procedure is for application in national networks and could be applied in the international network upon bilateral agreement.

Note – In the case where this exchange knows that there is no echo suppressor situated in the preceding network the procedure is not initiated.

11.2 *Actions at the exchange initiating the echo suppressor control procedure*

Upon receipt of an initial address message the following actions are taken if no indication is received that an outgoing half-echo suppressor is already included:

- a request for outgoing half-echo suppressor is sent in the backward direction;
- a timer T is started (Note);
- an outgoing half-echo suppressor is reserved;
- the initial address message is sent on with the indication outgoing half-echo suppressor included.

Upon receipt of a response on the outgoing half-echo suppressor request the following actions are taken:

a) the response is negative:
   - the reserved outgoing half-echo suppressor is included;
   - the timer T is stopped;

b) the response is positive:
   - the reserved outgoing half-echo suppressor is released;
   - the timer T is stopped.

Note – If response on the request for outgoing half-echo suppressor has not been received before timer T has expired, then the reserved half-echo suppressor is included.

11.3 *Actions at the originating exchange*

Upon receipt of a request for outgoing half-echo suppressor the following actions are taken:

a) if the originating exchange is not able to insert outgoing half-echo suppressor:
   - a negative response is sent in the forward direction;

b) if the originating exchange is able to insert outgoing half-echo suppressor:
   - a half-echo suppressor is included;
   - a positive response is sent in the forward direction.

11.4 *Actions at an intermediate exchange*

11.4.1 *The exchange being able to insert half-echo suppressor*

Upon receipt of a request for outgoing half-echo suppressor the following actions are taken (Note 1):

- an outgoing half-echo suppressor is reserved;
- the request message is sent on;
- a timer T is started (Note 2).

Note 1 – In the case the intermediate exchange knows that there is no echo suppressor in the preceding network the intermediate exchange performs actions in accordance with § 10.3.

Note 2 – If response on the request for outgoing half-echo suppressor has not been received before timer T has expired, then the reserved half-echo suppressor is included and a positive response is sent in the forward direction.

Upon receipt of a response on the outgoing half-echo suppressor request the following actions are taken:

a) the response is negative:
   - the reserved outgoing half-echo suppressor is included;
   - the timer T is stopped;
   - a positive response is sent in forward direction;

b) the response is positive:
   - the reserved outgoing half-echo suppressor is released;
   - the timer T is stopped;
   - the response is sent on.

Upon receipt of an initial address message with the indication "outgoing half-echo suppressor included" the following actions are taken:

- an incoming half-echo suppressor is reserved;
- the initial address message is sent on.

Upon receipt of an address complete message with an indication on incoming half-echo suppressor the following actions are taken:

a) the indication is negative:
   - the reserved incoming half-echo suppressor is included;
   - the address complete message is sent on with a positive indication;

b) the indication is positive:
   - the reserved incoming half-echo suppressor is released;
   - the address complete message is sent on.

11.4.2 *The exchange not being able to insert half-echo suppressor*

No special actions are required.

11.5 *Actions at the destination exchange*

Upon receipt of an initial address message with the indication "outgoing half-echo suppressor included" the following actions are taken:

a) if the destination exchange is not able to insert an incoming half-echo suppressor:
   - a negative indication on the inclusion of incoming half-echo suppressor is given in the address complete message;

b) if the destination exchange is able to insert incoming half-echo suppressor:
   - a half-echo suppressor is included;
   - a positive indication on the inclusion of incoming half-echo suppressor is given in the address complete message.

12 State transition diagrams

12.1 *General*

This section contains the description of the signalling procedures described in this Recommendation in the form of state transition diagrams according to the CCITT Specification and Description Language (SDL).

In order to facilitate functional description, the Telephone User Part signalling procedure function is divided into functional blocks, as shown in Figure 1/Q.724; state transition diagrams are provided for each functional block, as shown below:

- Signalling procedure control (SPRC): Figure 2/Q.724
- Call processing control (CPC): Figure 3/Q.724
- Continuity-check outgoing (CCO): Figure 4/Q.724
- Continuity-check incoming (CCI): Figure 5/Q.724
- Continuity-recheck outgoing (CRO): Figure 6/Q.724
- Continuity-recheck incoming (CRI): Figure 7/Q.724
- Blocking signal sending (BLS): Figure 8/Q.724
- Blocking signal reception (BLR): Figure 9/Q.724
- Circuit reset (CRS): Figure 10/Q.724
- Other functional blocks (for further study).

The detailed functional breakdown shown in the following diagrams is intended to illustrate a reference model and to assist interpretation of the text in the earlier sections. The state transition diagrams are intended to show precisely the behaviour of the signalling system as viewed from a remote location. It must be emphasized that the functional partitioning shown in the following diagrams is used only to facilitate understanding of the system behaviour and is not intended to specify the functional partitioning to be adopted in a practical implementation of the signalling system.

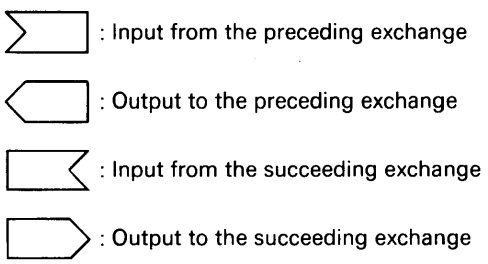
12.2 *Drafting conventions*

a) Acronyms used in Figures 1/Q.724 to 10/Q.724 are listed in § 12.3.

b) External inputs and outputs are used for interactions with different functional blocks. Internal inputs and outputs are used for interactions within each functional block, e.g. to indicate control of time-outs.

c) External inputs and outputs contain as part of their name acronyms of their source and destination functional block names with an arrow in between, e.g. Start CPC→ CCO.

d) For interexchange signals or signal messages, external input and output symbols are used as shown below to indicate the direction of each signal on message.



Note – The functions covered by the present Figures 1/Q.724 to 10/Q.724 are limited in the following points:

- they refer only to call processing functions in international transit exchanges;
- they do not necessarily cover all the abnormal situations.

However, they include operations on receipt of unreasonable signalling information as specified in § 6.5, except the case of the blocking and unblocking signals as mentioned above.

The diagrams for functions not presently covered are for further study.

12.3 *Abbreviations and timers used in Figures 1/Q.724 to 10/Q.724*

General

OGC	Outgoing trunk circuit
ICC	Incoming trunk circuit
NOK	Not OK
CC	Continuity-check
BBS	Circuit blocked by sending the blocking signal
BBR	Circuit blocked by reception of the blocking signal
CCT	Telephone circuit

Function block names (See Figure 1/Q.724)

SPRC Signalling procedure control
CPC Call processing control
CCO Continuity-check outgoing
CCI Continuity-check incoming
CRO Continuity-recheck outgoing
CRI Continuity-recheck incoming
BLR Blocking and unblocking signal reception
BLS Blocking and unblocking signal sending
CRS Circuit-reset
L3 Level 3 (Signalling network functions)
L4 Level 4 (Telephone user part)

Messages and signals

ACM Address complete message
ADC Address complete signal, charge
ADI Address incomplete signal
ADN Address complete signal, no charge
ADX Address complete signal, coin box
AFC Address complete signal, charge, subscriber free
AFN Address complete signal, no charge, subscriber free
AFX Address complete signal, coin box, subscriber free
ANC Answer signal, charge
ANN Answer signal, no charge
BLA Blocking-acknowledgement signal
BLO Blocking signal
CBK Clear-back signal
CCF Continuity-failure signal
CCH Continuity-check indicator:
- 0: CC not required
- 1: CC required on this circuit
- 2: CC is being (has been) performed on a previous circuit

CCR Continuity-check-request signal
CFL Call-failure signal
CGC Circuit-group-congestion signal
CLF Clear-forward signal
COT Continuity signal
FOT Forward-transfer signal
IAM Initial address message
LOS Line-out-of-service signal
NNC National-network-congestion signal
RAN Reanswer signal
RLG Release-guard signal
RSC Reset-circuit signal
SAO Subsequent address message with one signal
SAM Subsequent address message
SEC Switching-equipment-congestion signal
SSB Subscriber-busy signal (electrical)
SST Send-special-information-tone signal
UBA Unblocking-acknowledgement signal
UBL Unblocking signal
UNN Unallocated-number signal

T1 Timer "waiting for continuity or continuity-failure signal" [10-15 seconds, see § 6.4.3 a)]

T2 Timer "waiting for address-complete signal" [20-30 seconds, see § 6.4.3 a)]

T3 Timer "waiting for clear-forward signal after sending unsuccessful message" [4-15 seconds, see § 6.4.3 b)]

T4 Timer "waiting for clear-forward signal after sending call-failure signal" [4-15 seconds, see § 6.4.3 b)]

T5 Timer "stop sending call-failure messages on time out" [1 minute, see § 6.4.3 b)]

T6 Timer "waiting for release-guard signal" (4-15 seconds, see § 6.2.3)

T7 Timer "stop sending clear-forward signal on time out" (1 minute, see § 6.2.3)

T8 Timer "waiting for backward check-tone" (should not exceed 2 seconds, see § 7.4.1)

T9 Timer "delay to start first-time continuity-recheck" (1-10 seconds, see § 7.3)

T10 Timer "delay for multiple retests of continuity" (1-3 minutes, see § 7.3)

T11 Timer "waiting to alert maintenance personnel following initiation of blocking" (5 minutes, see § 5)

T12 Timer "waiting for blocking-acknowledgement signal" (4-15 seconds, see § 6.4.4)

T13 Timer "waiting to alert maintenance personnel on failure to receive BLA" (1 minute, see § 6.4.4)

T14 Timer "delay to repeat sending of blocking signals" (1 minute, see § 5.1)

T15 Timer "waiting for unblocking acknowledgement" (4-15 seconds, see § 6.4.4)

T16 Timer "waiting to alert maintenance personnel on failure to receive unblocking acknowledgement" (1 minute, see § 6.4.4)

T17 Timer "delay to repeat sending of unblocking acknowledgement" (1 minute, see § 5.1)

T18 Timer "waiting for a response to the reset-circuit signal" (4-15 seconds, see § 1.15)

T19 Timer "delay to send the reset-circuit signal" (1 minute, see § 1.15)

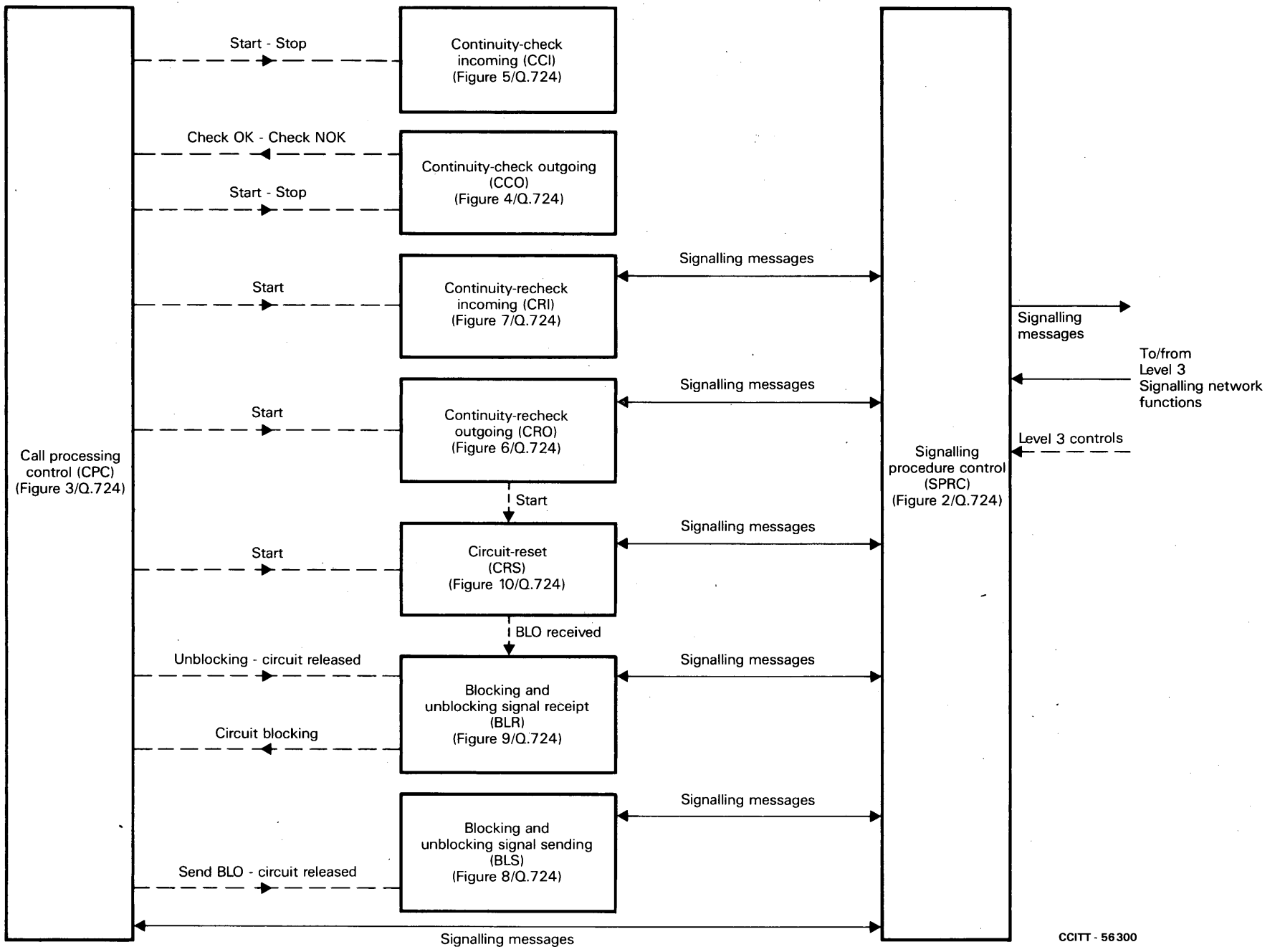
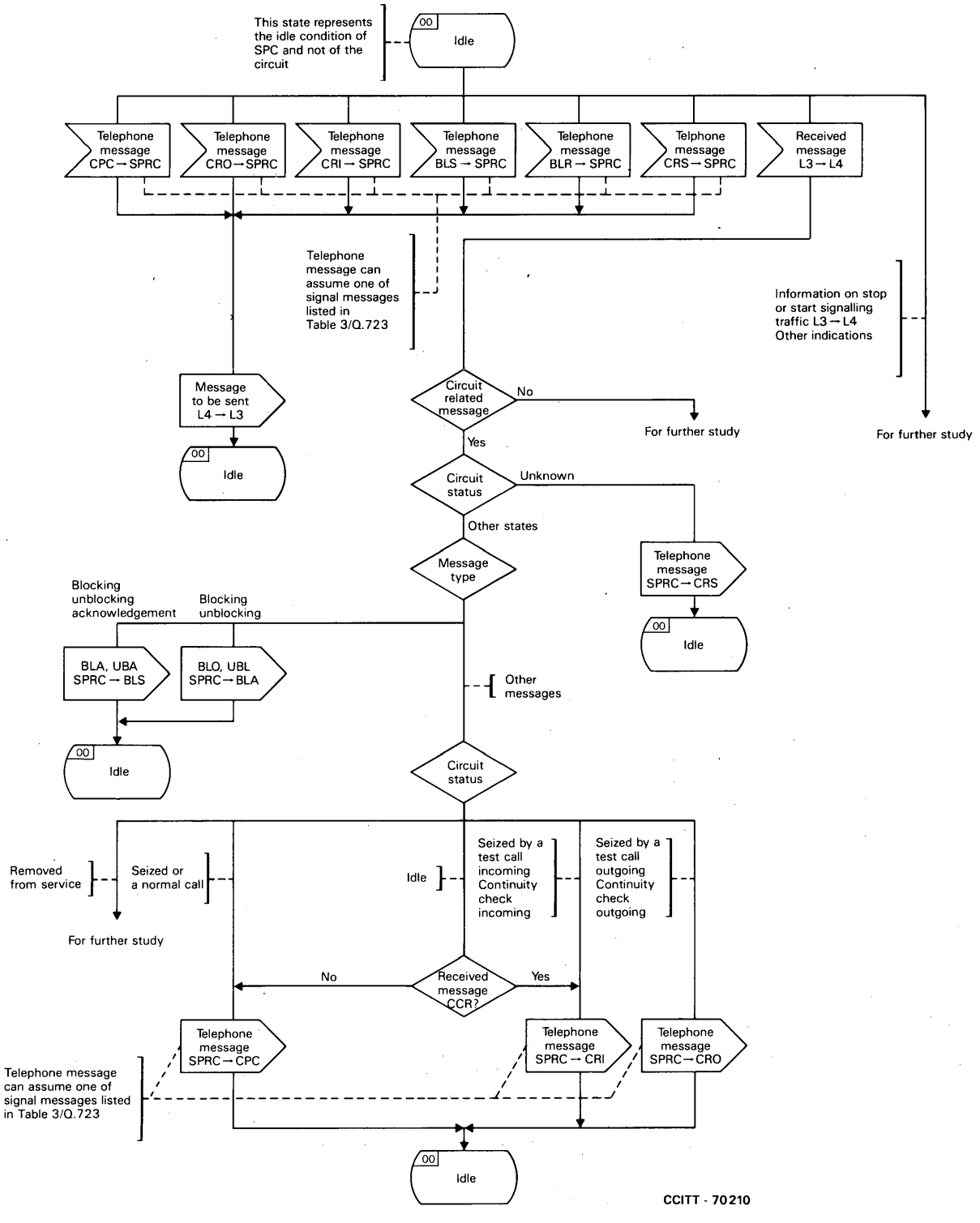


FIGURE 1/Q.724

Level 4 – Telephone User Part functions



Note – In this particular figure, the direction of input and output symbols does not necessarily represent the forward or backward direction of messages contained in them.

FIGURE 2/Q.724

Signalling procedure control (SPC)

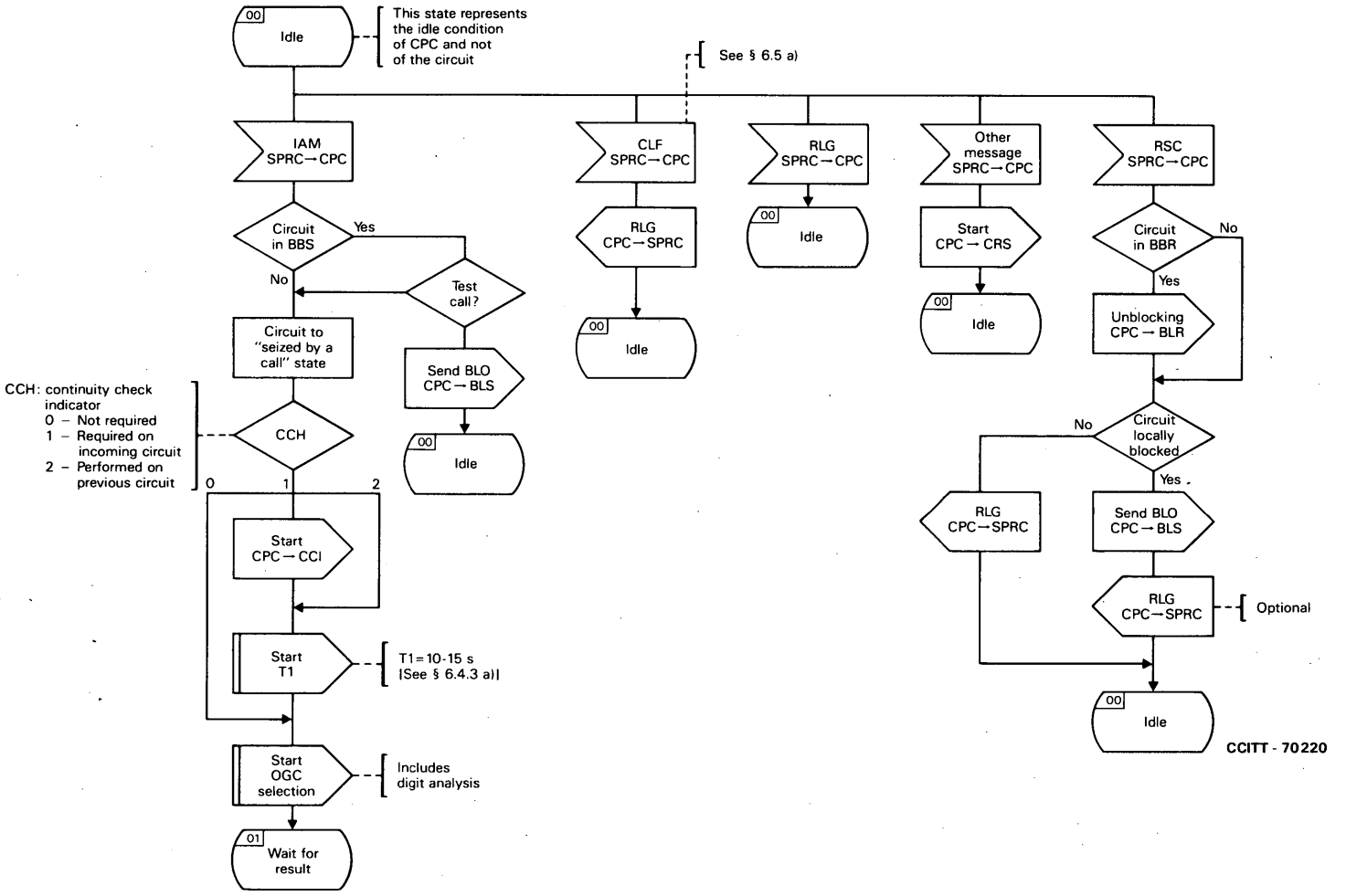
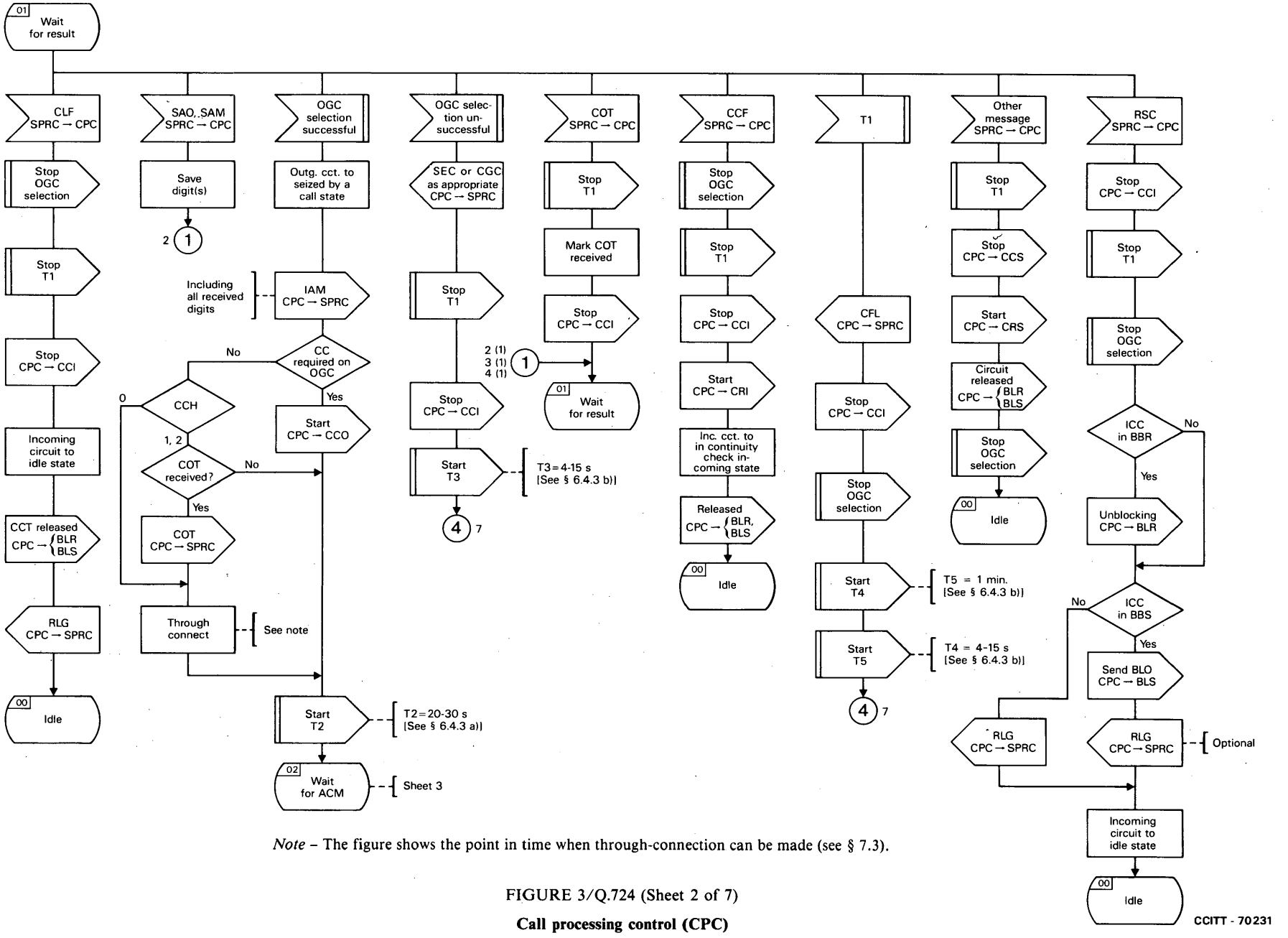


FIGURE 3/Q.724 (Sheet 1 of 7)

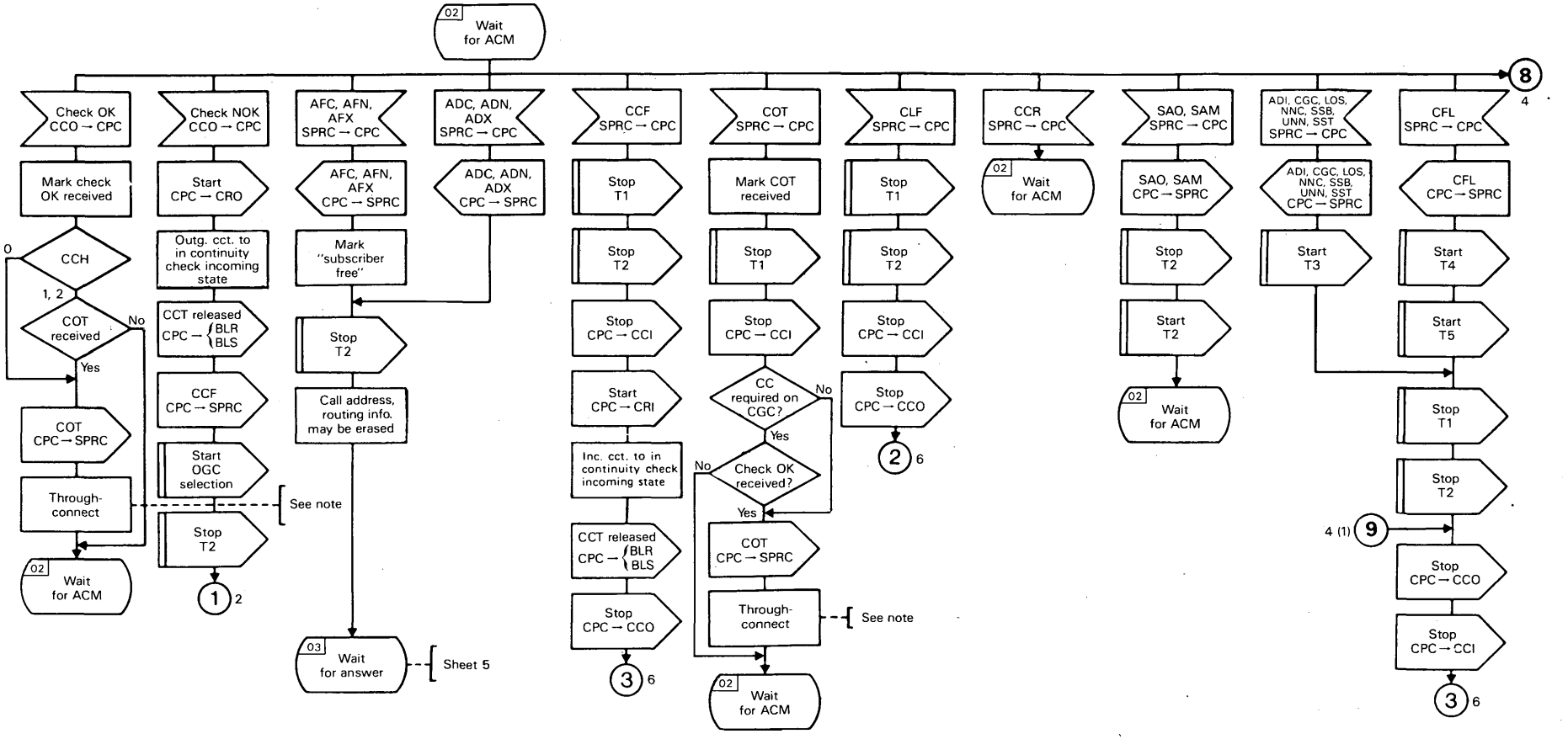
Call processing control (CPC)



Note – The figure shows the point in time when through-connection can be made (see § 7.3).

FIGURE 3/Q.724 (Sheet 2 of 7)

Call processing control (CPC)



Note – The figure shows the point in time when through-connection can be made (see § 7.3).

FIGURE 3/Q.724 (Sheet 3 of 7)

Call processing control (CPC)

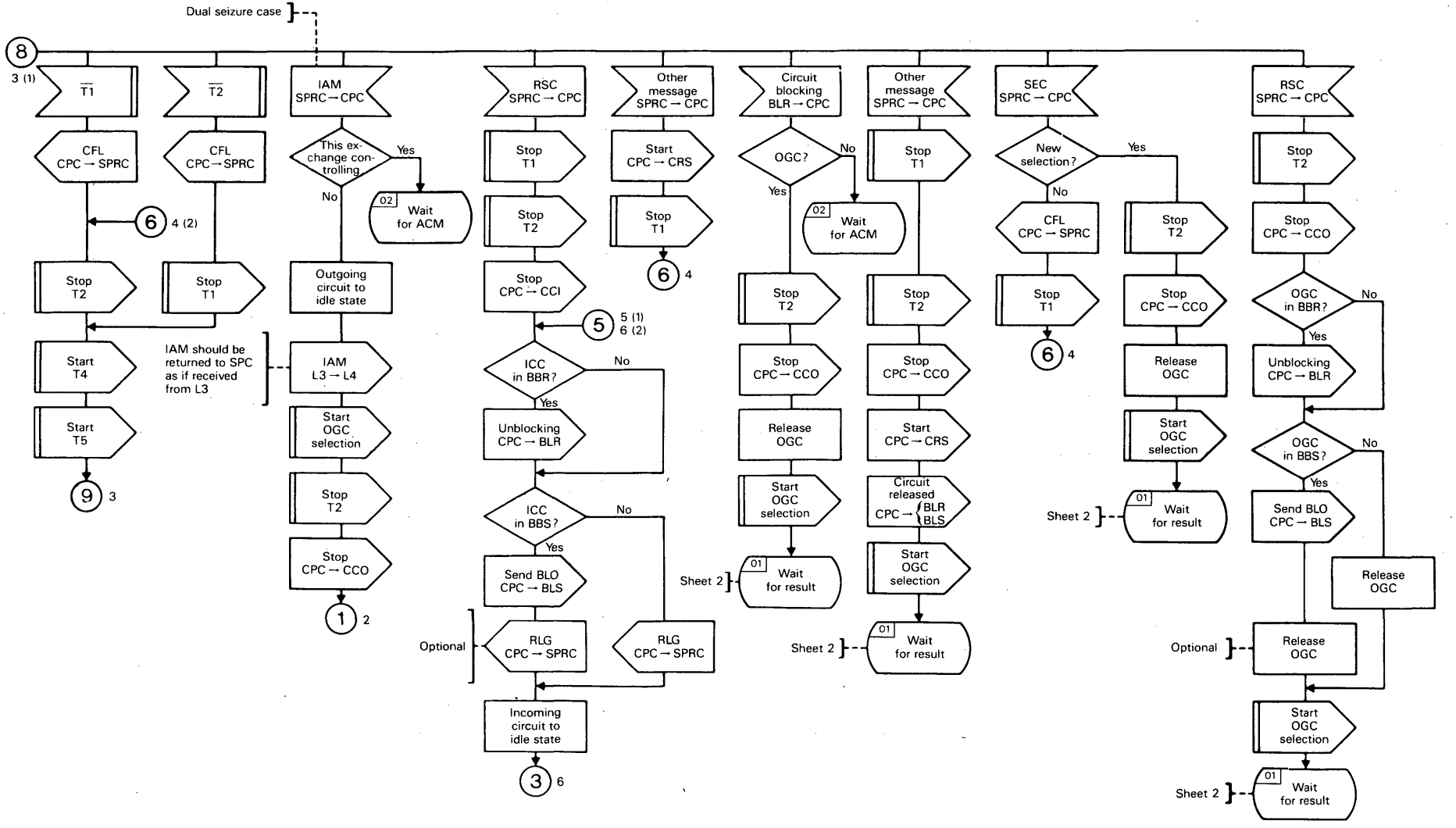


FIGURE 3/Q.724 (Sheet 4 of 7)

CCITT - 70251

Call processing control (CPC)

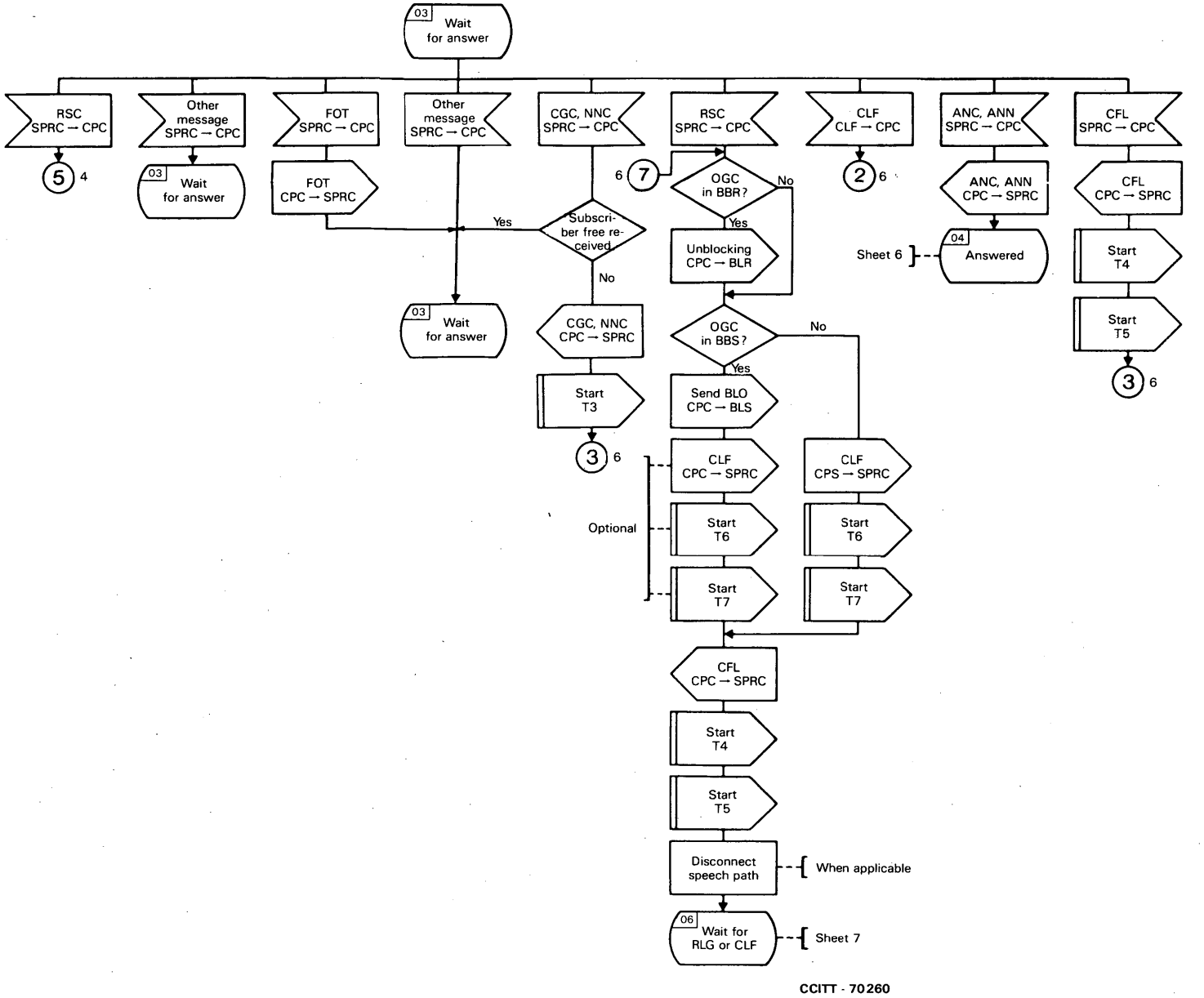


FIGURE 3/Q.724 (Sheet 5 of 7)

Call processing control (CPC)

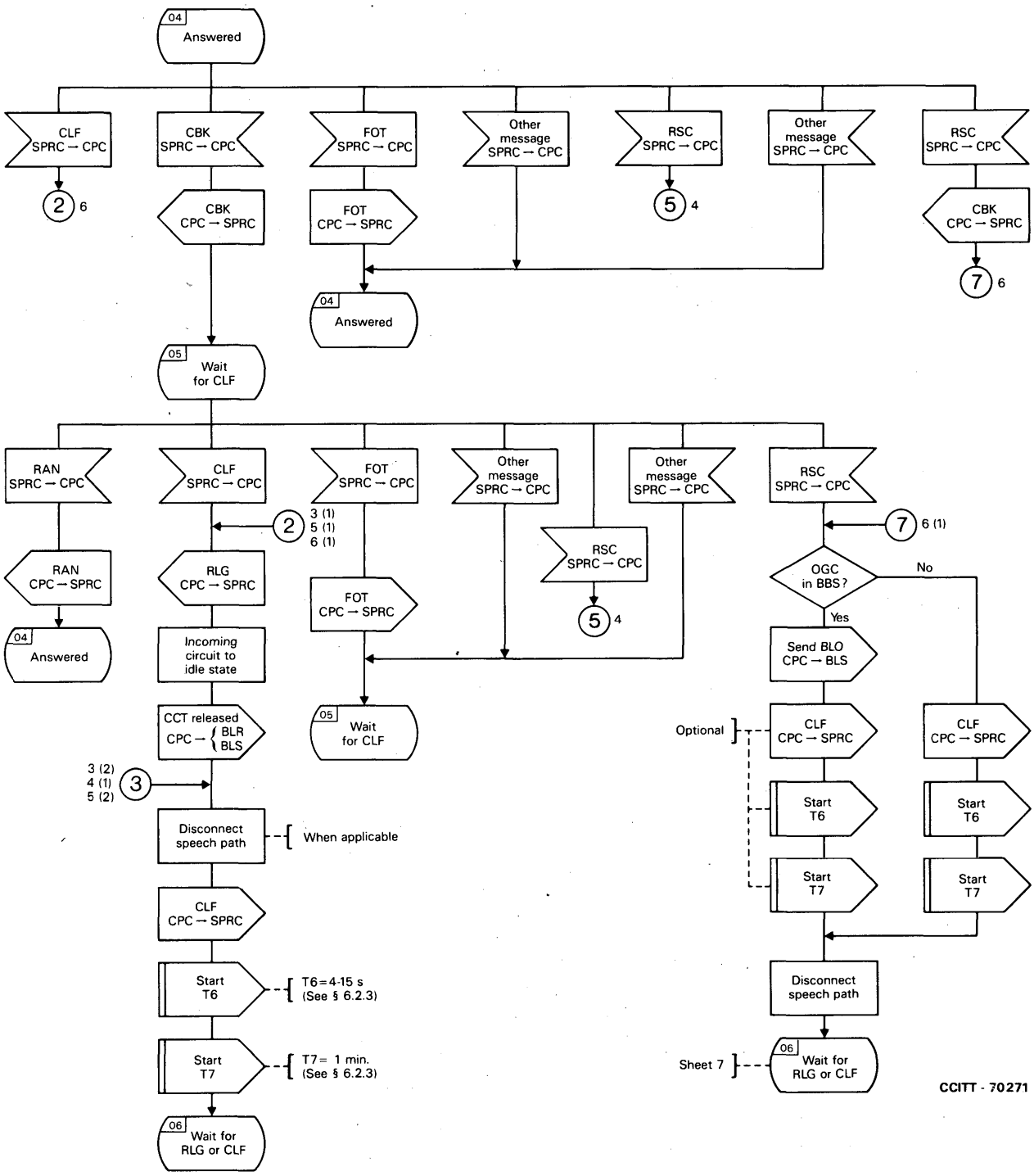


FIGURE 3/Q.724 (Sheet 6 of 7)

Call processing control (CPC)

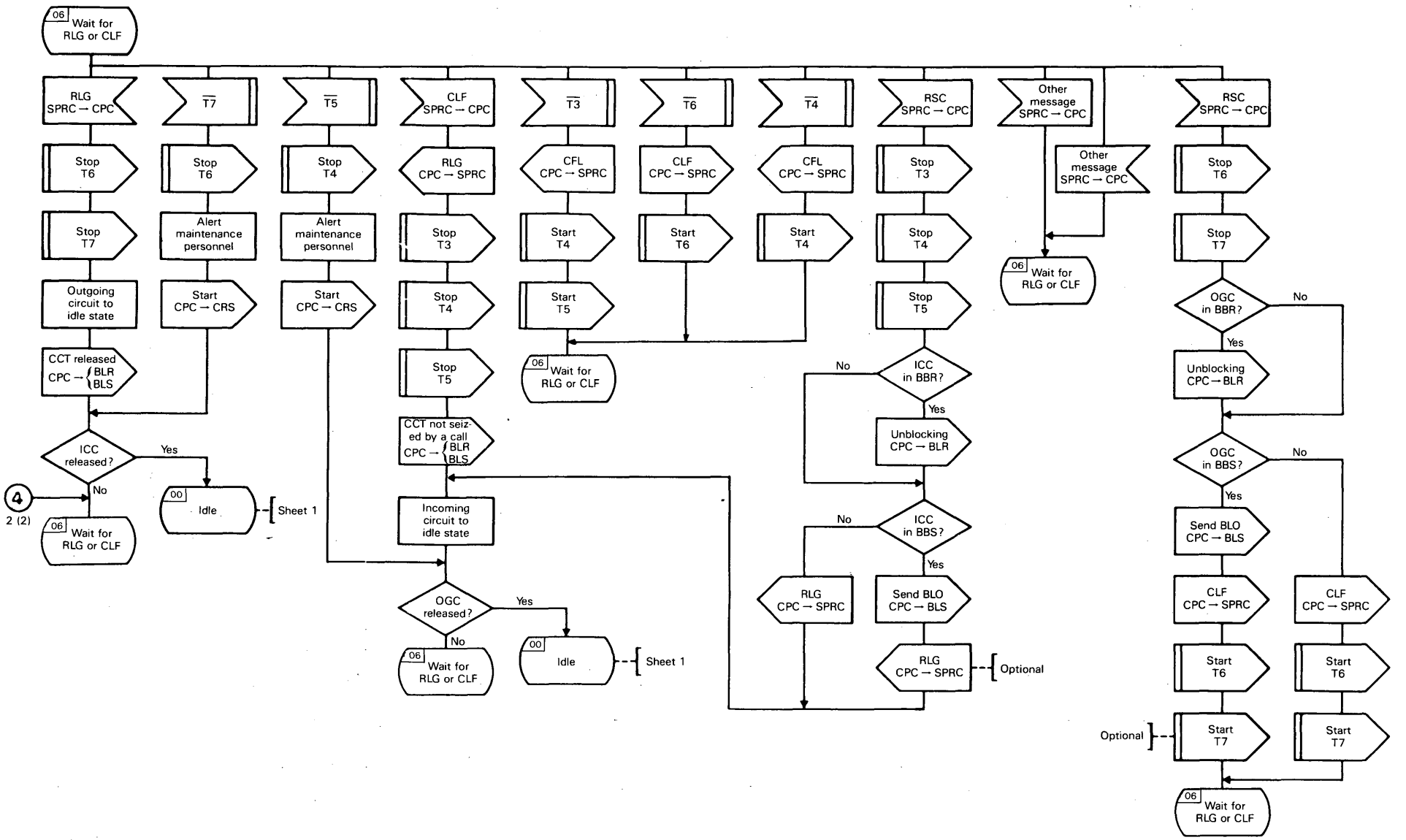


FIGURE 3/Q.724 (Sheet 7 of 7)

Call processing control (CPC)

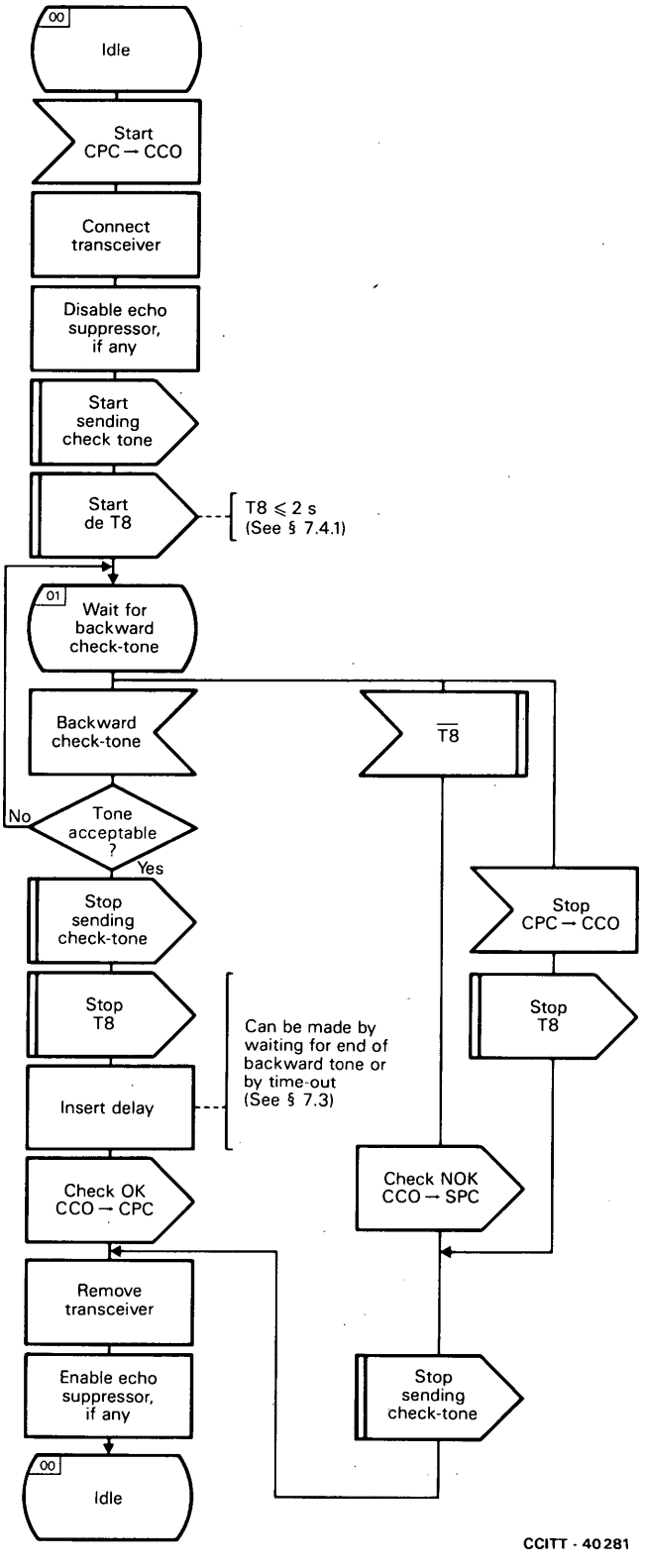


FIGURE 4/Q.724

Continuity-check outgoing (CCO)

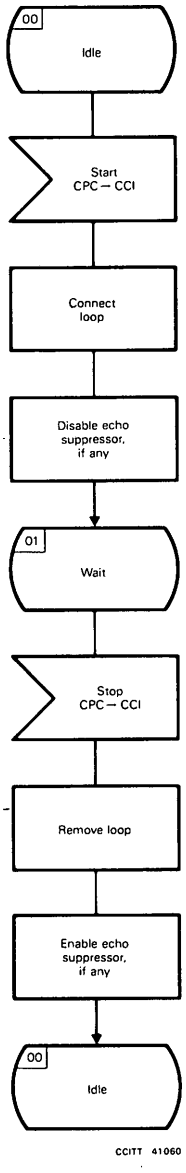


FIGURE 5/Q.724

Continuity-check incoming (CCI)

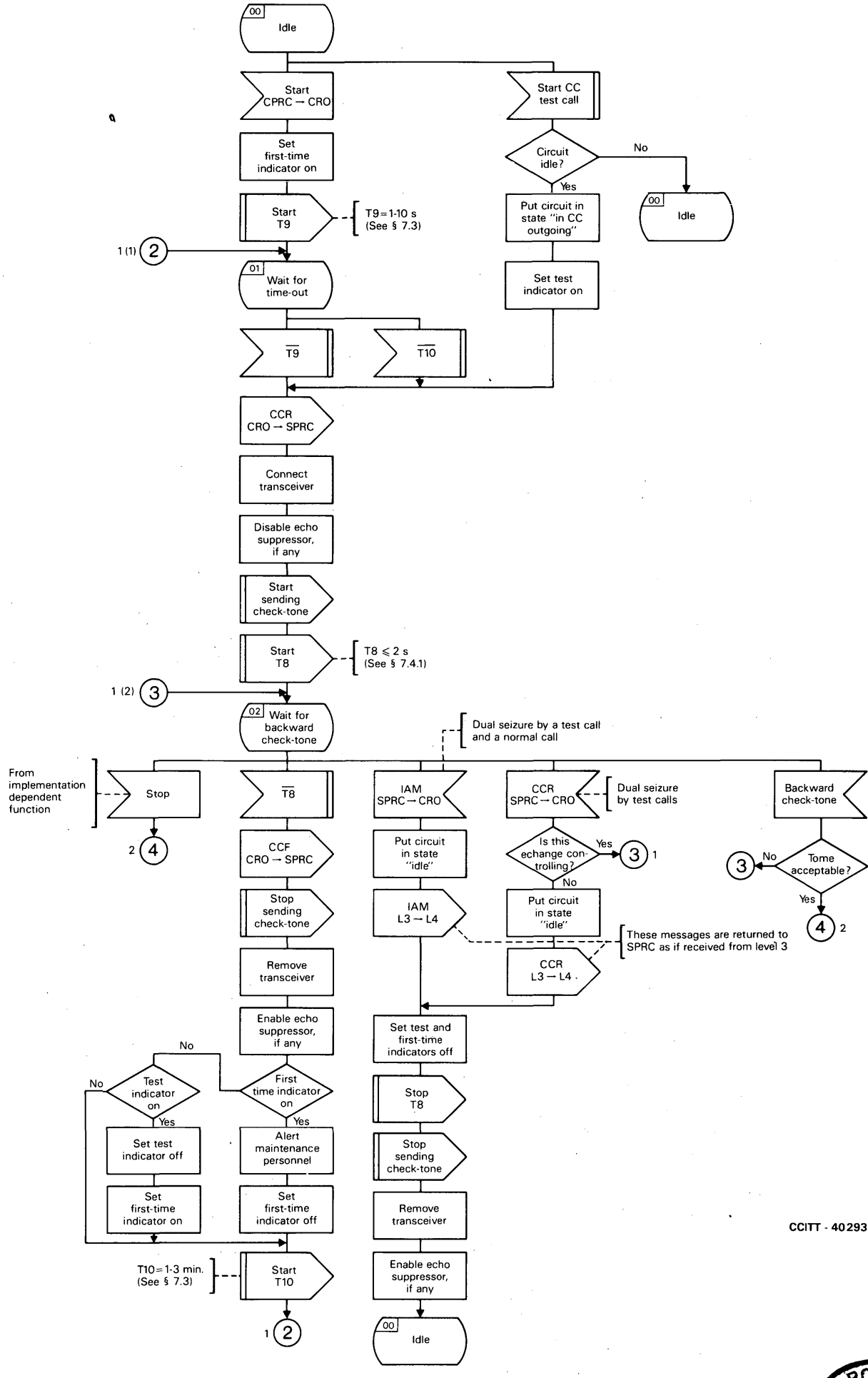


FIGURE 6/Q.724 (Sheet 1 of 2)

Continuity-recheck outgoing (CRO)

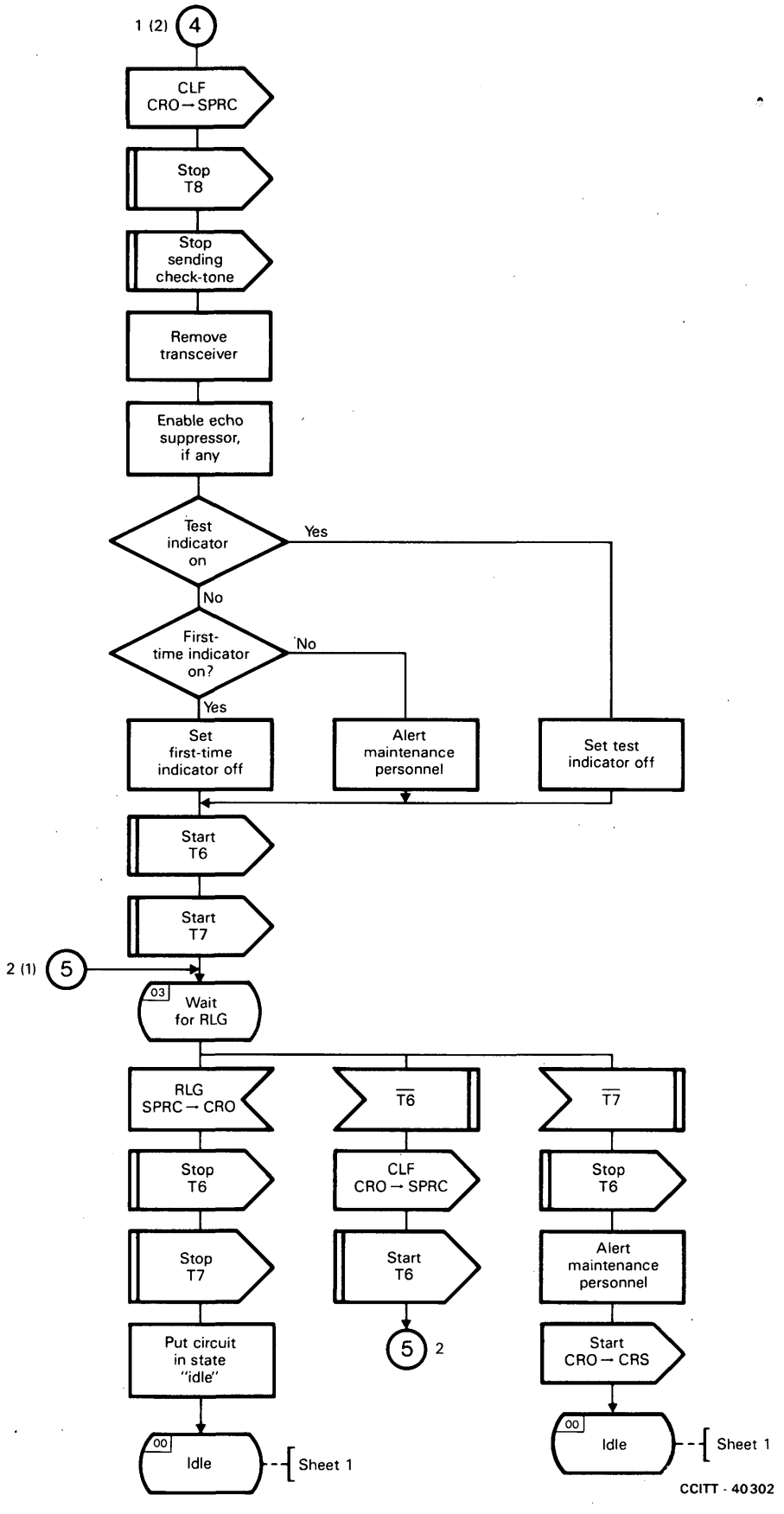


FIGURE 6/Q.724 (Sheet 2 of 2)

Continuity-recheck outgoing (CRO)

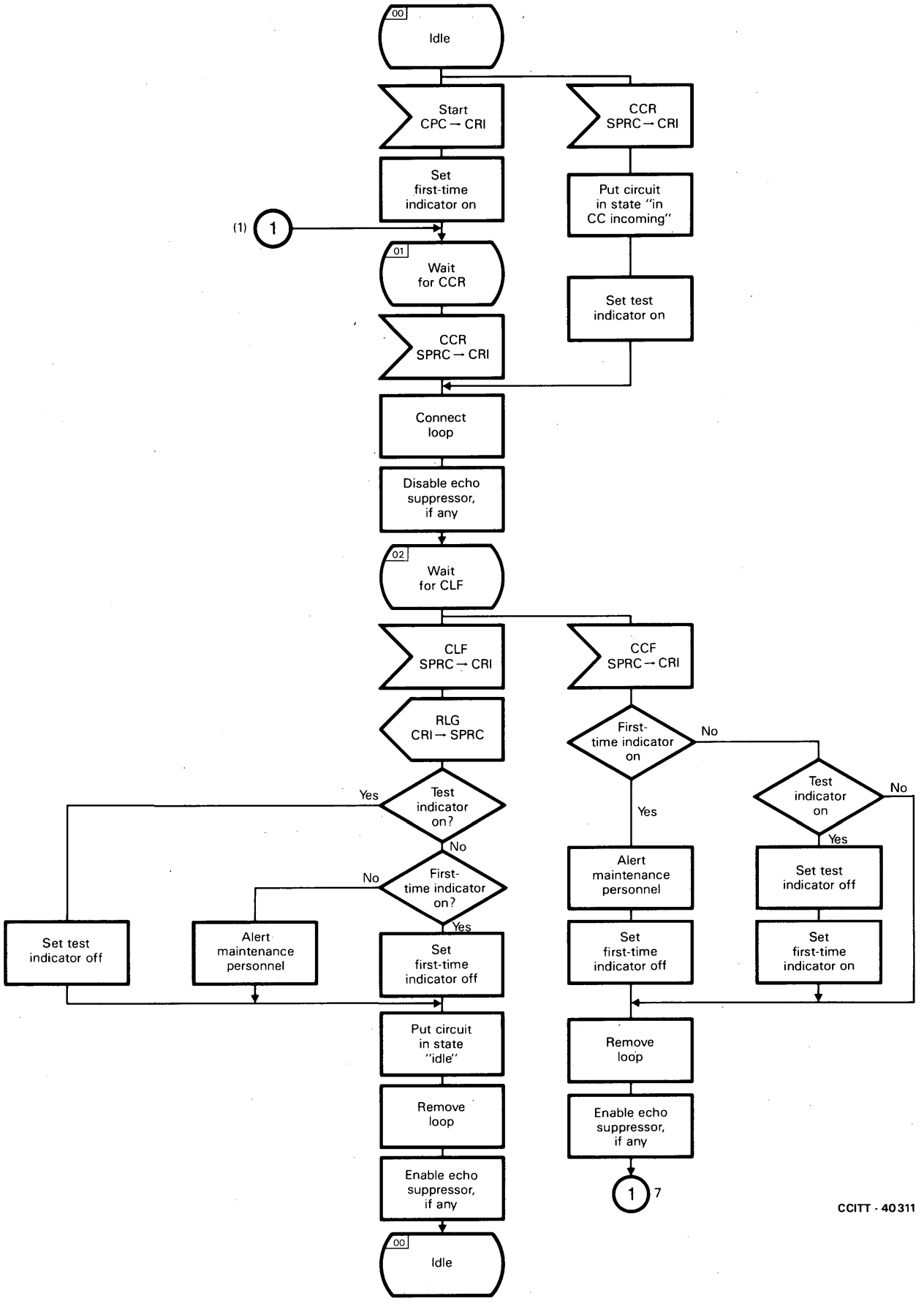


FIGURE 7/Q.724

Continuity-recheck incoming (CRI)

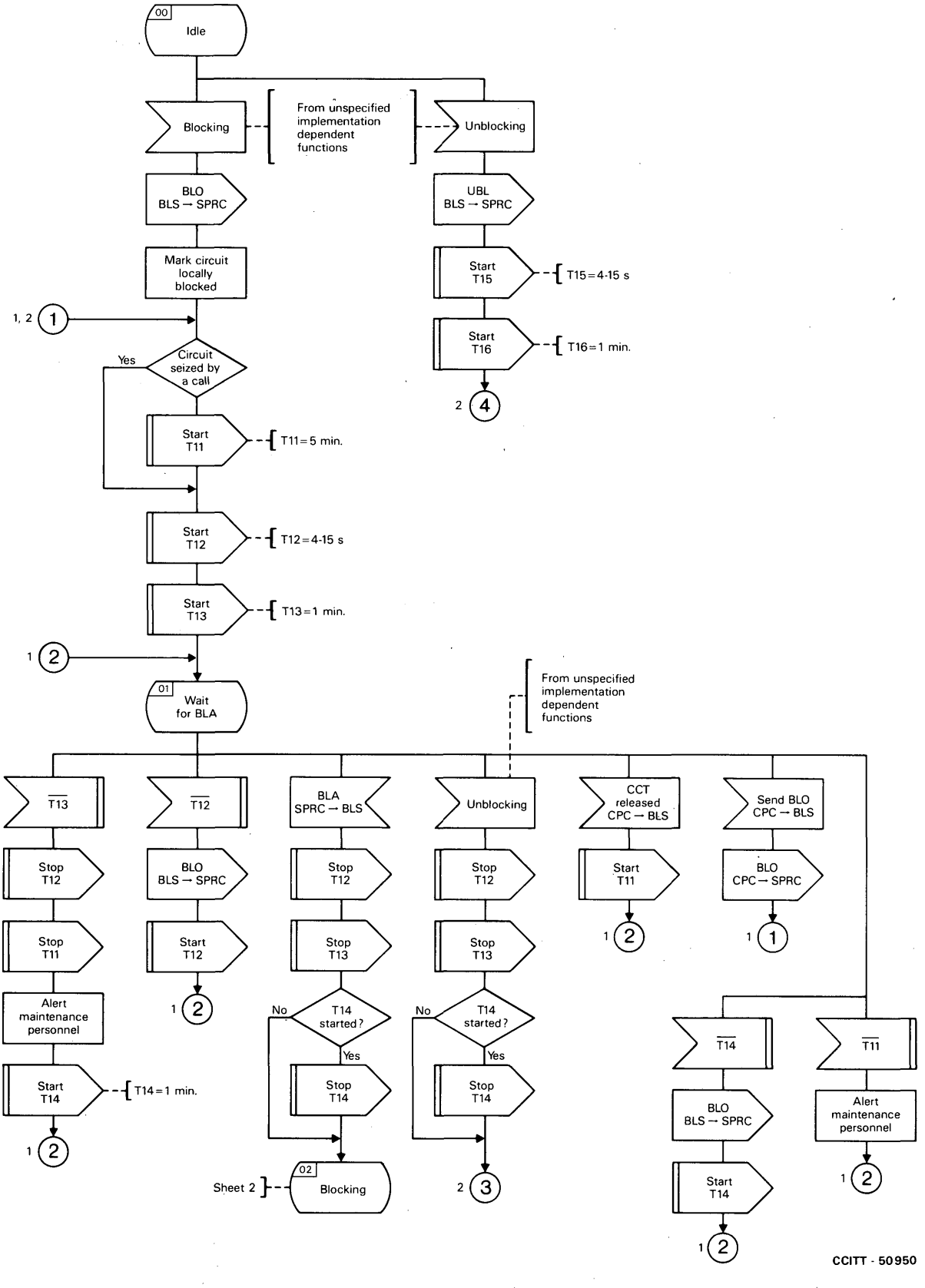


FIGURE 8/Q.724 (Sheet 1 of 2)

Blocking and unblocking signal sending (BLS)

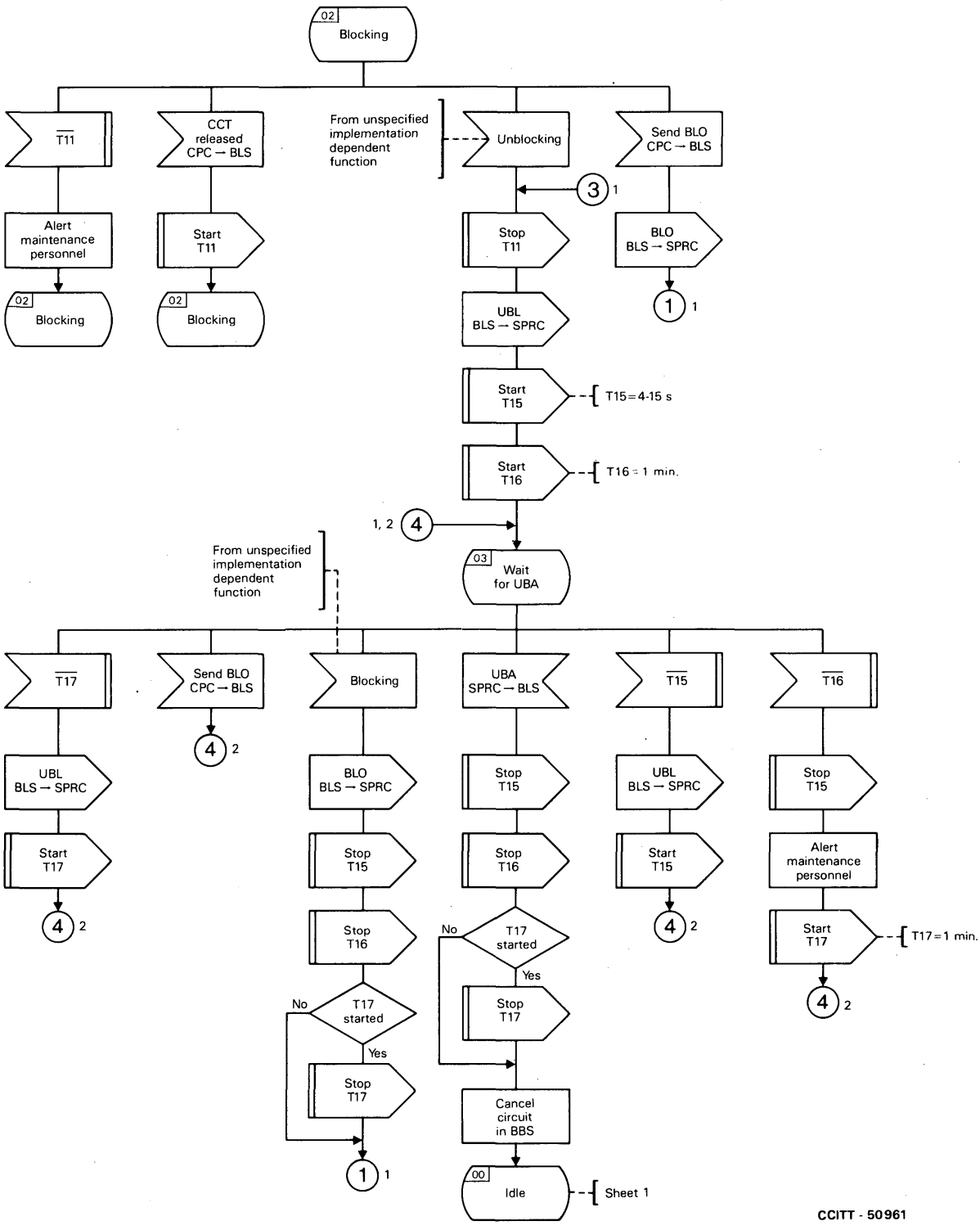


FIGURE 8/Q.724 (Sheet 2 of 2)

Blocking and unblocking signal sending (BLS)

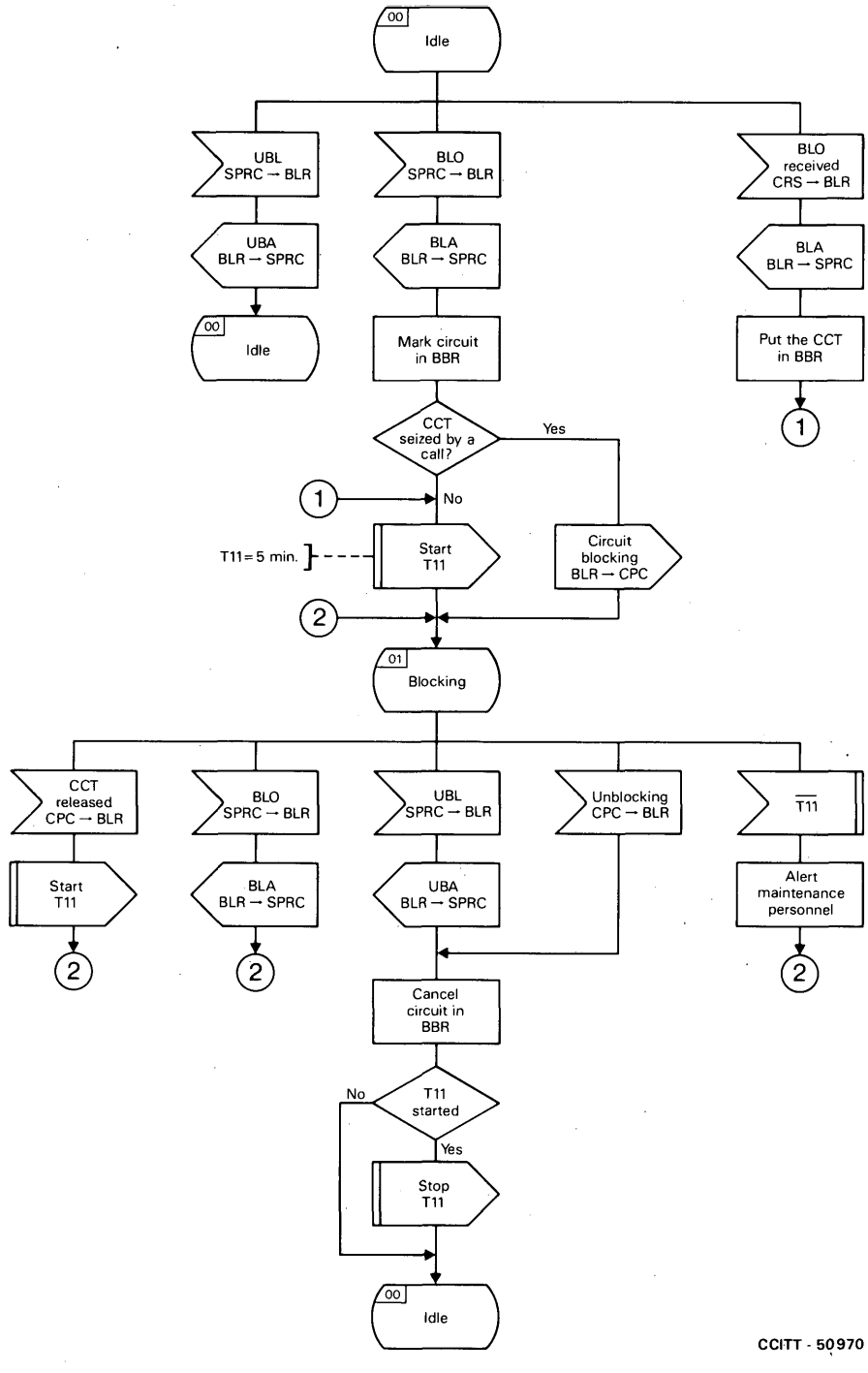


FIGURE 9/Q.724 (Sheet 1 of 1)

Blocking and unblocking signal reception (BLR)

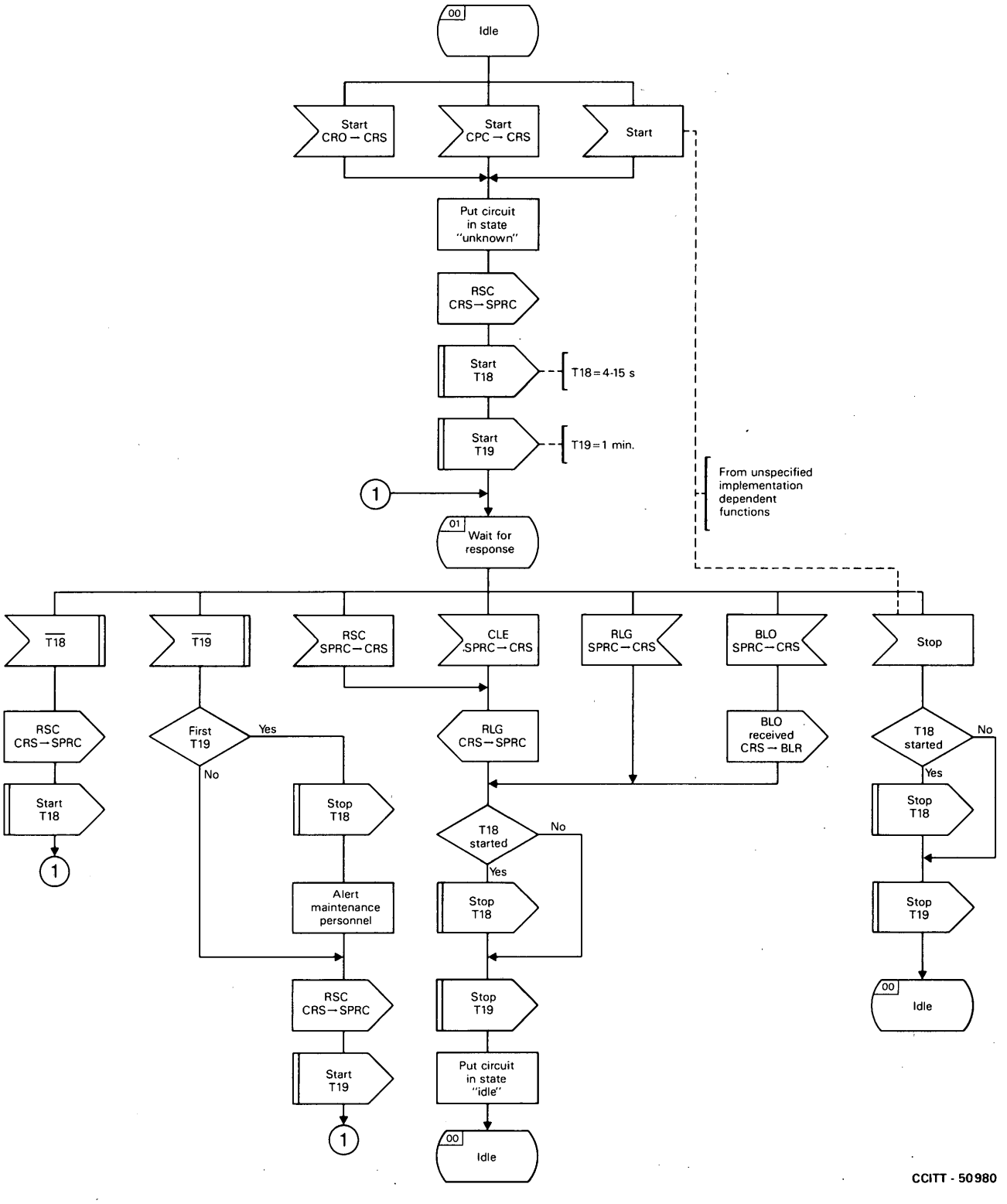


FIGURE 10/Q.724 (Sheet 1 of 1)

Circuit-reset (CRS)

ANNEX A

(to Recommendation Q.724)

State transition diagrams for circuit group supervision
(Provisional)

A.1 *Additional abbreviations*

CGC	Circuit group control
CGRS	Circuit group reset sending
CGRR	Circuit group reset receipt
MBUS	Maintenance oriented circuit group blocking and unblocking sending
MBUR	Maintenance oriented circuit group blocking and unblocking receipt
HBUS	Hardware failure oriented circuit group blocking and unblocking sending
HBUR	Hardware failure oriented circuit group blocking and unblocking receipt
SBUS	Software generated circuit group blocking and unblocking sending
SBUR	Software generated circuit group blocking and unblocking receipt

A.2 *List of timers*

T20	Timer "waiting for second group reset message" (5 seconds, see § 1.15.2)
T21	Timer "waiting for group reset acknowledgement message" (4-15 seconds, see § 1.15)
T22	Timer "delay to send the reset group reset messages" (1 minute, see § 1.15)
T23	Timer "waiting for second maintenance oriented group blocking message" (5 seconds, see § 5.2)
T24	Timer "waiting for second maintenance oriented group unblocking message" (5 seconds, see § 5.2)
T25	Timer "waiting to alert maintenance personnel following initiation of maintenance oriented group blocking" (5 minutes, see § 5)
T26	Timer "waiting for maintenance oriented group blocking acknowledgement message" (4-15 seconds, see § 6.4.4)
T27	Timer "delay to send the maintenance oriented group blocking message" (1 minute, § 6.4.4)
T28	Timer "waiting for maintenance oriented group unblocking acknowledgement message" (4-15 seconds, see § 6.4.4)
T29	Timer "delay to send the maintenance oriented group unblocking message" (1 minute, see § 6.4.4)
T30	Timer "waiting for second hardware failure oriented group blocking message" (5 seconds, see § 5.2)
T31	Timer "waiting for second hardware failure oriented group unblocking message" (5 seconds, see § 5.2)
T32	Timer "waiting for hardware failure oriented group blocking acknowledgement message" (4-15 seconds, see § 6.4.4)
T33	Timer "delay to send hardware failure oriented group blocking message" (1 minute, see § 6.4.4)
T34	Timer "waiting for hardware failure oriented group unblocking acknowledgement message" (4-15 seconds, see § 6.4.4)
T35	Timer "delay to send hardware failure oriented group unblocking message" (1 minute, see § 6.4.4)

T36 Timer "waiting for second software generated group blocking message" (5 seconds, see § 5.2)

T37 Timer "waiting for second software generated group unblocking message" (5 seconds, see § 5.2)

T38 Timer "waiting for software generated group blocking acknowledgement message" (4-15 seconds, see § 6.4.4)

T39 Timer "delay to send software generated group blocking message" (1 minute, see § 6.4.4)

T40 Timer "waiting for software generated group unblocking acknowledgement message" (4-15 seconds, see § 6.4.4)

T41 Timer "delay to send software generated group unblocking message" (1 minute, see § 6.4.4)

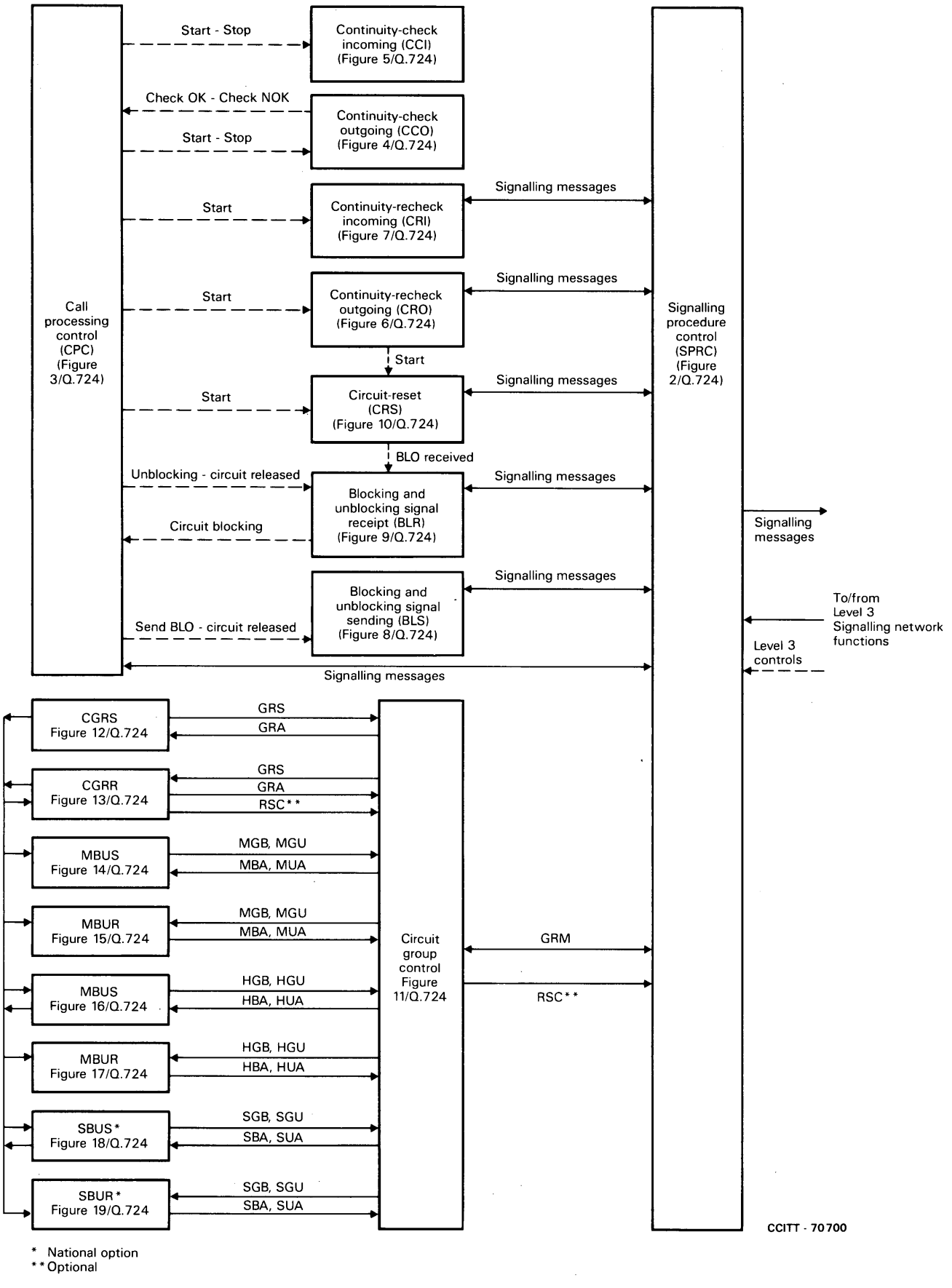
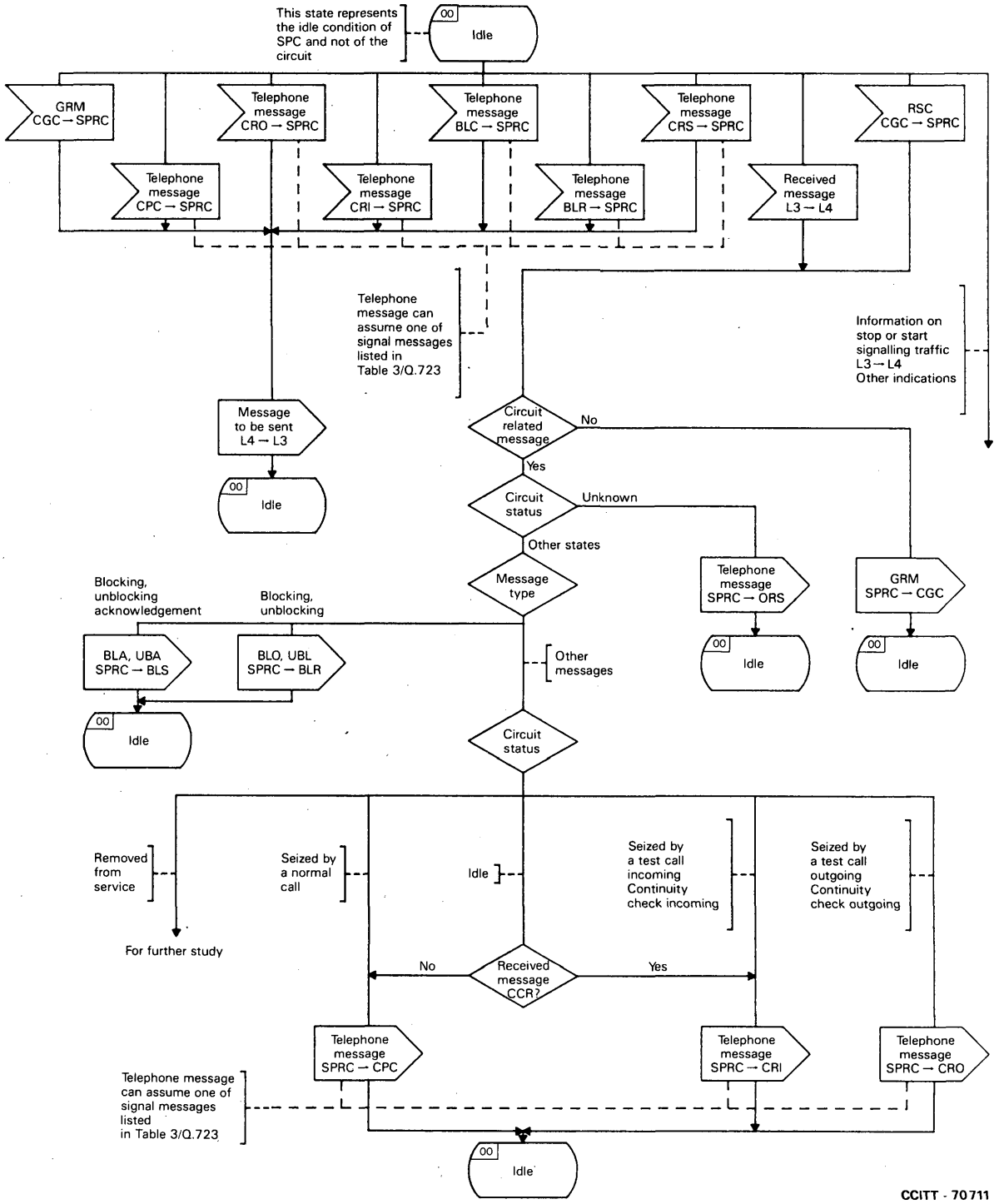


FIGURE A-1/Q.724

Level 4 – Telephone User Part functions



Note – In this particular figure, the direction of input and output symbols does not necessarily represent the forward or backward direction of messages contained in them.

FIGURE A-2/Q.724 (Sheet 1 of 1)

Signalling procedure control (SPRC)

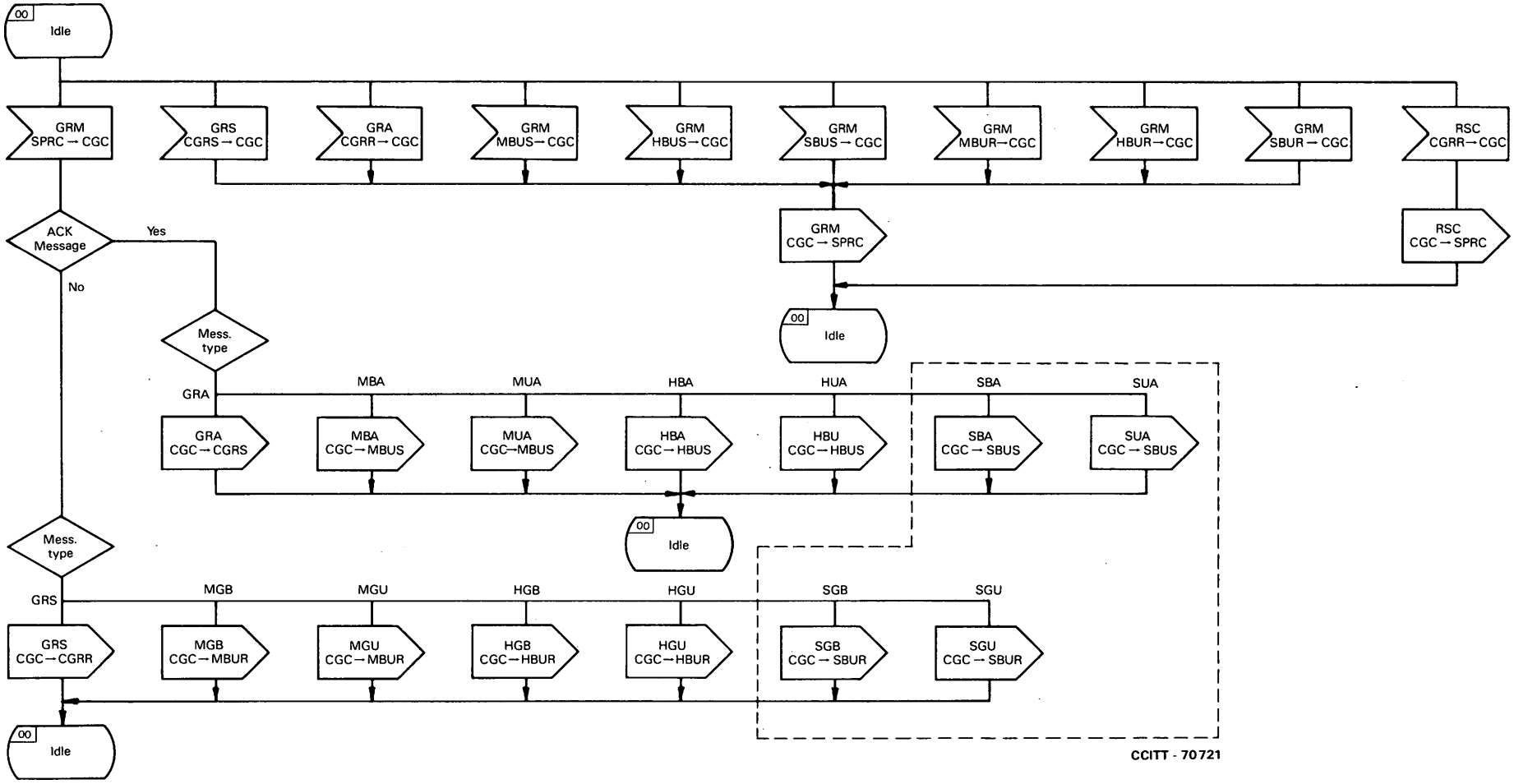


FIGURE A-3/Q.724 (Sheet 1 of 1)

Circuit group control (CGC)

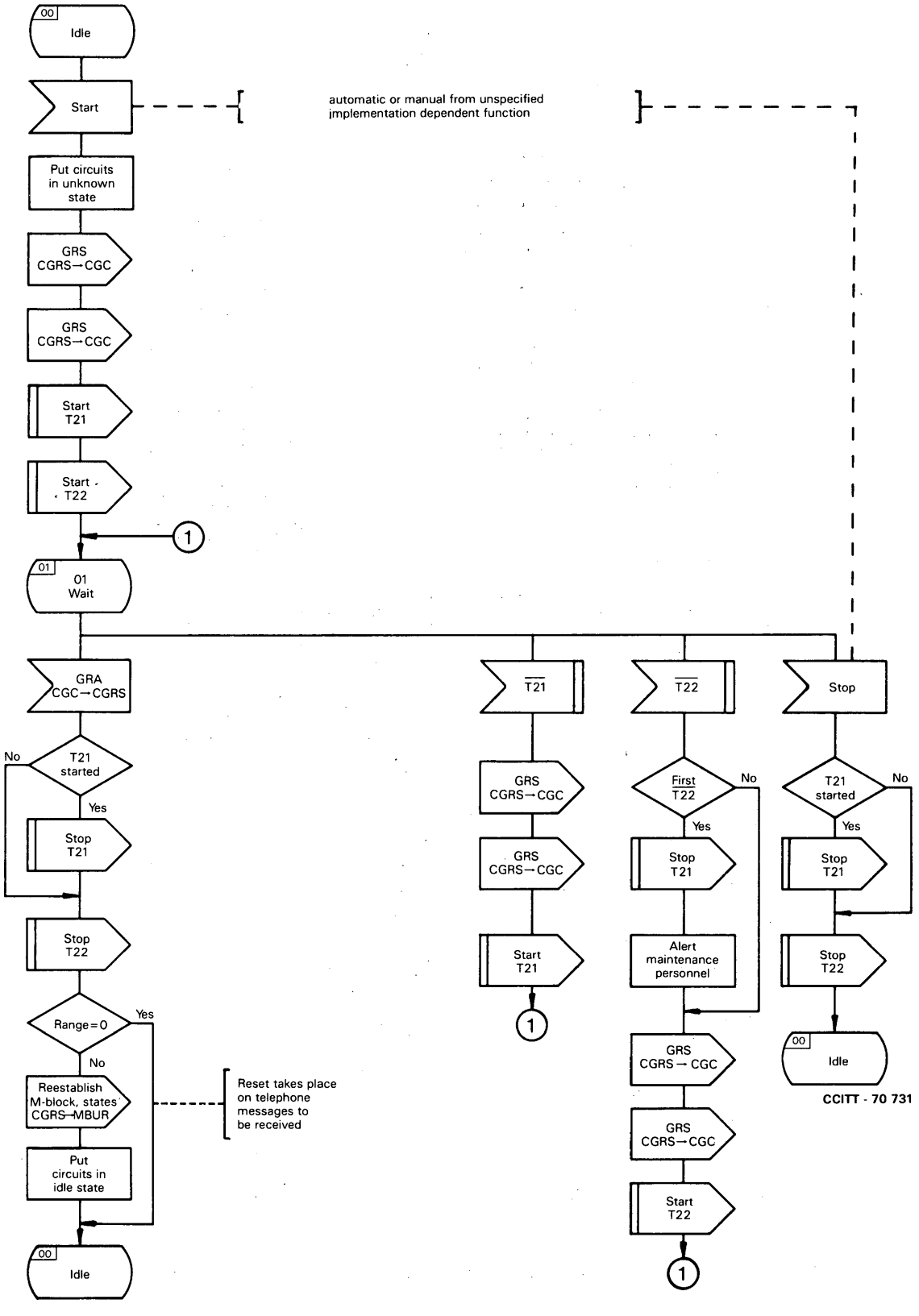
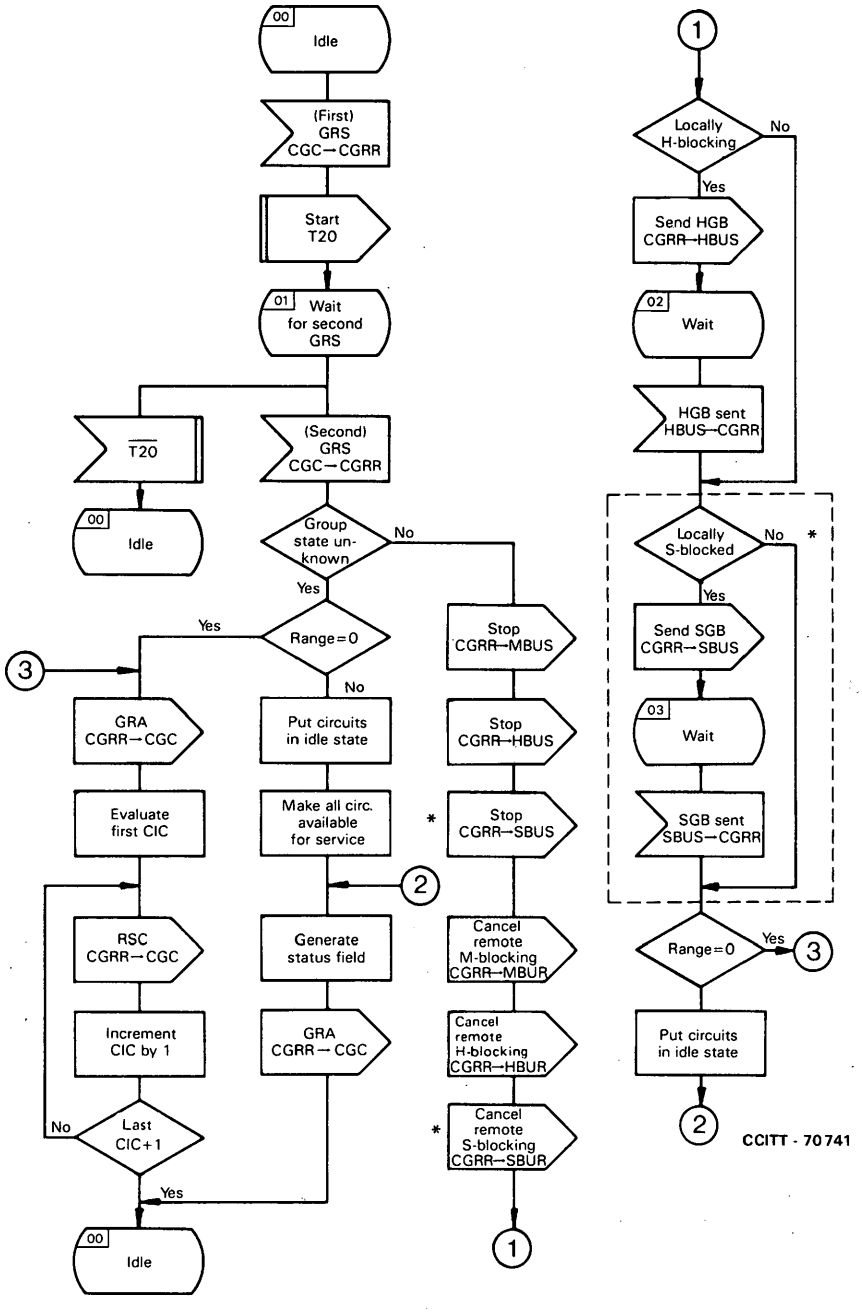


FIGURE A-4/Q.724 (Sheet 1 of 1)

Circuit group reset sending (CGRS)



* Not included if the national option (SBUS and SBUR) is not implemented.

FIGURE A-5/Q.724 (Sheet 1 of 1)

Circuit group reset receipt (CGRR)

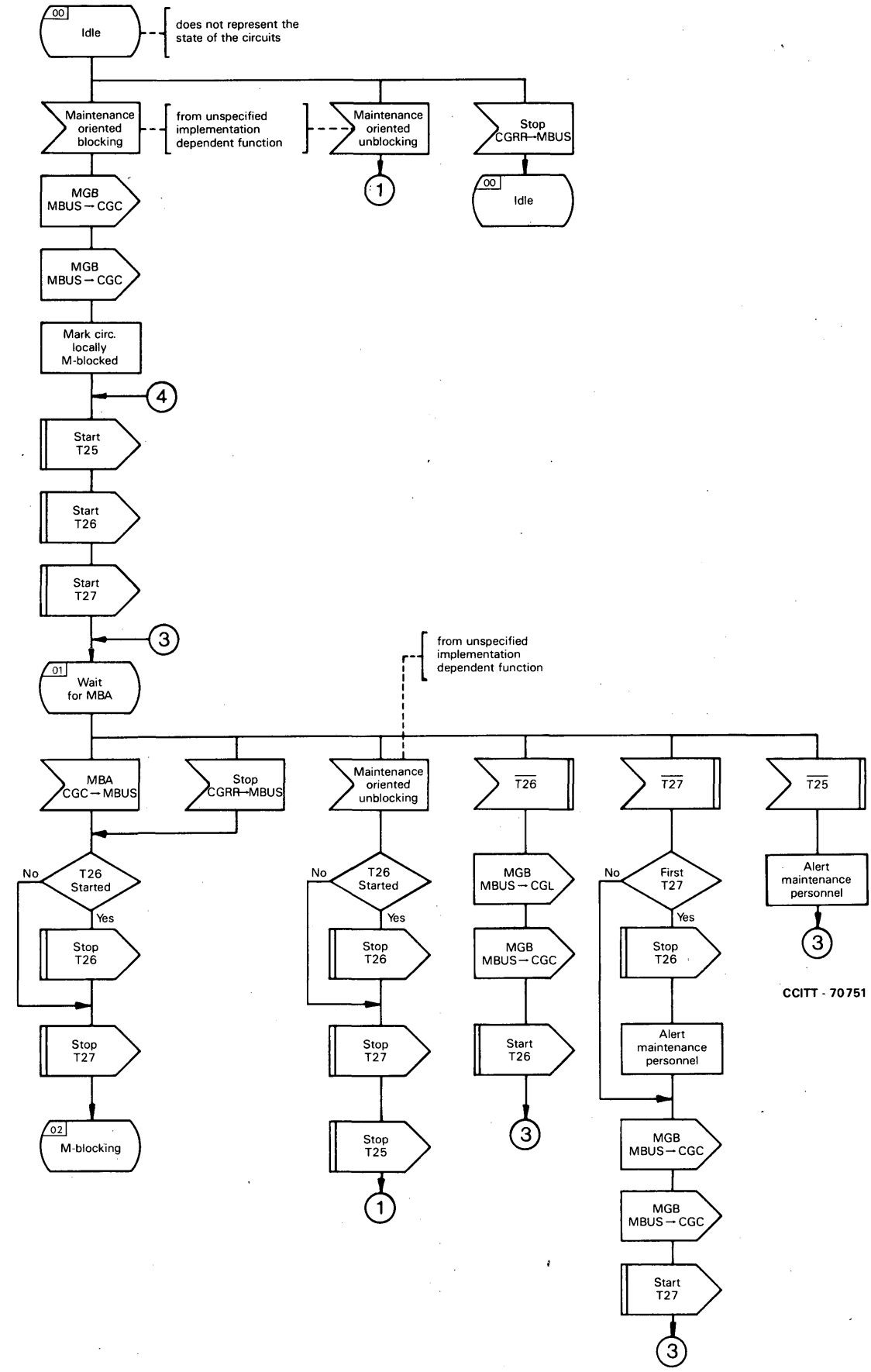


FIGURE A-6/Q.724 (Sheet 1 of 2)

Maintenance oriented circuit group blocking and unblocking sending (MBUS)

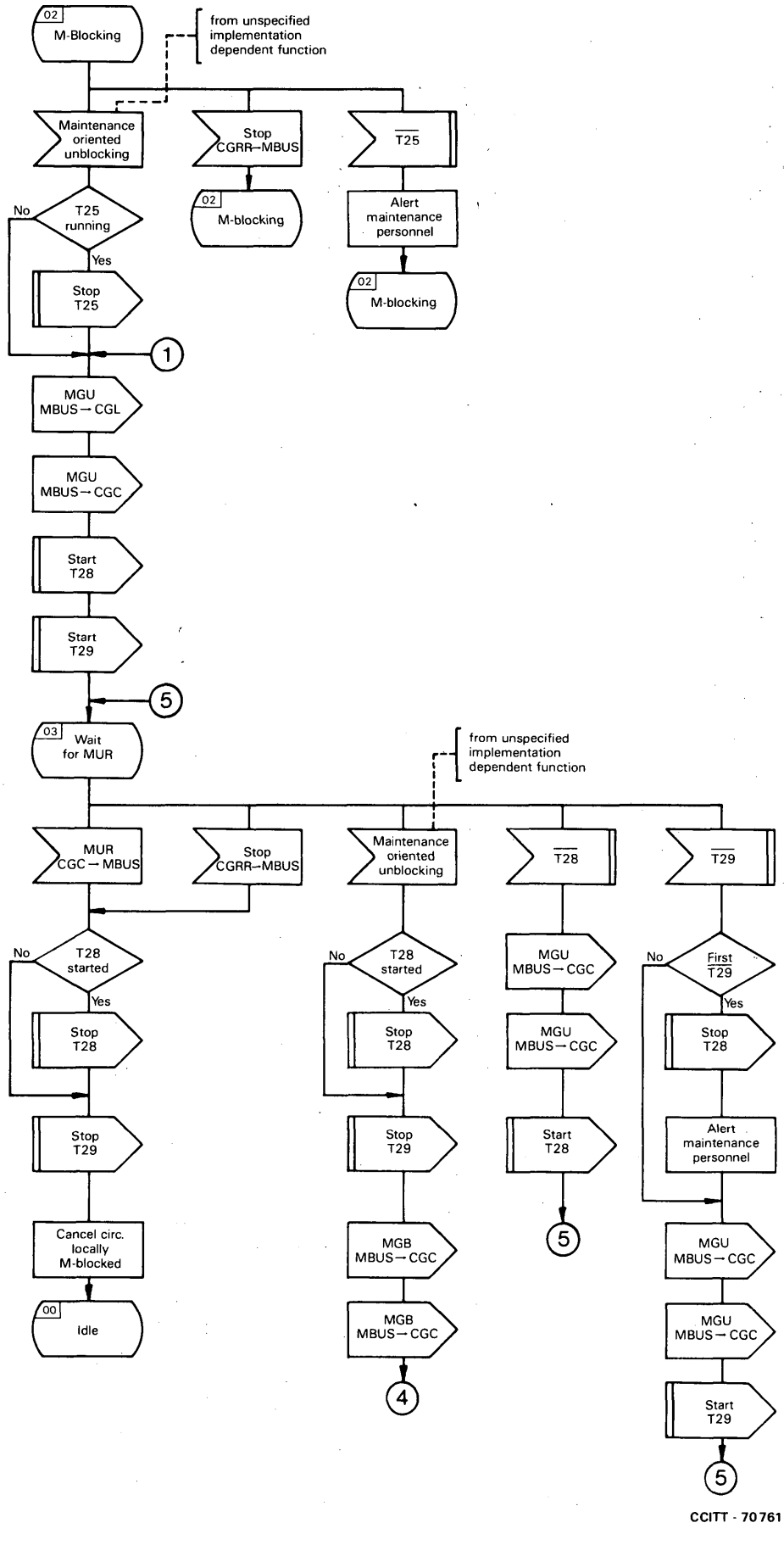


FIGURE A-6/Q.724 (Sheet 2 of 2)

Maintenance oriented circuit group blocking and unblocking sending (MBUS)

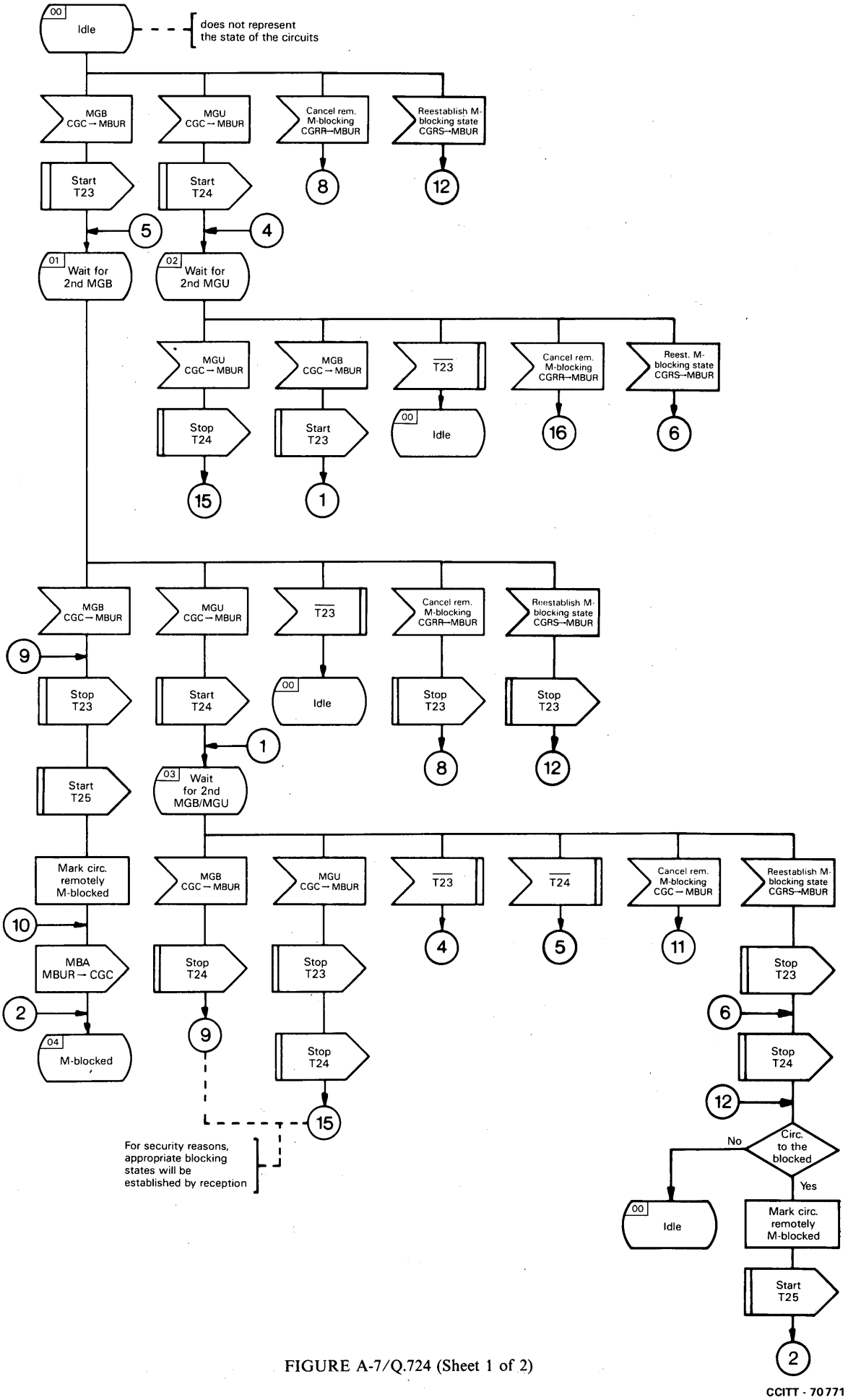


FIGURE A-7/Q.724 (Sheet 1 of 2)

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Maintenance oriented circuit group blocking and unblocking receipt (MBUR)

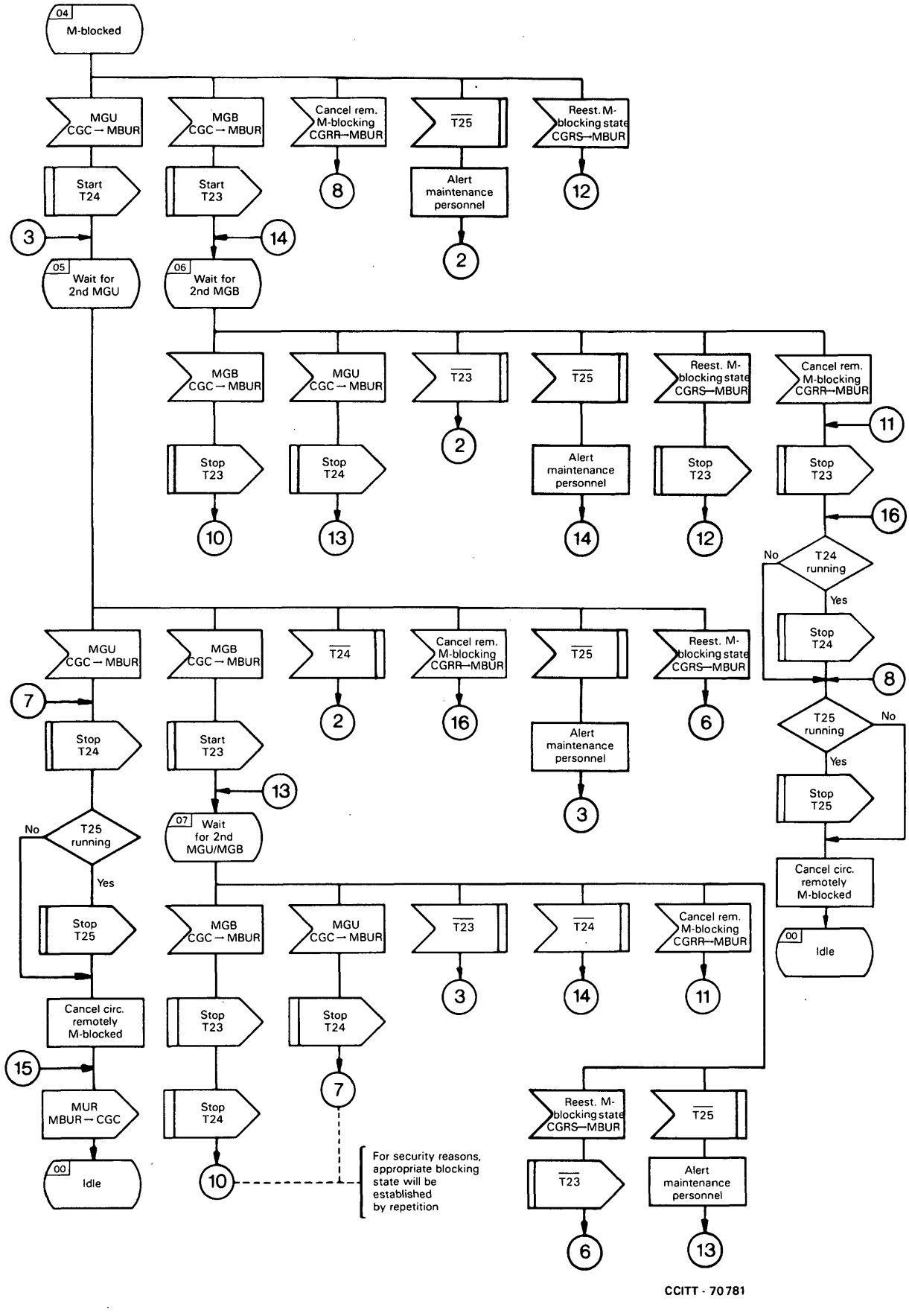


FIGURE A-7/Q.724 (Sheet 2 of 2)

Maintenance oriented circuit group blocking and unblocking receipt (MBUR)

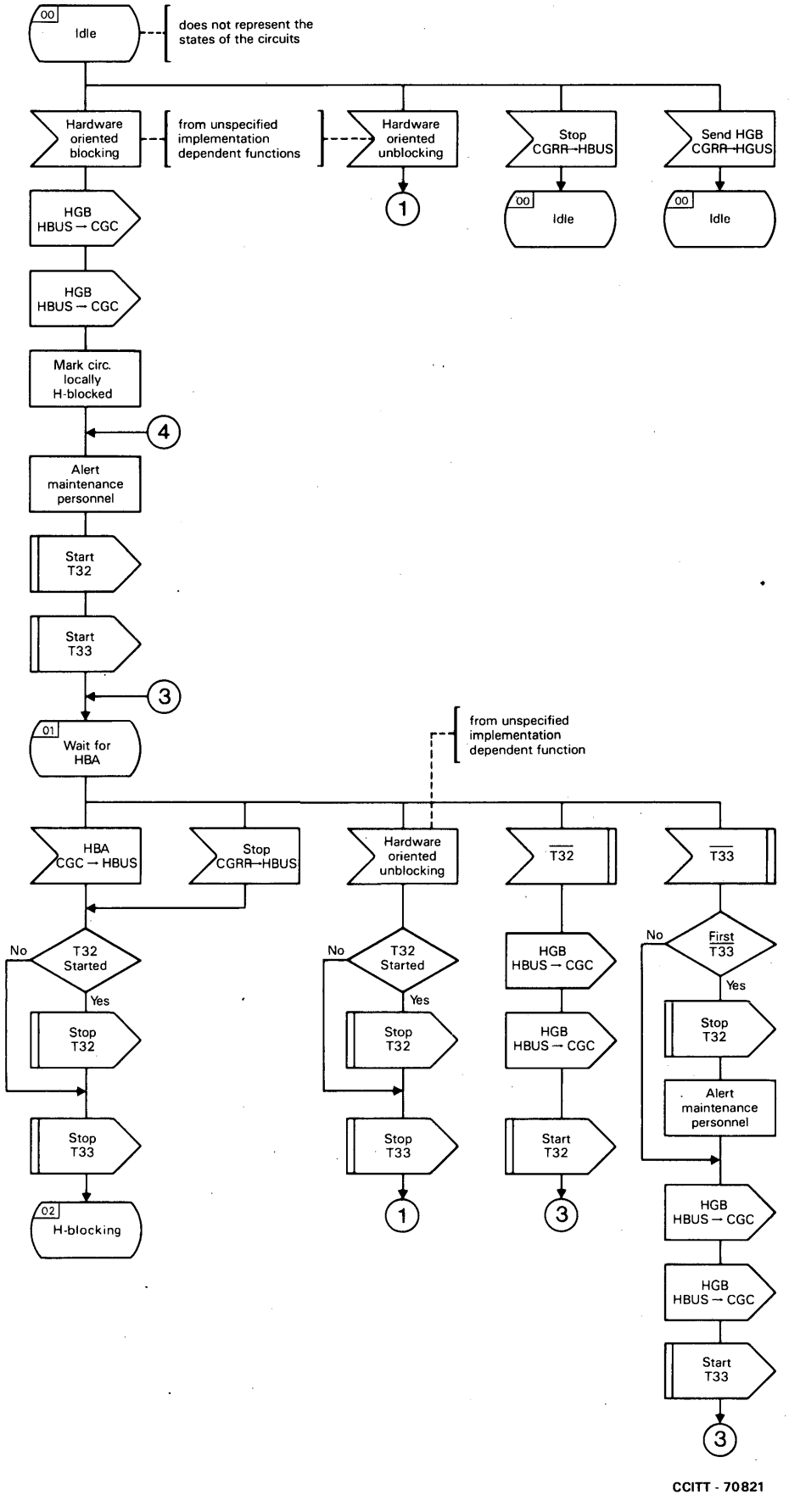


FIGURE A-8/Q.724 (Sheet 1 of 2)

Hardware failure oriented circuit group blocking and unblocking sending (HBUS)

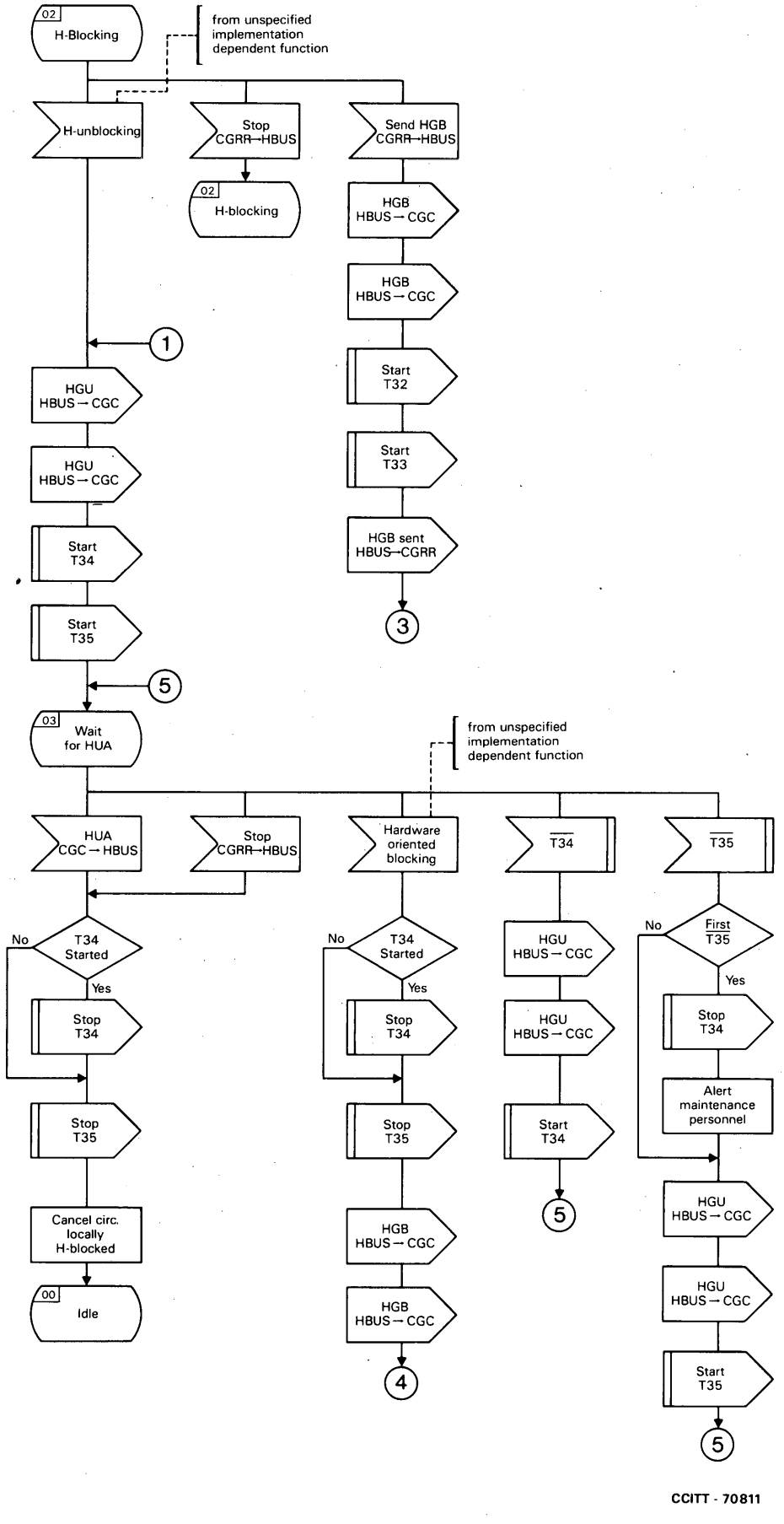


FIGURE A-8/Q.724 (Sheet 2 of 2)

Hardware failure oriented circuit group blocking and unblocking sending (HBUS)

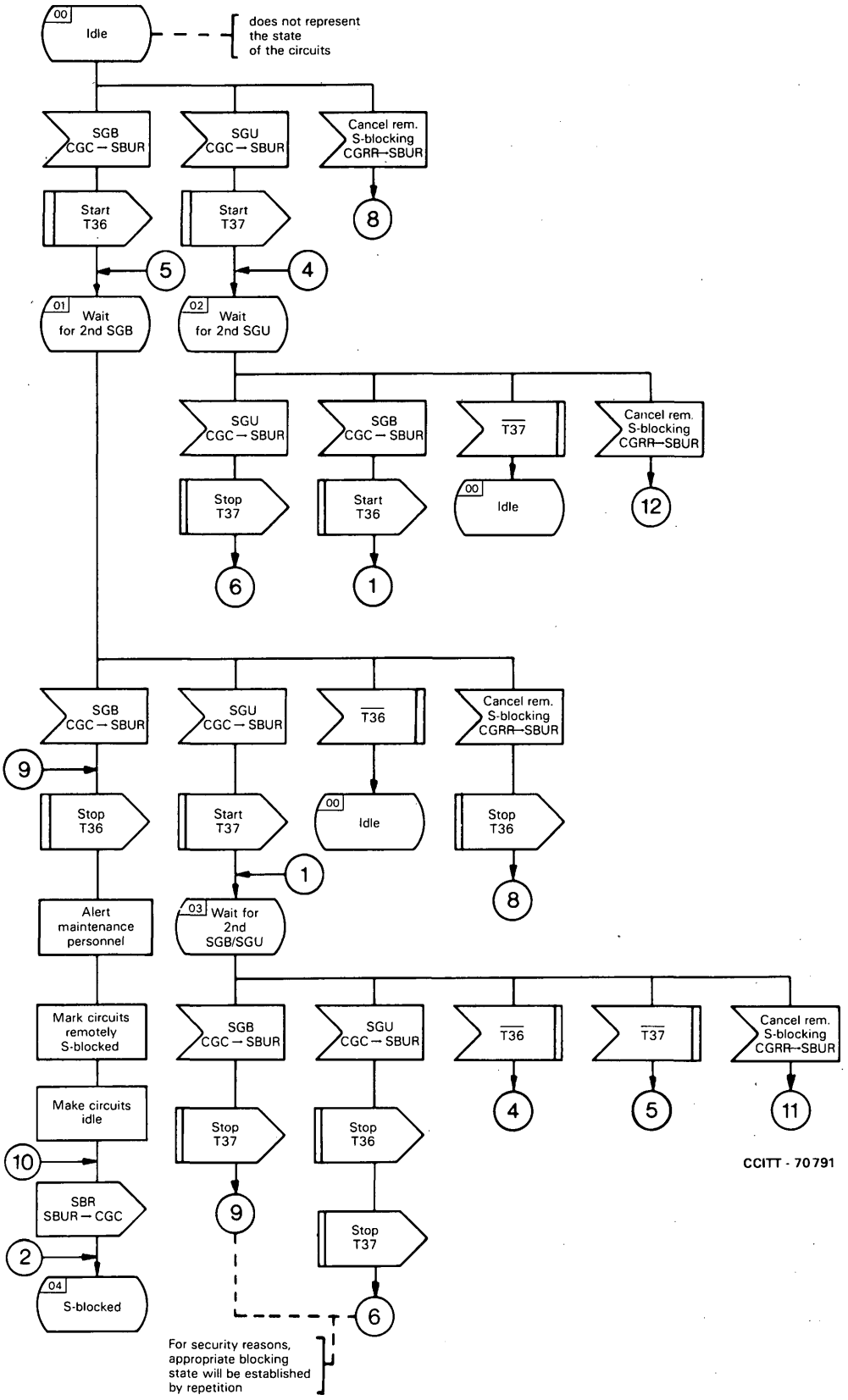


FIGURE A-9/Q.724 (Sheet 1 of 2)

Hardware failure oriented circuit group blocking and unblocking receipt (HBUR)

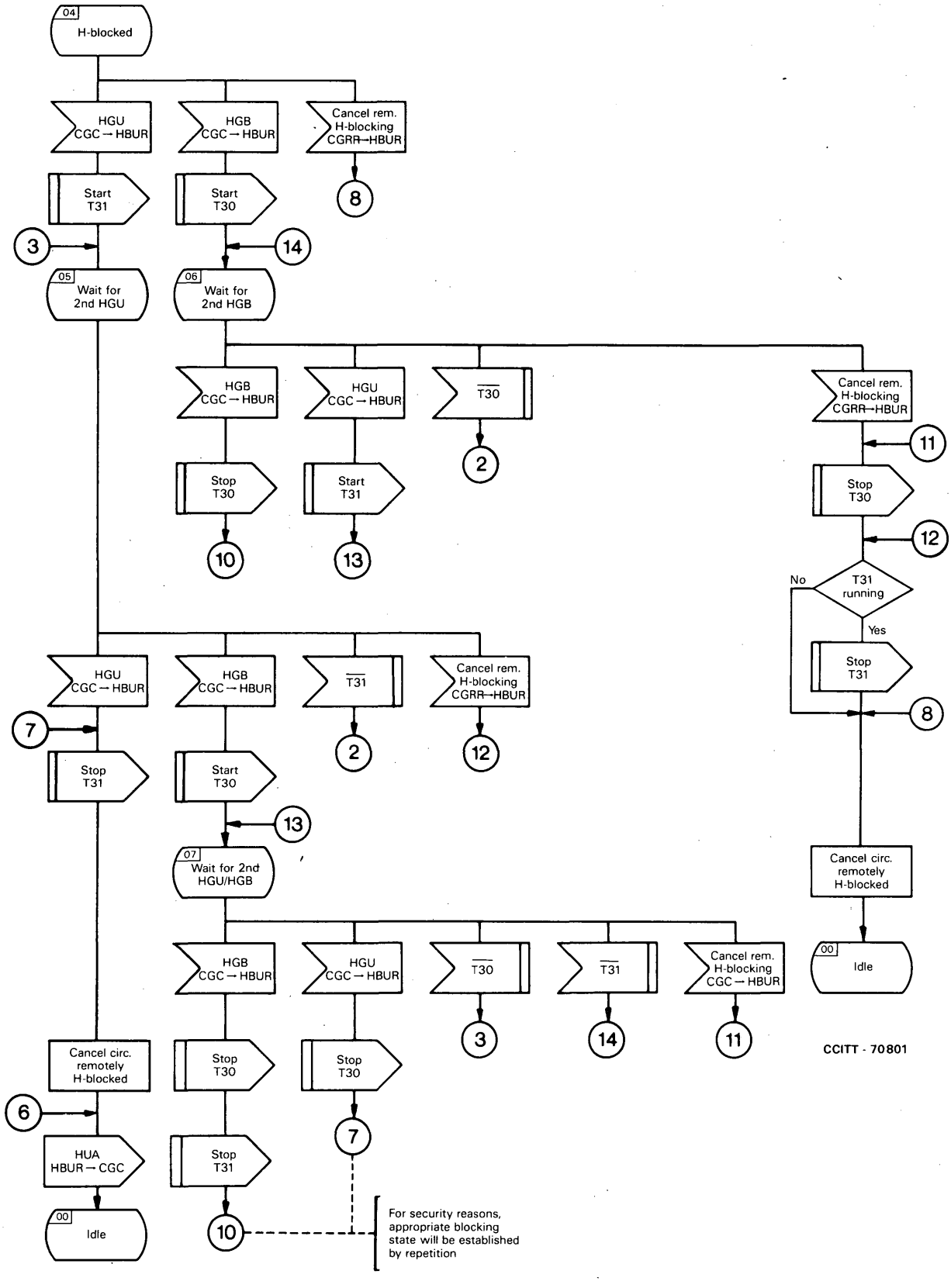


FIGURE A-9/Q.724 (Sheet 2 of 2)

Hardware failure oriented circuit group blocking and unblocking receipt (HBUR)

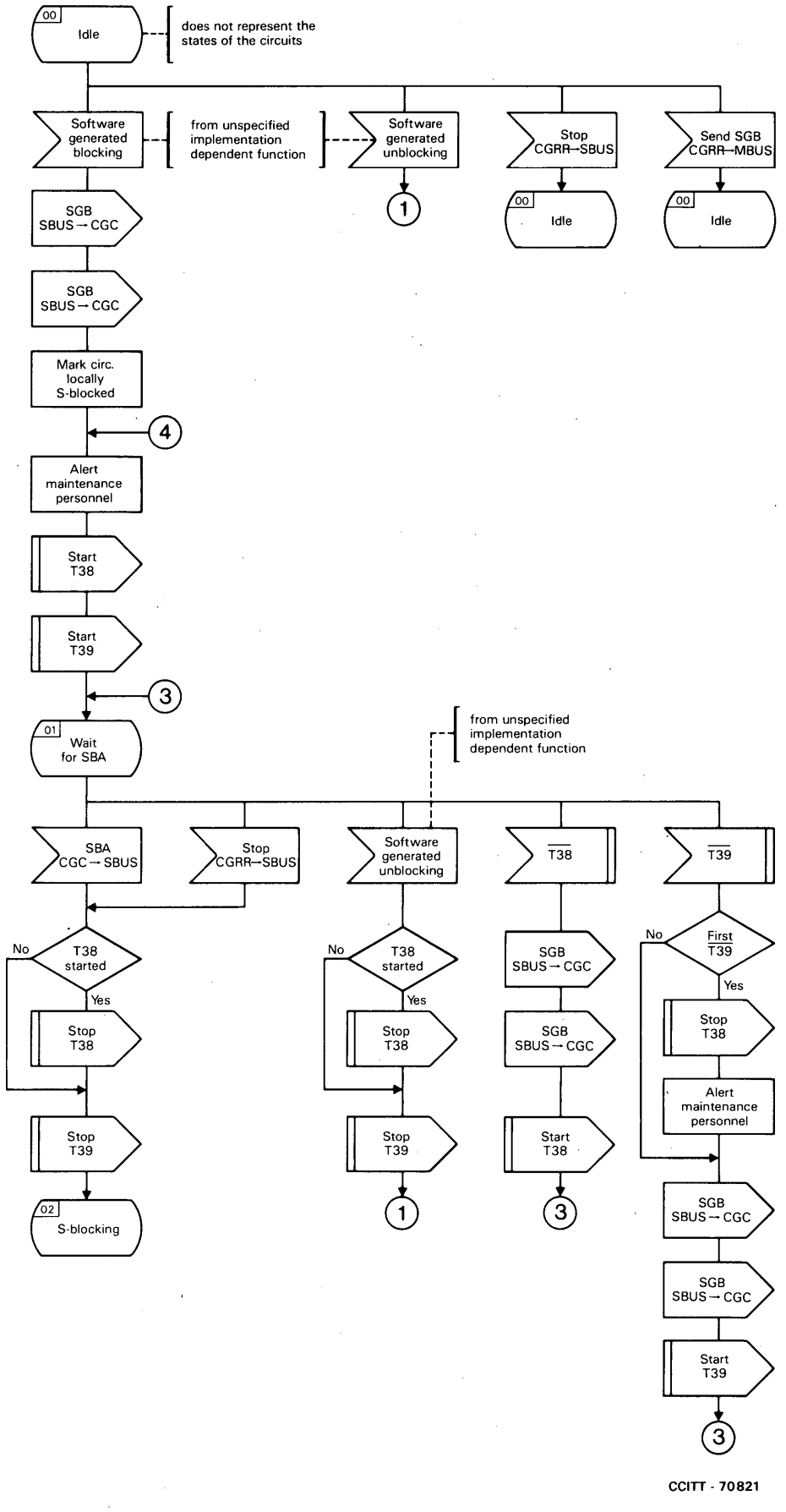


FIGURE A-10/Q.724 (Sheet 1 of 2)

Software generated circuit group blocking and unblocking sending (SBUS) (National option)

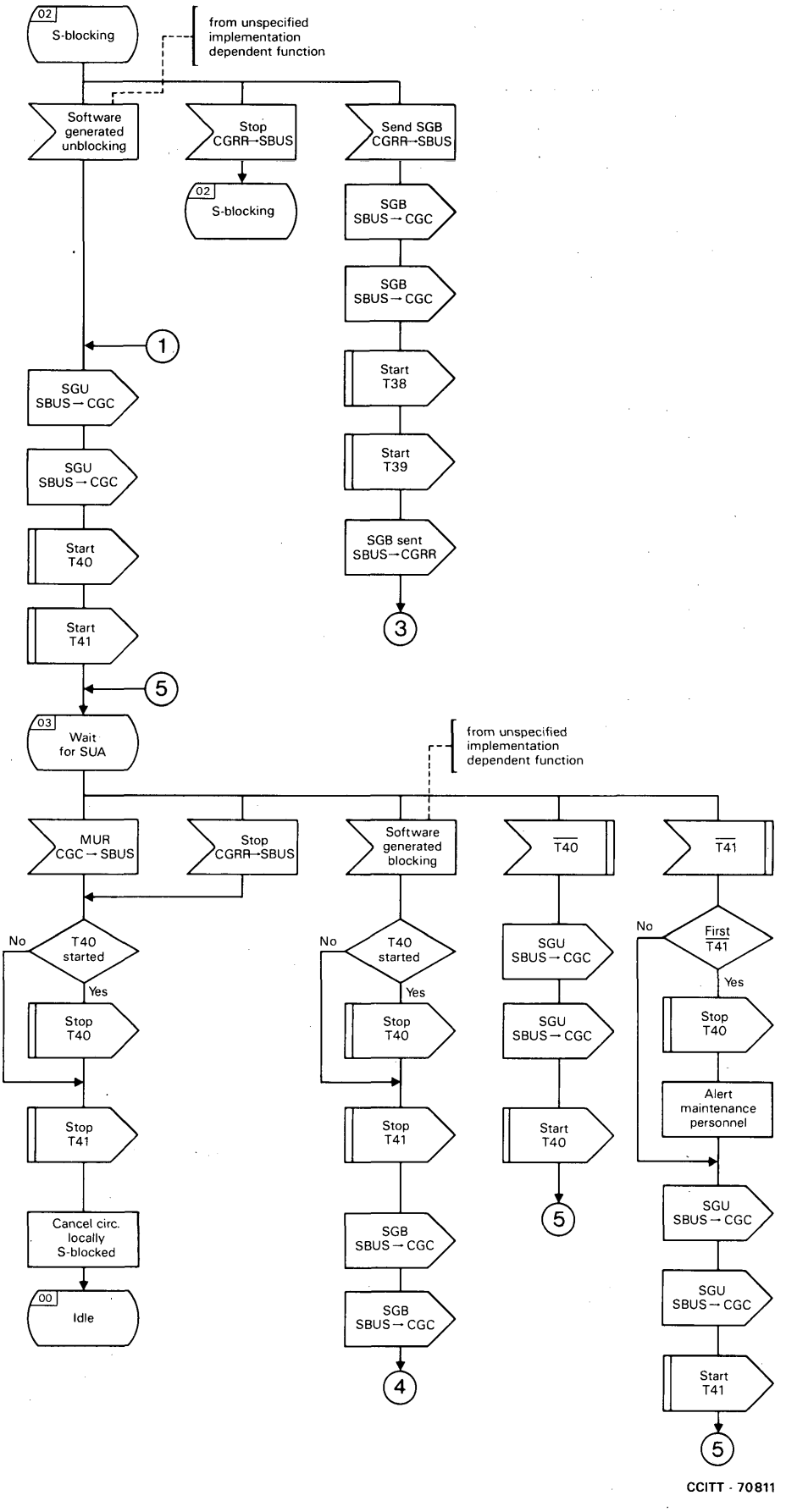


FIGURE A-10/Q.724 (Sheet 2 of 2)

Software generated circuit group blocking and unblocking sending (SBUS) (National option)

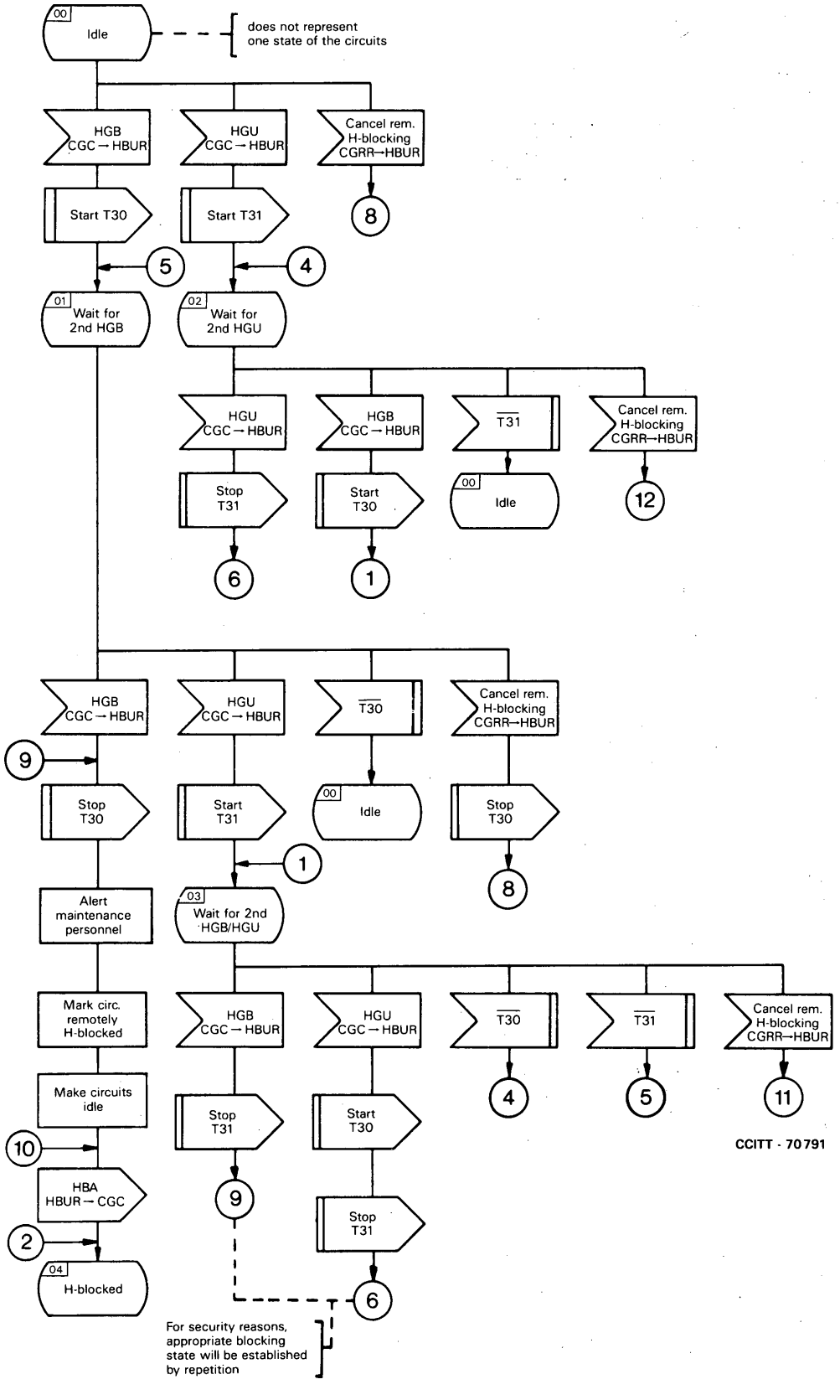


FIGURE A-11/Q.724 (Sheet 1 of 2)

Software generated circuit group blocking and unblocking receipt (SBUR) (National option)

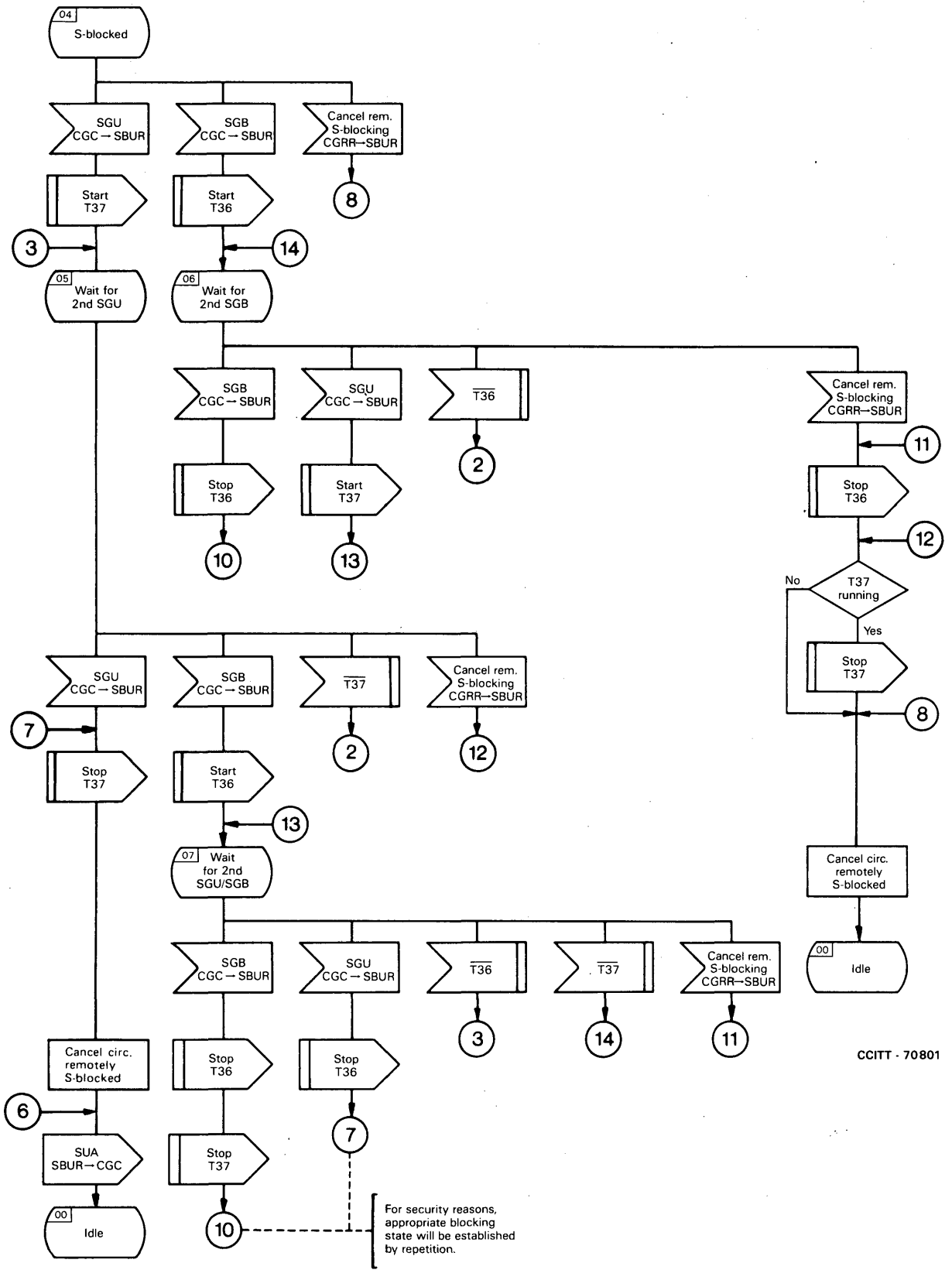


FIGURE A-11/Q.724 (Sheet 2 of 2)

Software generated circuit group blocking and unblocking receipt (SBUR) (National option)

References

[1] CCITT Recommendation *Sending sequence of numerical (or address) signals*, Vol. VI, Rec. Q.107.

[2] CCITT Recommendation *Performance requirements*, Vol. VI, Rec. Q.504.

[3] CCITT Recommendation *Special release arrangements*, Vol. VI, Rec. Q.118.

[4] CCITT Recommendation *Overflow-alternative, routing-rerouting automatic repeat attempt*, Vol. VI, Rec. Q.12.

[5] CCITT Recommendation *Interruption control*, Vol. VI, Rec. Q.416.

Recommendation Q.725

SIGNALLING PERFORMANCE IN THE TELEPHONE APPLICATION

1 Introduction

This Recommendation gives the requirements of the telephone application of Signalling System No. 7.

In Recommendation Q.706, the Message Transfer Part performance is described. The Message Transfer Part is the basis of the telephone application of Signalling System No. 7 and provision of a signalling network to serve the telephone service must take account of the performance of the Message Transfer Part and the requirements of the telephone application. For example, taking account of the message transfer times detailed in Recommendation Q.706 and the requirements for message transfer times between two telephone exchanges, a figure may be derived for the total permissible number of signalling links in signalling relations in tandem for a particular call.

2 Unsuccessful calls due to signalling malfunction

The proportion of calls that are unsuccessful due to signalling malfunction should be less than 1 in 10^5.

By means of error detection (see Recommendation Q.703) as well as transmission fault indication (see Recommendations G.732 [1] and G.733 [2]), it is ensured that, overall, not more than one error in 10^8 of all signal units transmitted is accepted and will cause false operation.

Unsuccessful calls may be caused by undetected errors, loss of messages or messages delivered out of sequence (during emergency situations within the signalling network) and may result in:

- incomplete call set-up,
- misrouted calls (e.g. connection of wrong numbers),
- calls routed correctly but mishandled (e.g. false clearing).

3 Unavailability of a signalling route set

The overall unavailability of a signalling route set causing the unavailability of a signalling relation should not exceed a total of 10 minutes per year.

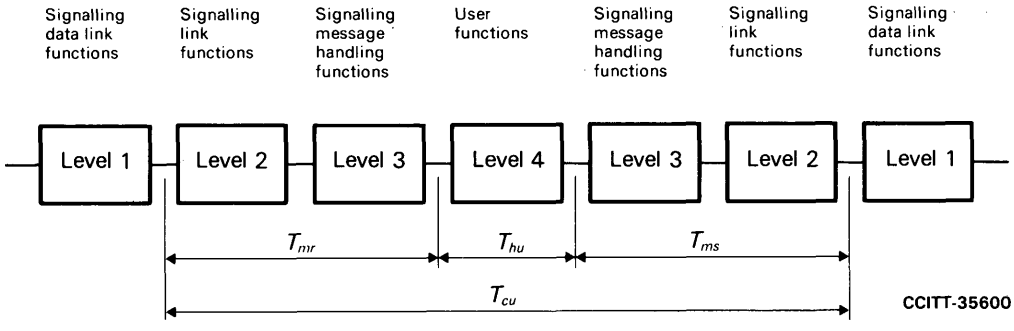
Note – The availability of a signalling route set within a signalling network may be enhanced by replication of signalling links, signalling paths and signalling routes.

4 Labelling potential

The label of the Telephone User Part of Signalling System No. 7 provides the potential to identify 16 384 signalling points and up to 4096 speech circuits for each signalling relation.

5 Cross-office transfer time

5.1 *Functional reference points and transfer time components*



T_{cu} Cross-office transfer time

T_{hu} Telephone User Part handling time

T_{mr} Message Transfer Part receiving time [a]

T_{ms} Message Transfert Part sending time [a]

[a] The definitions of these times are given in Recommendation Q.706.

FIGURE 1/Q.725

Functional diagram of the cross-office transfer time

5.2 *Definitions*

a) **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.

b) **user handling time, T_{hu}**

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

5.3 *Queueing delay*

The formulae for the queueing delays are described in Recommendation Q.706, § 4.2.

The telephone traffic model assumed is given in Table 1/Q.725, from which the proportion of signal messages may be obtained as shown in Table 2/Q.725. Using Table 2/Q.725, examples of queueing delays are calculated as shown in Figures 2/Q.725 to 5/Q.725, where one call attempt per second per 64 kbit/s signalling data link may yield 0.00577 Erlang of the traffic loading of each channel.

5.4 *Estimates for message transfer time*

The figures in Table 3/Q.725 are related to a signalling bit rate of 64 kbit/s.

5.5 *Effect of retransmission*

As a consequence of correction by retransmission, not more than one in 10^4 signals should be delayed more than 300 ms as a long-term average. This requirement refers to each signalling link.

This requirement is laid down in order to ensure satisfactory answer delays.

TABLE 1/Q.725

Traffic model

Sending procedure			"En bloc"				Overlap			
Type of call			AW	SB	CC	AB	AW	SB	CC	AB
Per cent calls			30	10	5	5	30	10	5	5
Messages per call		Length (bits)								
	12-digit IAM	176	1	1	1	0				
	6-digit IAM	152					1	1	1	1
	3-digit SAM	128					1	1	0	1
	1-digit SAM	112					3	3	0	0
	Address complete	112	1	1	0	0	1	1	0	0
	Others	104	3,5	2	3	0	3,5	2	3	2

Note – AW Answered,
SB Subscriber busy and not answered,
CC Circuit congestion,
AB Abortive.

The assumptions used in this model are chosen for illustrative purposes, and should not be considered to be typical.

TABLE 2/Q.725

Proportion of messages

Length (bits)	176	152	128	112	104	Total
Messages per call in both directions	0.45	0.5	0.45	2.0	2.9	6.3
Percent	7.1	7.9	7.1	31.7	46.0	100
Mean message length (T_m)	117.2 bits					
k_1	1.032					
k_2	1.107					

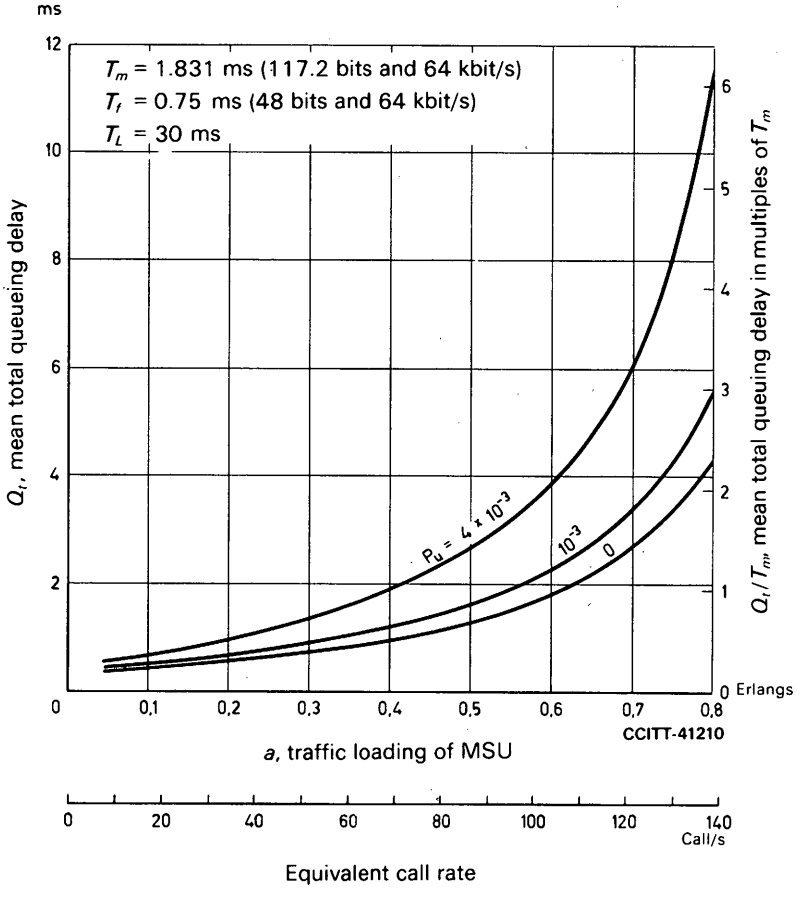
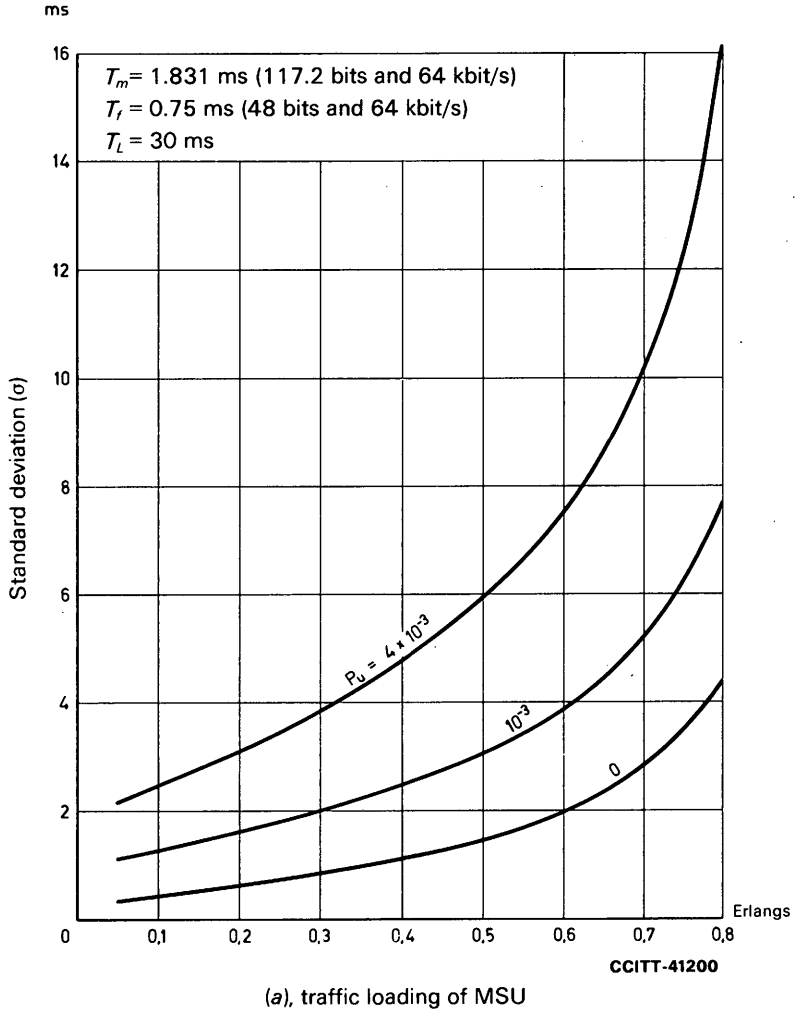


FIGURE 2/Q.725

Mean total queueing delay of each channel of traffic; basic error correction method



(*a*), traffic loading of MSU

FIGURE 3/Q.725

Standard deviation of queueing delay of each channel of traffic; basic error correction method

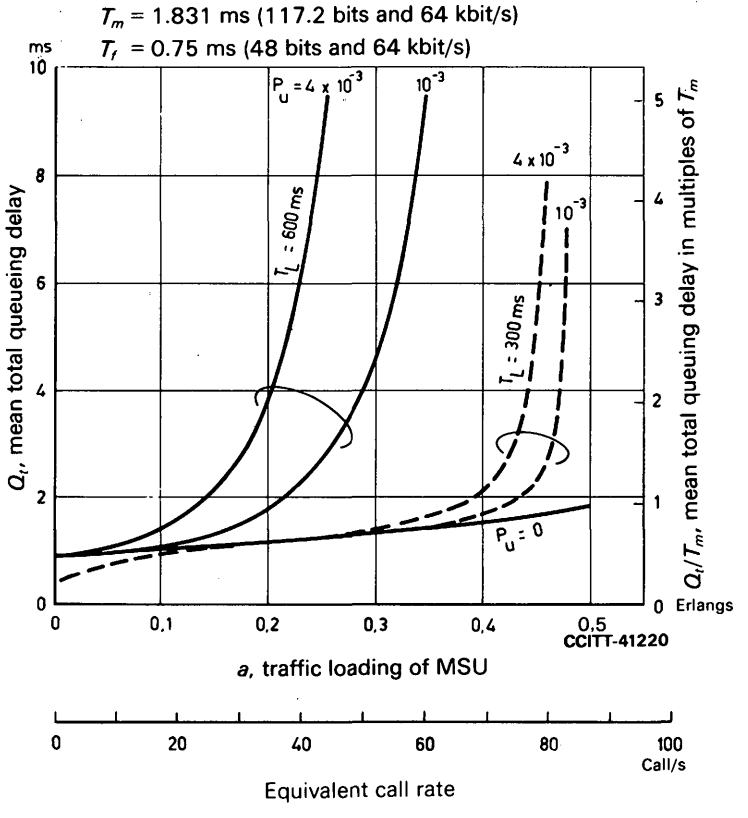


FIGURE 4/Q.725

Mean total queueing delay of each channel of traffic; preventive cyclic retransmission error correction method

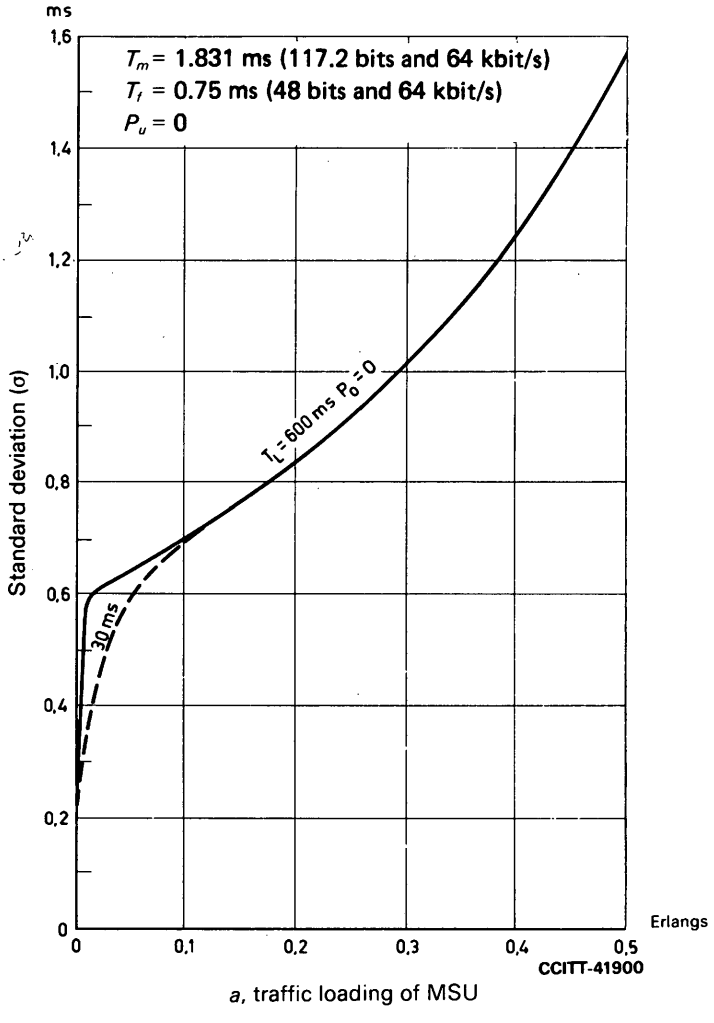


FIGURE 5/Q.725

Standard deviation of queueing delay of each channel of traffic: preventive cyclic retransmission error correction method

TABLE 3/Q.725

Message type	Exchange call attempt loading	Cross-office transfer time T_{cu} (ms) [a]	
		Mean	95%
Simple (e.g. answer)	Normal +15% +30%	110 165 275	220 330 550
Processing intensive (e.g. IAM)	Normal +15% +30%	180 270 450	360 540 900

[a] Provisional values.

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Rec. G.732.

[2] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Rec. G.733.

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SECTION 3

DATA USER PART (DUP)

Recommendation Q.741

SIGNALLING SYSTEM No. 7 – DATA USER PART

(This Recommendation appears in Fascicle VIII.4 of the Red Book, as Recommendation X.61.)

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SECTION 5

INTEGRATED SERVICES DIGITAL NETWORK USER PART (ISDN UP)

Recommendation Q.761

FUNCTIONAL DESCRIPTION OF THE ISDN USER PART OF SIGNALLING SYSTEM No. 7

1 General

The ISDN User Part encompasses the signalling functions required to provide switched services and user facilities for voice and non-voice applications in an integrated services digital network.

The ISDN User Part is also suited for application in dedicated telephone and circuit switched data networks and in analogue and mixed analogue/digital networks.

The ISDN User Part meets all requirements of service features, user facilities and network capabilities defined by CCITT for world wide international semiautomatic and automatic telephone traffic and for data transmission services.

The ISDN User Part is furthermore suitable for national applications. Most signalling procedures, information elements and message types specified for international use are also required in typical national applications. Moreover certain signals and procedures which were found to be needed in many national applications, and may in future also be used in the international network, have been specified and for the time being, have been classified for basic national use. In addition the system has sufficient flexibility and spare capacity to accommodate further national requirements.

The ISDN User Part makes use of the services provided by the MTP and in some cases by the SCCP for the transfer of information between ISDN User Parts.

Recommendations Q.761 to Q.766 specify the ISDN User Part. A general description of ISDN User Part signals and messages is provided in Recommendation Q.762. Message formats and message field codings are specified in Recommendation Q.763 while signalling procedures are described in Recommendation Q.764. The remaining two Recommend ations Q.765[1] and Q.766 deal with ISDN User Part flow control procedures and performance objectives, respectively.

2 Services supported by the ISDN User Part

2.1 *Basic service*

The basic service offered by the ISDN User Part is the control of circuit switched network connections between subscriber line exchange terminations. The standardized connection types are 64 kbit/s transparent and 64 kbit/s non-transparent. The latter is used for voice communication where the connection may include bit manipulating devices such as echo suppressors. Allowance has been made in the protocol to accommodate additional connection types, such as sub-rate channels, that may be subject to future standardization. The 64 kbit/s transparent connection may be used to carry any one of the standard user classes defined in Recommendation X.1.

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[1] Recommendation Q.765 has still to be drafted.

2.2 *User facilities and network capabilities*

In addition to the basic service the ISDN User Part also supports the following:

- user accessed calling party address identification;
- user accessed called party address identification;
- redirection of calls;
- connect when free waiting allowed;
- completion of calls to busy subscribers;
- malicious call identification;
- closed user groups.

A description of these services is given in Recommendation Q.764, § 4.

3 End-to-end signalling

End-to-end signalling is defined as the capability to transfer signalling information directly between the end points of a circuit switched connection or between signalling points that are not interconnected by a circuit switched connection.

End-to-end signalling is used typically between the ISDN User Parts located in call originating and terminating local exchanges, to request or to respond to requests for additional call related information or to transfer user-to-user information transparently through the network.

The means for connection-oriented or connectionless transport of end-to-end signalling information is provided by the services of the signalling connection control part (SCCP) and the message transfer part of System No. 7 as defined in Recommendations Q.711 to Q.714 and Q.701 to Q.706, respectively.

An alternative method for transporting end-to-end signalling information is called passalong. This service is provided within the ISDN User Part and is independent of the SCCP. With this method, signalling information is sent along the signalling path of a previously established physical connection.

End-to-end signalling between ISDN User Parts is described in Recommendation Q.764, § 3.

Recommendation Q.762

GENERAL FUNCTION OF MESSAGES AND SIGNALS

This Recommendation describes the elements of signalling information used by the ISDN User Part protocol and their function. The encoding of these elements, the format of the messages in which they are conveyed and their application in the ISDN User Part signalling procedures are described in Recommendations Q.763 and Q.764.

1 Signalling messages

1.1 *Address complete message*

A message sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received.

1.2 *Answer message*

A message sent in the backward direction indicating that the call has been answered. In semiautomatic working this signal has a supervisory function. In automatic working this signal is used in conjunction with charging information in order to:

- start metering the charge to the calling subscriber (ref. Recommendation Q.28), and
- to start measurement of call duration for international accounting purposes (Recommendation E.260).

1.3 *Blocking message*

A message sent for maintenance purposes to the exchange at the other end of a circuit, to cause an engaged condition of that circuit for subsequent calls outgoing from that exchange. An exchange receiving the blocking message must be capable of accepting incoming calls on the concerned circuit unless it has also sent a blocking message. Under certain conditions, a blocking message is also a proper response to a reset circuit message.

1.4 *Blocking acknowledgement message*

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

1.5 *Call modification completed message*

A message sent in response to a call modification request message indicating that the requested call modification (e.g. from voice to data) has been completed.

1.6 *Call modification request message*

A message sent in either direction indicating a calling or called party request to modify the characteristics of an established call (e.g. from data to voice).

1.7 *Charge information message*

Information sent in either direction for accounting and/or call charging purposes.

1.8 *Circuit group blocking message*

A message sent for maintenance purposes to the exchange at the other end of an identified group of circuits to cause an engaged condition of this group of circuits for subsequent calls outgoing from that exchange. An exchange receiving a circuit group blocking message must be able to accept incoming calls on the group of blocked circuits unless it has also sent a blocking message. Under certain conditions, a circuit group blocking message is also a proper response to a reset circuit message.

1.9 *Circuit group blocking acknowledgement message*

A message sent in response to a circuit group blocking signal to indicate that the requested group of circuits has been blocked.

1.10 *Circuit group unblocking message*

A message sent to the exchange at the other end of an identified group of circuits to cause cancellation in that group of circuits of an engaged condition invoked earlier by a circuit group blocking message.

1.11 *Circuit group unblocking acknowledgement message*

A message sent in response to a circuit group unblocking signal to indicate that the requested group of circuits has been unblocked.

1.12 *Closed user group selection and validation request message*

A message sent to a data base by an originating local exchange prior to setting up a closed user group call, to request information regarding the validity of the call and, if applicable, to obtain the interlock code of the calling party.

1.13 *Closed user group selection and validation response message*

A message sent by a data base in response to a closed user group selection and validation request indicating whether or not the call is valid and, if applicable, the interlock code of the calling subscriber.

1.14 *Continuity message*

A message sent in the forward direction indicating continuity of the preceding System No. 7 speech circuit(s) as well as of the selected speech circuit to the following international exchange, including verification of the speech path across the exchange with the specified degree of reliability.

1.15 *Continuity check request message*

A message sent by an exchange for a circuit on which a continuity check is to be performed, to the exchange at the other end of the circuit, requesting continuity checking equipment to be attached.

1.16 *Delayed release message*

A message sent in either direction indicating that the subscriber has disconnected but that the network is holding the connection.

1.17 *Facility accepted message*

A message sent from an exchange to another exchange or from a data base to an exchange indicating that the requested facility has been invoked.

1.18 *Facility deactivated message*

A message sent to deactivate a previously invoked facility.

1.19 *Facility information message*

A message sent to request or respond to a request for additional information related to a given facility.

1.20 *Facility reject message*

A message sent from an exchange to another exchange or from a data base to an exchange in response to a facility request message to indicate that the facility request has been rejected.

1.21 *Facility request message*

A message sent from an exchange to another exchange or from an exchange to a data base to request activation of a facility.

1.22 *Forward transfer message*

A message sent in the forward direction on semiautomatic calls when the outgoing international exchange operator wants the help of an operator at the incoming international exchange. The message will normally serve to bring an assistance operator (see Recommendation Q.101) into the circuit if the call is automatically set up at the exchange. When the call is completed via an operator (incoming or delay operator) at the incoming international exchange, the message should preferably cause this operator to be recalled.

1.23 *Information message*

A message sent to convey additional call related information, which may have been requested in an information request message.

1.24 *Information request message*

A message sent by an exchange to request additional call related information.

1.25 *Initial address message*

A message sent in the forward direction to initiate seizure of an outgoing circuit and to transmit address and other information relating to the routing and handling of a call.

1.26 *Pass along message*

A message that may be sent in either direction to transfer information between two signalling points along the same signalling path as that used to establish a physical connection between those two points.

1.27 *Pause message*

A message sent in either direction indicating that the subscriber's terminal has been temporarily disconnected.

1.28 *Reject connect modify message*

A message sent in response to a call modification request message indicating that the request has been rejected.

1.29 *Release message*

A message sent in either direction indicating that the circuit identified in the message is being released. An exchange receiving this message should also release the indicated circuit and any other circuits connected to it.

1.30 *Release complete message*

A message sent in either direction in response to the receipt of a released message, or if appropriate to a reset circuit message, when the circuit concerned has been brought into the idle condition.

1.31 *Released message*

A message sent in either direction, usually following the transmission of a release message, to indicate that the circuit has been released and is ready to be put in the idle state on receipt of the release complete message.

1.32 *Reset circuit message*

A message that is sent to release a circuit when, due to memory mutilation or other causes, it is unknown whether for example, a released or a release complete message is appropriate. If, at the receiving end, the circuit is blocked, reception of this message should cause that condition to be removed.

1.33 *Reset circuit group message*

A message sent to release an identified group of circuits when, due to memory mutilation or other causes, it is unknown which of the clearing signals is appropriate for each of the circuits in the group. Circuits that are blocked at the receiving end should be unblocked on receiving that message.

1.34 *Reset circuit group acknowledgement message*

A message sent in response to a reset circuit group message and indicating either that the requested group of circuits has been reset or that resetting of the circuit group has been started and that the resulting status of each circuit will be reported by appropriate call supervision, circuit supervision or circuit group supervision messages.

1.35 *Resume message*

A message sent in either direction indicating that the subscriber, after having sent a pause message, is reconnected.

1.36 *Subsequent address message*

A message that may be sent in the forward direction following an initial address message, to convey additional calling party address information.

1.37 *Unblocking message*

A message sent to the exchange at the other end of a circuit to cancel, in that exchange, the engaged condition of the circuit caused by a previously sent blocking message.

1.38 *Unblocking acknowledgement message*

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

1.39 *Unsuccessful backward set-up information message*

A message sent in the backward direction indicating that call set-up was unsuccessful for the reason (cause) given in the message. In case the call was forwarded or is to be rerouted, the appropriate indicator is carried in the message together with the redirection address and the called party address.

1.40 *User-to-user information message*

This message is for further study.

2 Signalling information

2.1 *Access barred*

Information sent in the backward direction indicating that the call cannot be completed because a compatibility check failed.

2.2 *Address incomplete*

Information sent in the backward direction indicating that the number of address signals received is not sufficient for setting up the call. This condition may be determined in the incoming international exchange (or in the national destination network):

- immediately after reception of an ST signal, or
- on time-out after the last received digit.

2.3 *Address presentation restricted indicators*

Information sent in either direction to indicate that the address information is not to be presented externally to the network.

2.4 *Address signal*

An element of information in a network address. The address signal may indicate digit values 0 to 9, code 11 or code 12. One address signal value is reserved to indicate end of pulsing (ST).

2.5 *Call failure indicator*

Information sent in the backward direction indicating call set-up failure due to a fault not covered by a specific indication.

2.6 *Call forwarding indicator*

Information indicating that the call has been forwarded to another address.

2.7 *Call identity*

Information sent in the call reference parameter indicating the identity of a call in a signalling point.

2.8 *Call reference*

Circuit independent information identifying a particular call.

2.9 *Call rerouting indicator*

Information indicating that the call must be rerouted to a different address.

2.10 *Called party address*

Information to identify the called party.

2.11 *Called party address request indicator*

Information sent in the forward direction indicating a request for the called party address to be returned.

2.12 *Called party address response indicator*

Information sent in response to a request for the called party address, indicating whether the requested address is included, not included or not available.

2.13 *Called party free indicator*

Information sent in a facility information message to indicate that a called party which had been busy is now free.

2.14 *Called party's category indicator*

Information sent in the backward direction indicating the category of the called party, e.g., ordinary subscriber or added payphone.

2.15 *Called party's status indicator*

Information sent in the backward direction indicating the status of the called party, e.g., subscriber free, call waiting or connect when free.

2.16 *Calling party address*

Information sent in the forward direction to identify the calling party.

2.17 *Calling party address request indicator*

Information sent in the backward direction indicating a request for the calling party address to be returned. This request may be coupled with a request to hold the connection.

2.18 *Calling party address response indicator*

Information sent in response to a request for the calling party address, indicating whether the requested address is included, not included, not available or incomplete and, if connection hold has been requested, whether or not hold has been provided.

2.19 *Calling party answer*

Information sent in facility information message to indicate that the calling party has answered.

2.20 *Calling party's category*

Information sent in the forward direction indicating the category of the calling party and, in case of semiautomatic calls, the service language to be spoken by the incoming, delay and assistance operators.

2.21 *Calling party's category request indicator*

Information sent in the backward direction indicating a request for the calling party's category to be returned.

2.22 *Calling party's category response indicator*

Information sent in response to a request for the calling party's category, indicating whether or not the requested information is included in the response.

2.23 *Cause indicator*

Information sent in the backward direction indicating the cause for the failure of an unsuccessful call attempt, e.g., circuit group congestion.

2.24 *CCBS call indicator*

Information sent in facility related messages indicating that the concerned facility is call completion to busy subscribers (CCBS).

2.25 *Charge indicator*

Information sent in the backward direction indicating whether or not the call is chargeable.

2.26 *Charge information request indicator*

Information sent in either direction requesting charge information to be returned.

2.27 *Charge information response indicator*

Information sent in response to a request for charge information indicating whether or not the requested information is included.

2.28 *Circuit group congestion*

Information sent in the backward direction indicating call set-up failure due to congestion encountered on an international circuit group.

2.29 *Circuit group supervision message type indicator*

Information sent in a circuit group blocking or unblocking message, indicating whether blocking (unblocking) is maintenance oriented, hardware oriented or software oriented.

2.30 *Circuit identification code*

Information identifying the physical path between a pair of exchanges.

2.31 *Closed user group call indicator*

Information sent in response to a closed user group selection and validation request, indicating whether or not the concerned call can be set up as a closed user group call and, if a closed user group call, whether or not outgoing access is allowed.

2.32 *Closed user group check indicator*

Information sent in response to a closed user group selection and validation request, indicating whether or not the validation request was successful.

2.33 *Closed user group interlock code*

Information uniquely identifying a closed user group within a network.

2.34 *Connection request*

Information sent in the forward direction on behalf of the signalling connection control part requesting the establishment of an end-to-end connection.

2.35 *Continuity check indicator*

Information sent in the forward direction indicating whether or not a continuity check will be performed on the circuit(s) concerned or is being (has been) performed on a previous circuit in the connection.

2.36 *Continuity indicator*

Information sent in the forward direction indicating whether or not the continuity check on the outgoing circuit was successful. A continuity check successful indication also implies continuity of the preceding circuit and successful verification of the path across the exchange with the specified degree of reliability.

2.37 *Credit indicator*

Information sent in a connection request, indicating the window size requested for an end-to-end connection.

2.38 *Divergence indicator*

Information sent from a data base in response to a closed user group selection and validation request message indicating that divergent closed user group data is stored at the data base and the exchange.

2.39 *Echo suppressor indicator*

Information sent in the forward direction indicating whether or not an outgoing half-echo suppressor is included in the connection.

2.40 *End-to-end information indicator*

Information sent in either direction indicating whether or not the sending exchange has further call information available for end-to-end transmission.

2.41 *End-to-end method indicator*

Information sent in either direction indicating the available methods, if any, for end-to-end transfer of information.

2.42 *Facility indicator*

Information sent in facility related messages identifying the facility or facilities with which the message is concerned.

2.43 *In call modification indicator*

Information sent in the forward direction indicating whether or not in call modification, i.e., transition from a voice to a data call or vice versa, is possible.

2.44 *Index*

Information sent in closed user group selection and validation messages identifying a particular closed user group.

2.45 *Index request indicator*

Information sent in the backward direction to request the transfer of an index.

2.46 *Interworking indicator*

Information sent in either direction indicating whether or not Signalling System No. 7 is used in all parts of the connection.

2.47 *ISDN user part indicator*

Information sent in the forward direction to indicate that the ISDN User Part is required in all parts of the connection.

2.48 *Line out of service*

Information sent in the backward direction indicating that the called party's line is out of service or faulty.

2.49 *Local reference*

Information sent in the connection request, indicating the local reference allocated by the signalling connection control part to an end-to-end connection.

2.50 *Malicious call identification request indicator*

Information sent in the backward direction to request the identity of the calling party for the purpose of malicious call identification.

2.51 *Misdialled trunk prefix*

Information sent in the backward direction indicating the erroneous inclusion of a trunk prefix (for national use only).

2.52 *National network congestion*

Information sent in the backward direction indicating failure of the call set-up attempt due to congestion encountered in the national destination network (excluding the busy condition of the called party).

2.53 *National/international call indicator*

Information sent in the forward direction indicating whether the call is an incoming international or an incoming national call.

2.54 *Nature of address indicator*

Information sent in association with an address indicating the nature of that address, e.g., ISDN international number, ISDN national significant number, or ISDN subscriber number.

2.55 *Normal call indicator*

Information sent in response to a closed user group selection and validation request, indicating that the call is to be treated as an ordinary call.

2.56 *Odd/even indicator*

Information sent in association with an address, indicating whether the number of address messages contained in the address is even or odd.

2.57 *Original address*

Information sent in the forward direction indicating the address towards which the call was originally routed (i.e., before redirection of the call occurred).

2.58 *Original address request indicator*

Information sent in the backward direction indicating a request for the original address to be returned.

2.59 *Point code*

Information sent in the call reference parameter indicating the code of the signalling point in which the call identity allocated to the call reference is relevant.

2.60 *Protocol class*

Information sent in the connection request parameter indicating the protocol class requested for the end-to-end connection.

2.61 *Protocol control indicator*

Information consisting of the end-to-end method indicator, the interworking indicator, the end-to-end information indicator and the ISDN User Part indicator.

2.62 *Range*

Information sent in a circuit group supervision message (e.g. circuit group blocking) to indicate the range of circuits affected by the action in the message.

2.63 *Redirection address*

Information sent in the backward direction indicating the address towards which the call must be rerouted or has been forwarded.

2.64 *Redirection indicator*

Information sent in the backward direction indicating whether the call has been forwarded or rerouted and whether or not connected party address presentation is restricted.

2.65 *Reverse holding indicator*

Information sent in the backward direction indicating that reverse holding of the connection is requested.

2.66 *Routing label*

Information provided to the message transfer part for the purpose of message routing (see Recommendation Q.704, § 1.2).

2.67 *Satellite indicator*

Information sent in the forward direction indicating the number of satellite circuits in the connection.

2.68 *Send special information tone*

Information sent in the backward direction indicating that the special information tone should be returned to the calling party. This tone indicates that the called party cannot be reached for reasons that are of long-term nature (see also Recommendation Q.35).

2.69 *Signalling point code (national use)*

Information sent in an unsuccessful backward set-up information message to identify the signalling point in which the call failed.

2.70 *Status*

Information sent in a circuit group supervision message (e.g., circuit group blocking) to indicate the specific circuits, within the range of circuits state in the message, that are affected by the action specified in the message.

2.71 *Subscriber busy*

Information sent in the backward direction indicating that the called party is busy for the requested ISDN service. The subscriber busy indication will also be sent in case discrimination between a subscriber busy and national network congestion condition is not possible.

2.72 *Switching equipment congestion*

Information sent in the backward direction indicating call set-up failure due to congestion encountered at international switching equipment.

2.73 *Transmission medium indicator*

Information sent in the forward direction indicating the type of transmission medium required for the connection (e.g. 64 kbit/s transparent, 64 kbit/s non-transparent).

2.74 *Unallocated number*

Information sent in the backward direction indicating that the called party address is not in use.

2.75 *User class indicator*

Information sent in the forward direction, indicating the user class of service of the calling party (for further study).

2.76 *User-to-user information*

Information generated by a user and transferred transparently through the interexchange network between the originating and terminating local exchanges.

2.77 *Voice/data indicator*

Information sent in the in-call modification indicators parameter, indicating whether the call modification is from voice to data or data to voice.

ANNEX A

(to Recommendation Q.762)

Table of messages and mandatory or optional parameters in the ISDN UP messages

ISDN UP message acronym list

Mandatory or optional parameters in the ISDN UP messages

Parameter: / Message:	Sub-field	Group	Forward address		General set up			Backward set up		Call supervision			Circuit supervision						Circuit group supervision			In call modification						Node-to-node			User-to-user
Field		Type Ref.	IAM	SAM	INR	INF	COT	ACM	CRG	ANN	FOT	UBM	REL DRS	RLC RLSD	CCR RSC	BLO UBL	BLA UBLA	PAU RES	CGB CGU	CGBA CGUA	GRS GRA	CMR CMC	RCM	FAA FAD	FAR	FRJ	FAI	CSVR	CSVS	PAM	USR
Message type			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Nature of connection indicator	Satellite indicator Continuity check indicator Echo suppressor indicator		M																											
Forward call indicator	National/international indicator End-to-end method indicator Interworking indicator End-to-end information indicator ISDN user part indicator		M																											
Backward call indicator	Charge indicator Called line status indicator Called line category End-to-end method indicator Interworking indicator End-to-end information indicator ISDN user part indicator Reverse holding indicator							M		M																				
Information request indicator	Calling party address request indicator Called party address request indicator Calling party category request indicator Charge information request indicator Original address request indicator Index request indicator Malicious call ID request indicator Reverse holding indicator				M																									
Information indicator	Calling party address response indicator Called party address response indicator Called party category response indicator Charge information response indicator Original address response indicator Index response indicator					M																								
Facility indicator																							M	M	M	M				
Call modification indicator																					M	M								
Cause indicator												M													M					
Facility information indicator	Called party free Calling party answer Facility request enquiry Facility request active																									M				
CUG check response indicator	Access indicator Divergence indicator Check success indicator Normal call indicator CUG call indicator																											M		
Calling party category			M			O																								
Transmission medium requirements	Transmission medium indicator In call modification indicator		M																											
User service information	User class indicator High level service indicator		O																											
Call reference			O		O	O		O		O	O	O	O							O	O	O	O	O	O	O	O	O		
Called party address	Odd/even indicator		M			O		O				O											M	M	O	O	M	M		
Calling party address	Nature of address indicator		O			O																	M	M	O	O	M	M		
Original address	Address signals		O																											
Redirection address												O																		
Subsequent address	Odd/even indicator Address signals			M																										
Charge information						O																								
Compatibility information																							M	M	O					
Optional forward call indicator	CUG call indicator Call rerouting indicator Call forwarding indicator CCBS call indicator Calling party adr. pres. res. indicator Calling party adr. incom. indicator Called party adr. request indicator		O																											
Address presentation restricted indicator	Calling party adr. pres. res. indicator Called party adr. pres. res. indicator Original address pres. res. indicator Redirection address pres. res. indicator		O			O						O																		
Continuity indicator							M																							
Redirection indicator								O				O																		
Circuit group supervision message type indicator																			M	M										
CUG interlock code	Binary code ISDN identifier		O																									O		
Range and status	Range Status																		M	M	M									
Index																											O	O		
Compatibility information			O																											
Connection request			O		O	O		O																						
User to user information			O	O		O		O		O																				
Signalling point code												O																		

TABLE A-2/Q.762

ISDN user part message acronym list

English	*French*	*Spanish*	
ACM	ACO	MDC	Address complete (§ 1.1)
ANM	REP	RST	Answer (§ 1.2)
BLA	BLA	ARB	Blocking acknowledgement (§ 1.4)
BLO	BLO	BLO	Blocking (§ 1.3)
CCR	CCD	PPC	Continuity check request (§ 1.15)
CGB	BLG	BGC	Circuit group blocking (§ 1.8)
CGBA	BGA	ARBG	Circuit group blocking acknowledgement (§ 1.9)
CGU	DBF	DGC	Circuit group unblocking (§ 1.10)
CGUA	DGA	ARDG	Circuit group unblocking acknowledgement (§ 1.11)
CMC	MAE	MLC	Call modification completed (§ 1.5)
CMR	MAD	PML	Call modification request (§ 1.6)
COT	CCP	CON	Continuity (§ 1.14)
CRG	TAX	TAS	Charging (Note)
CSVR	SGVD	PSVG	Closed user group selection and validation request (§ 1.12)
CSVS	SGVR	RSVG	Closed user group selection and validation response (§ 1.13)
DRS	LID	LID	Delayed release (§ 1.16)
FAA	SUAC	FAA	Facility accepted (§ 1.17)
FAD	SUDS	FAD	Facility deactivated (§ 1.18)
FAI	SUIN	INFA	Facility information (§ 1.19)
FAR	SUDM	PFA	Forward request (§ 1.21)
FOT	IOP	INT	Forward transfer (§ 1.22)
FRJ	SURF	RFA	Facility reject (§ 1.20)
GRA	RZA	ARRG	Reset circuit group acknowledgement (§ 1.34)
GRS	RZG	RGC	Reset circuit group (§ 1.33)
IAM	MIA	MID	Initial address (§ 1.25)

TABLE A-2/Q.762 *(cont.)*

English	*French*	*Spanish*	
INF	INF	INF	Information (§ 1.23)
INR	IND	PIN	Information request (§ 1.24)
PAM	FAP	MDP	Pass along (§ 1.26)
PAU	PAU	PAU	Pause (§ 1.27)
RCM	MAR	RMC	Reject connect modify (§ 1.28)
REL	LIB	LIB	Release (§ 1.29)
RES	RPR	REA	Resume (§ 1.35)
RLC	LIT	LIC	Release complete (§ 1.30)
RLSD	DCX	LDO	Released (§ 1.31)
RSC	RZC	RCI	Reset circuit (§ 1.32)
SAM	MSA	MSD	Subsequent address (§ 1.36)
UBL	DBO	DBL	Unblocking (§ 1.37)
UBA	DBA	ARD	Unblocking acknowledgement (§ 1.38)
UBM	EAR	MEI	Unsuccessful backward set-up information (§ 1.39)
USR	UAU	IUU	User-to-user information (Note)

Note – Message for further study.

TABLE A-3/Q.762

Signalling information

Signalling information	Reference (§)
Access barred	2.1
Address incomplete	2.2
Address presentation restricted indicators	2.3
Address signal	2.4
Call failure indicator	2.5
Call forwarding indicator	2.6
Call identity	2.7
Call reference	2.8
Call rerouting indicator	2.9
Called party address	2.10
Called party address request indicator	2.11
Called party address response indicator	2.12
Called party free indicator	2.13
Called party's category indicator	2.14
Called party's status indicator	2.15
Calling party address	2.16
Calling party address request indicator	2.17
Calling party address response indicator	2.18
Calling party answer	2.19
Calling party's category	2.20
Calling party's category request indicator	2.21
Calling party's category response indicator	2.22
Cause indicator	2.23
CCBS call indicator	2.24
Charge indicator	2.25
Charge information request indicator	2.26
Charge information response indicator	2.27
Circuit group congestion	2.28
Circuit group supervision message type indicator	2.29
Circuit identification code	2.30
Closed user group call indicator	2.31
Closed user group check indicator	2.32
Closed user group interlock code	2.33
Connection request	2.34
Continuity check indicator	2.35
Continuity indicator	2.36
Credit indicator	2.37
Divergence indicator	2.38
Echo suppressor indicator	2.39
End-to-end information indicator	2.40
End-to-end method indicator	2.41
Facility indicator	2.42
In call modification indicator	2.43
Index	2.44

TABLE A-3/Q.762 *(cont.)*

Signalling information	Reference (§)
Index request indicator	2.45
Interworking indicator	2.46
ISDN user part indicator	2.47
Line out of service	2.48
Local reference	2.49
Malicious call identification request indicator	2.50
Misdialled trunk prefix	2.51
National network congestion	2.52
National/international call indicator	2.53
Nature of address indicator	2.54
Normal call indicator	2.55
Odd/even indicator	2.56
Original address	2.57
Original address request indicator	2.58
Point code	2.59
Protocol class	2.60
Protocol control indicator	2.61
Range	2.62
Redirection address	2.63
Redirection indicator	2.64
Reverse holding indicator	2.65
Routing label	2.66
Satellite indicator	2.67
Send special information tow	2.68
Signalling point code (national use)	2.69
Status	2.70
Subscriber busy	2.71
Switching equipment congestion	2.72
Transmission medium indicator	2.73
Unallocated number	2.74
User class indicator	2.75
User-to-user information	2.76
Voice/data indicator	2.77

FORMATS AND CODES

1 General

ISDN user part messages are carried on the signalling link by means of signal units, the format of which is described in Recommendation Q.703, § 2.2.

The format of and the codes used in the service information octet are described in Recommendation Q.704, § 12.2. The service indicator for the ISDN user part is coded 0 1 0 1.

The signalling information field of each message signal unit containing an ISDN user part message consists of an integral number of octets and encompasses the following parts (see Figure 1/Q.763):

a) routing label;

b) circuit identification code;

c) the mandatory fixed part;

d) the mandatory variable part;

e) the optional part, which may contain fixed length and variable length parameter fields.

Note – The service information octet, the routing label and circuit identification code are not included in the information transferred between the ISDN user part and signalling connection control part.

A description of the various message parts is given in the following sections.

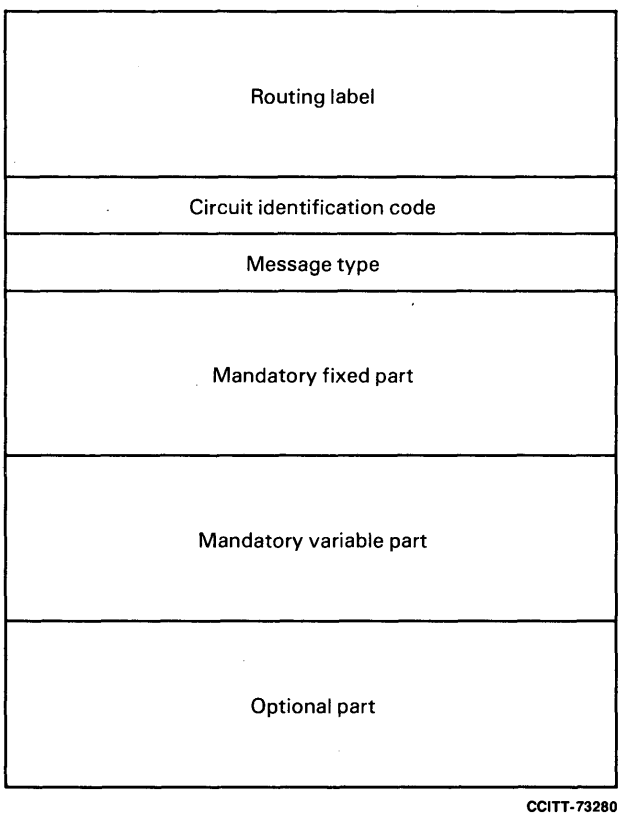

FIGURE 1/Q.763

ISDN user part message parts

1.1 *Routing label*

The format and codes used for the routing label are described in Recommendation Q.704, § 2.2. For each individual circuit connection, the same routing label must be used for each message that is transmitted for that connection.

1.2 *Circuit identification code*

The format of the circuit identification code is shown in Figure 2/Q.763.

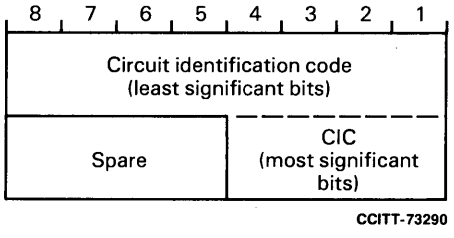

FIGURE 2/Q.763

Circuit identification field

The allocation of circuit identification codes to individual circuits is determined by bilateral agreement and/or in accordance with applicable predetermined allocations.

Allocations for certain applications are defined below:

a) *2048 kbit/s digital path*

For circuits which are derived from a 2048 kbit/s digital path (Recommendations G.732 [1] and G.734 [2] the channel 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 speech circuit. The remaining bits in the channel identification code are used where necessary, to identify one among several systems interconnecting an originating and destination point.

b) *8448 kbit/s digital path*

For circuits which are derived from a 8448 kbit/s digital path (Recommendation G.744 [3] and G.747 [4] the channel identification code contains in the 7 least significant bits an identification of the channel which is assigned to the speech circuit. The codes in Table 1/Q.763 are used.

The remaining bits are used, where necessary, to identify one among several systems interconnecting an originating and destination point.

TABLE 1/Q.763

0 0 0 0 0 0 0	channel 1
0 0 0 0 0 0 1	channel 2
⋮	⋮
0 0 1 1 1 1 1	channel 32
0 1 0 0 0 0 0	channel 33
⋮	⋮
1 1 1 1 1 1 0	channel 127
1 1 1 1 1 1 1	channel 128

c) *Frequency division multiplex (FDM) systems in networks using the 2048 kbit/s pulse code modulation standard*

For frequency division multiplex systems existing in networks that also use the 2048 kbit/s pulse code modulation standard, the channel identification code contains in the 6 least significant bits the identification of a channel within a group of 60 channels carried by 5 basic frequency division multiplex groups which may or may not be part of the same supergroup.

The codes in Table 2/Q.763 are used.

TABLE 2/Q.763

0 0 0 0 0 0	unallocated	
0 0 0 0 0 1 ⋮ 0 0 1 1 0 0	channel 1 ⋮ channel 12	1st basic (FDM) group
0 0 1 1 0 1 0 0 1 1 1 0 0 0 1 1 1 1 0 1 0 0 0 0 0 1 0 0 0 1 ⋮ 0 1 1 0 0 1	channel 1 channel 2 channel 3 unallocated channel 4 ⋮ channel 12	2nd basic (FDM) group
0 1 1 0 1 0 ⋮ 0 1 1 1 1 1 1 0 0 0 0 0 1 0 0 0 0 1 ⋮ 1 0 0 1 1 0	channel 1 ⋮ channel 6 unallocated channel 7 ⋮ channel 12	3rd basic (FDM) group
1 0 0 1 1 1 ⋮ 1 0 1 1 1 1 1 1 0 0 0 0 1 1 0 0 0 1 1 1 0 0 1 0 1 1 0 0 1 1	channel 1 ⋮ channel 9 unallocated channel 10 channel 11 channel 12	4th basic (FDM) group
1 1 0 1 0 0 ⋮ 1 1 1 1 1 1	channel 1 ⋮ channel 12	5th basic (FDM) group

1.3 *Message type code*

The message type code consists of a one octet field and is mandatory for all messages. The message type code uniquely defines the function and format of each ISDN user part message.

The allocation with reference to the appropriate descriptive section of this Recommendation is summarized in Table 3/Q.763.

1.4 *Formatting principles*

Each message consists of a number of PARAMETERS listed and described in Section 2. Each parameter has a NAME which is coded as a single octet (see Table 4/Q.763). The length of a parameter may be fixed or variable, and a LENGTH INDICATOR of one octet for each parameter may be included as described below.

The detailed format is uniquely defined for each message type as described in § 3.

A general format diagram is shown in Figure 3/Q.763.

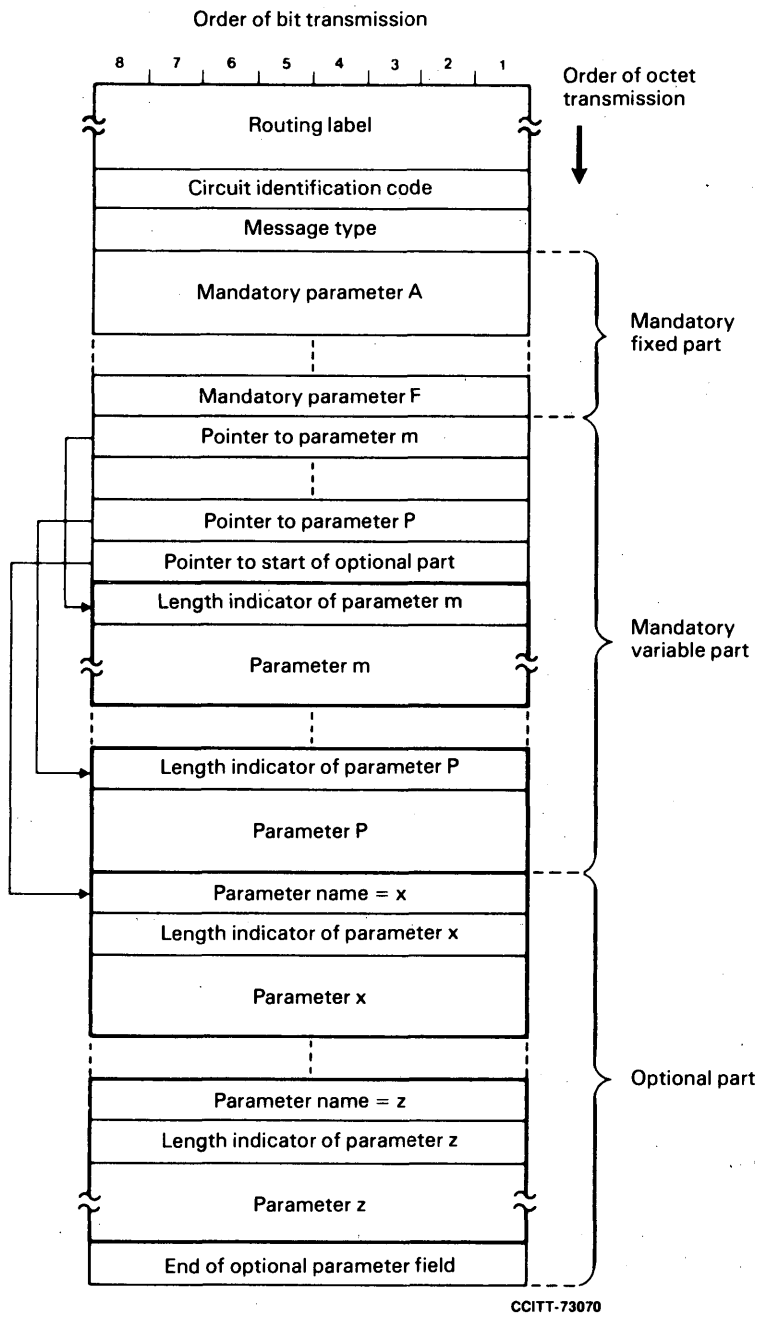

FIGURE 3/Q.763

1.5 *Fixed mandatory part*

Those parameters that are mandatory and of fixed length for a particular message type will be contained in the *fixed mandatory part.* The position, length and order of the parameters is uniquely defined by the message type, thus the names of the parameters and the length indicators are not included in the message.

1.6 *Variable mandatory part*

Mandatory parameters of variable length will be included in the *variable mandatory part. Pointers* are used to indicate the beginning of each parameter. Each pointer is encoded as a single octet. The name of each parameter and the order in which the pointers are sent is implicit in the message type. Parameter names are, therefore, not included in the message. The details of how pointers are encoded is found in § 2.3. The number of parameters, and thus the number of pointers is uniquely defined by the message type.

A pointer is also included to indicate the beginning of the optional part. If the message type indicates that no optional part is allowed, then this pointer will not be present. If the message type indicates that an optional part is possible, but there is no optional part included in this particular message then a pointer field containing all zeros will be used.

All the pointers are sent consecutively at the beginning of the variable mandatory part. Each parameter contains the parameter length indicator followed by the contents of the parameter.

1.7 *Optional part*

The optional part consists of parameters that may or may not occur in any particular message type. Both fixed length and variable length parameters may be included. Optional parameters may be transmitted in any order. Each optional parameter will include the parameter name (one octet) and the length indicator (one octet) followed by the parameter contents.

1.8 *End of optional parameters octet*

After all optional parameters have been sent an "end of optional parameters" octet containing all zeros will be transmitted.

1.9 *Order of transmission*

Since all the fields consist of an integral number of octets, the formats are presented as a stack of octets. The first octet transmitted in the one shown at the top of the stack and the last is the one at the bottom (see Figure 3/Q.763).

Within each octet the bits are transmitted with the least significant bit first.

1.10 *Coding of spare bits*

Spare bits are coded 0 unless indicated otherwise.

1.11 *National message types and parameters*

If message type codes and parameter codes are required for national uses, the codes chosen should be from the highest code downwards, that is, starting at code 11111111.

2 Parameter formats and codes

2.1 *Message type codes*

The encoding of the message type parameter is shown in Table 3/Q.763.

TABLE 3/Q.763

Message type	Reference (Table)	Code
Address complete	5/Q.763	00000110
Answer	6/Q.763	00001001
Blocking	18/Q.763	00010011
Blocking acknowledgement	18/Q.763	00010101
Call modification completed	19/Q.763	00011101
Call modification request	19/Q.763	00011100
Charging	Note	
Circuit group blocking	20/Q.763	00011000
Circuit group blocking acknowledgement	20/Q.763	00011010
Circuit group unblocking	20/Q.763	00011001
Circuit group unblocking acknowledgement	20/Q.763	00011011
Closed user group selection and validation request	7/Q.763	00100101
Closed user group selection and validation response	8/Q.763	00100110
Continuity	9/Q.763	00000101
Continuity check request	18/Q.763	00010001
Delayed release	17/Q.763	00100111
Facility accepted	22/Q.763	00100000
Facility deactivated	22/Q.763	00100010
Facility information	10/Q.763	00100011
Facility reject	11/Q.763	00100001
Facility request	22/Q.763	00011111
Forward transfer	17/Q.763	00001000
Information	12/Q.763	00000100
Information request	13/Q.763	00000011
Initial address	14/Q.763	00000001
Pass along	23/Q.763	00101000
Pause	17/Q.763	00001101
Reject connect modify	19/Q.763	00011110
Release	17/Q.763	00001011
Release complete	18/Q.763	00010000
Released	18/Q.763	00001111
Reset circuit	18/Q.763	00010010
Reset circuit group	21/Q.763	00010111
Reset circuit group acknowledgement	21/Q.763	00101001
Resume	17/Q.763	00001110
Subsequent address	15/Q.763	00000010
Unblocking	18/Q.763	00010100
Unblocking acknowledgement	18/Q.763	00010110
Unsuccessful backward set-up information	16/Q.763	00001010
User-to-user information	Note	

Note – For further study.

2.2 *Coding of the length indicator*

The length indicator field is binary coded to indicate the number of octets in the parameter content field. The length indicator does not include the parameter name octet or the length indicator octet.

2.3 *Coding of the pointers*

The pointer value (in binary) gives the number of octets between the pointer itself (included) and the first octet (not included) of the parameter associated with that pointer.

The pointer value all zeros is used to indicate that, in the case of optional parameters, no optional parameter is present.

3 ISDN user part parameters

3.1 *Parameter names*

The parameter name codes are given in Table 4/Q.763 together with references to the subsections in which they are described.

TABLE 4/Q.763

Parameter name	Reference (§)	Code
Address presentation restriction indicators	3.2	00011111
Backward call indicators	3.3	00010001
Call modification indicators	3.4	00010111
Call reference	3.5	00000001
Called party address	3.6	00000100
Calling party address	3.7	00001010
Calling party's category	3.8	00001001
Cause indicator	3.9	00010100
Charge information (Note 2)	3.10	
Circuit group supervision message type indicator	3.11	00010101
Closed user group check response indicators	3.12	00011100
Closed user group interlock code	3.13	00011010
Compatibility information (Note 2)	3.14	
Connection request	3.15	00001101
Continuity indicators	3.16	00010000
End of optional parameters	3.17	00000000
Facility indicator	3.18	00011000
Facility information indicators	3.19	00011001
Forward call indicators	3.20	00000111
Index	3.21	00011011
Information indicators	3.22	00001111
Information request indicators	3.23	00001110
Nature of connection indicators	3.24	00000110
Optional forward call indicators	3.25	00001000
Original address	3.26	00001011
Range and status	3.27	00010110
Redirection address	3.28	00001100
Redirection indicator	3.29	00010011
Signalling point code (Note 1)	3.30	00011110
Subsequent address	3.31	00000101
Transmission medium requirements indicators	3.32	00000010
User service information	3.33	00011101
User-to-user information (Note 2)	3.34	

Note 1 – For national use only.

Note 2 – For further study.

3.2 *Address presentation restriction indicators*

The format of the address presentation restriction indicators parameter field is shown in Figure 4/Q.763.

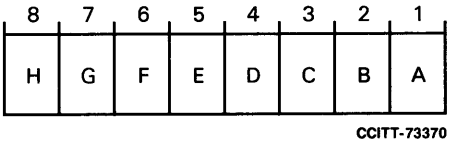

FIGURE 4/Q.763

Address presentation restriction indicators parameter field

The following codes are used in the address presentation restriction parameter field:

bit A: Calling party address presentation restricted indication
0 presentation allowed
1 presentation restricted

bit B: Called party address presentation restricted indication
0 presentation allowed
1 presentation restricted

bit C: Original address presentation restricted indication
0 presentation allowed
1 presentation restricted

bit D: Redirection address presentation restricted indication
0 presentation allowed
1 presentation restricted

bits H-E: Spare

3.3 *Backward call indicators*

The format of the backward call indicators parameter field is shown in Figure 5/Q.763.

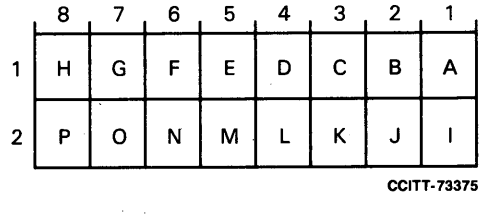

FIGURE 5/Q.763

Backward call indicators parameter field

The following codes are used in the backward call indicators parameter field:

bits B A: Charge indicator
- 0 0 no indication
- 0 1 no charge
- 1 0 charge

bits D C: Called line status indicator
- 0 0 no indication
- 0 1 subscriber free
- 1 0 connect when free
- 1 1 spare

bits F E: Called line category
- 0 0 no indication
- 0 1 ordinary subscriber
- 1 0 payphone
- 1 1 spare

bits H G: End-to-end method indicator (Note)
- 0 0 no end-to-end method available
- 0 1 pass along method available
- 1 0 SCCP method available
- 1 1 pass along and SCCP methods available

bit I: Interworking indicator (Note)
- 0 no interworking encountered
- 1 interworking encountered

bit J: End-to-end information indicator (Note)
- 0 no end-to-end information available
- 1 end-to-end information available

bit K: ISDN User Part Indicator (Note)
- 0 ISDN User Part not used all the way
- 1 ISDN User Part used all the way

bit L: Reverse holding indicator
- 0 reverse holding not required
- 1 reverse holding required

bits M-P: Spare

Note – Bits G-K constitute the protocol control indicator.

3.4 *Call modification indicators*

The format of the call modification indicators parameter field is shown in Figure 6/Q.763.

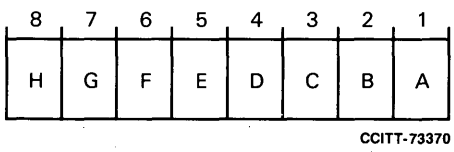

FIGURE 6/Q.763

Call modification indicators parameter field

The following codes are used in the call modification indicators parameter field:

bits B A: Voice/data indicator
- 0 0 spare
- 0 1 modify voice to data
- 1 0 modify data to voice
- 1 1 spare

bits H-C: spare

3.5 *Call reference*

The format of the call reference parameter is shown in Figure 7/Q.763.

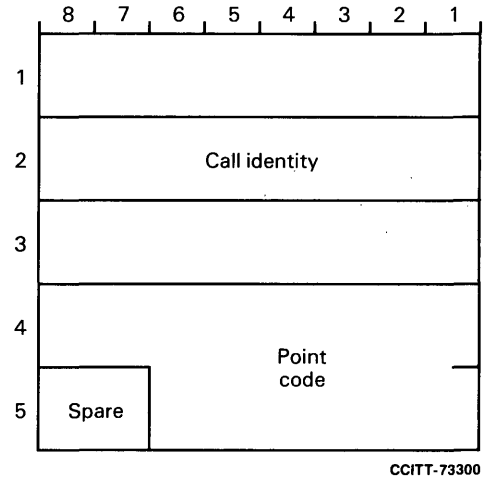

FIGURE 7/Q.763

Call reference parameter field

The following codes are used in the subfields of the call reference parameter field:

a) *Call identity*

A code expressing in pure binary representation the identification number allocated to the call.

b) *Point code*

The code of the signalling point in which the call identity is relevant.

3.6 *Called party address*

The format of the called party address parameter field is shown in Figure 8/Q.763.

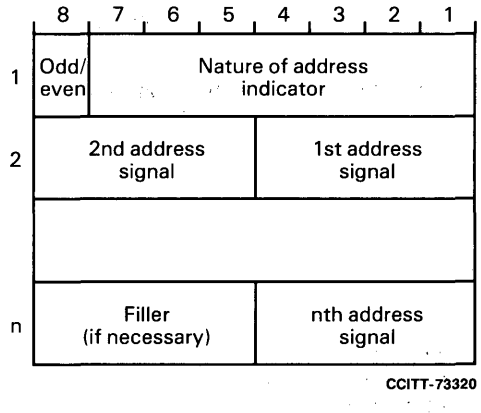

FIGURE 8/Q.763

Called party address parameter field

The following codes are used in the subfields of the called party parameter field:

a) *Odd/even (O/E) indicator*

0 even number of address signals
1 odd number of address signals

b) *Nature of address indicator*

0000000	spare
0000001	subscriber number
0000010	spare, reserved for national use
0000011	national (significant) number
0000100	international number
0000101 to 11111111	spare

c) *Address signal*

0000	digit 0
0001	digit 1
0010	digit 2
0011	digit 3
0100	digit 4
0101	digit 5
0110	digit 6
0111	digit 7
1000	digit 8
1001	digit 9
1010	spare
1011	code 11
1100	code 12
1101	spare
1110	spare
1111	ST

The most significant address signal is sent first. Subsequent address signals are sent in successive 4-bit fields.

d) *Filler*

In case of an odd number of address signals, the filler code 0 0 0 0 is inserted after the last address signal.

3.7 *Calling party address*

The format of the calling party address parameter field corresponds to the format shown in Figure 8/Q.763.

The following codes are used in the calling party address parameter field:

a) *Odd/even indicator*

See § 3.6 a).

b) *Nature of address indicator*

0000000	spare
0000001	subscriber number
0000010	spare, reserved for national use
0000011	national (significant) number
0000100	international number
0000101 to 11111111	spare

Note – Other types of nature of address indications (e.g. transit exchange identity) are for further study.

c) *Address signal*

0000	digit 0
0001	digit 1
0010	digit 2
0011	digit 3
0100	digit 4
0101	digit 5
0110	digit 6
0111	digit 7
1000	digit 8
1001	digit 9
1010 to 1111	spare

d) *Filler*

See § 3.5 d).

3.8 *Calling party's category*

The format of the calling party's category indicator parameter field is shown in Figure 9/Q.763.

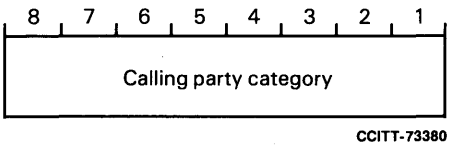

FIGURE 9/Q.763

Calling party's category parameter field

The following codes are used in the calling party's category parameter field:

00000000	calling party's category unknown
00000001	operator, language French
00000010	operator, language English
00000011	operator, language German
00000100	operator, language Russian
00000101	operator, language Spanish
00000110 00000111 00001000	available to Administrations for selecting selecting a particular language by mutual agreement
00001001	reserved (see Recommendation Q.104 ( )) (Note)
00001010	ordinary calling subscriber
00001011	calling subscriber with priority
00001100	data call (voice band data)
00001101	test call
00001110	non-voice terminal (for further study)
00001111 to 11111111	spare

Note – In national networks, code 0 0 0 0 1 0 0 1 may be used to indicate that the calling party is a national operator.

3.9 *Cause indicator*

The format of the cause indicator parameter field is shown in Figure 10/Q.763.

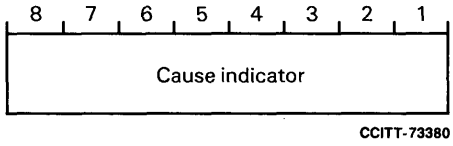

FIGURE 10/Q.763

Cause indicator parameter field

The following codes are used in the cause indicator parameter field:

00000000	spare
00000001	switching equipment congestion
00000010	circuit group congestion
00000011	national network congestion
00000100	address incomplete
00000101	call failure
00000110	subscriber busy
00000111	unallocated number
00001000	line out of service
00001001	send special information tone
00001010	access barred
00001011	closed user group validation out of service
00001100	misdialled trunk prefix
00001101 to 11111111	spare

3.10 *Charge information*

The format of the charge information parameter field is for further study.

3.11 *Circuit group supervision message type indicator*

The format of the circuit group supervision message type indicator parameter field is shown in Figure 11/Q.763.

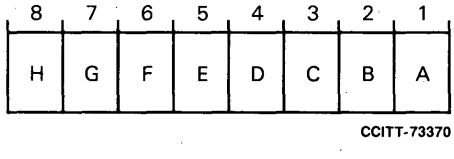

FIGURE 11/Q.763

Circuit group supervision message type indicator parameter field

The following codes are used in the circuit group supervision message type indicator parameter field:

bits B A: Type indicator
- 0 0 maintenance oriented
- 0 1 hardware failure oriented
- 1 0 software generated
- 1 1 spare

bits C-H: spare

3.12 *Closed user group check response indicators*

The format of the closed user group check response indicator parameter field is shown in Figure 12/Q.763.

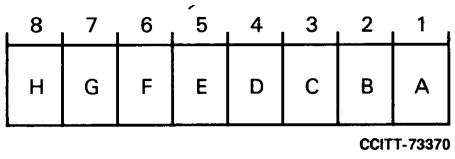

FIGURE 12/Q.763

Closed user group check response indicators parameter field

The following codes are used in the closed user group check response indicators parameter field:

bit A: Access indicator
0 access barred
1 access allowed

bit B: Divergence indicator
0 divergence
1 no divergence

bit C: Check successful indicator
0 check unsuccessful
1 check successful

bit D: Normal call indicator
0 not a normal call
1 normal call

bits F E: Closed user group call indicator
0 0 spare
0 1 closed user group call
1 0 closed user group call, outgoing access allowed
1 1 closed user group call, outgoing access not allowed

bits H G: Spare

3.13 *Closed user group interlock code*

The format of the closed user group interlock code parameter field is shown in Figure 13/Q.763.

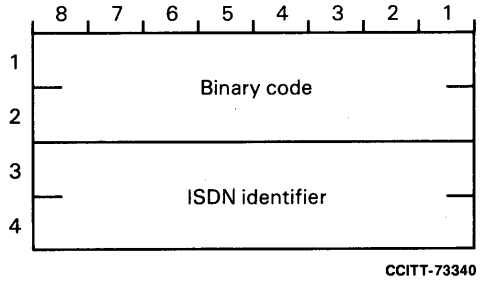

FIGURE 13/Q.763

Closed user group interlock code

The following codes are used in the subfields of the closed user group interlock code parameter field:

a) *Binary code*

A code allocated to a closed user group in a particular ISDN.

b) *ISDN identifier*

A code identifying a particular ISDN (for further study).

3.14 *Compatibility information*

The format of the compatibility information parameter is for further study.

3.15 *Connection request*

The format of the connection request parameter field is shown in Figure 14/Q.763.

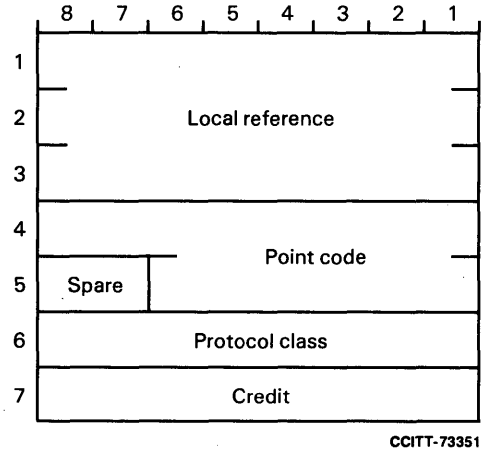

FIGURE 14/Q.763

Connection request parameter field

The following codes are used in the subfields of the connection request parameter field:

a) *Local reference*

A code indicating the local reference allocated by the signalling connection control part to the end-to-end connection.

b) *Point code*

A code identifying the signalling point at which the connection request originated.

c) *Protocol class*

A code identifying in pure binary representation, the protocol class requested for the end-to-end connection.

d) *Credit*

A code identifying in pure binary representation the window size requested for the end-to-end connection.

Note – The credit subfield is required only for protocol class 3 and class 4.

3.16 *Continuity indicators*

The format of the continuity indicators parameter field is shown in Figure 15/Q.763.

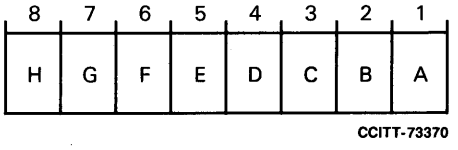

FIGURE 15/Q.763

Continuity indicators parameter field

The following codes are used in the continuity indicators parameter field:

bit A: Continuity indicator
0 continuity check failed
1 continuity check successful

bits B-H: Spare

3.17 *End of optional parameter fields indicator*

The last optional parameter field of a message is followed by the end of optional parameter fields indicator, which occupies a one-octet field containing all zeros.

3.18 *Facility indicator*

The format of the facility indicator parameter field is shown in Figure 16/Q.763.

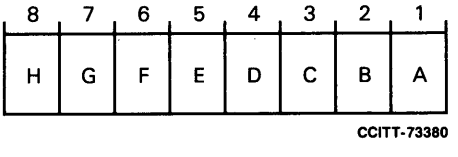

FIGURE 16/Q.763

Facility indicator parameter field

The following codes are used in the facility indicator parameter field:

00000000 spare
00000001 completion of calls to busy subscriber

00000010 to 11111111 spare

3.19 *Facility information indicators parameter field*

The format of the facility information indicators parameter field is shown in Figure 17/Q.763.

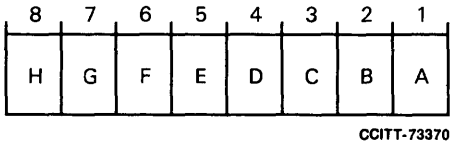

FIGURE 17/Q.763

Facility information indicators parameter field

The following codes are used in the facility information indicators parameter subfield:

bit A: Called party free indicator
0 called party busy
1 called party free

bit B: Calling party answer indicator
0 no calling party answer
1 calling party answer

bit C: Facility request enquiry indicator
0 no enquiry
1 facility request active?

bit D: Facility request active indicator
0 facility request not active
1 facility request active

bits E-H: Spare

3.20 *Forward call indicators*

The format of the forward call indicators parameter field is shown in Figure 18/Q.763.

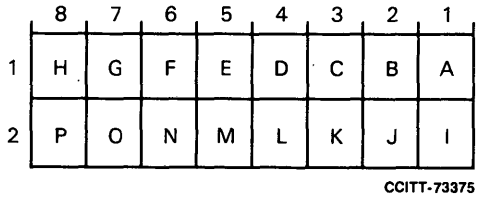

FIGURE 18/Q.763

Forward call indicators parameter field

The following codes are used in the forward call indicators parameter field:

bit A: National/international call indicator
0 incoming national call
1 incoming international call

bits C B: End-to-end method indicator (Note)
0 0 no end-to-end method available
0 1 pass along method available
1 0 SCCP method available
1 1 pass along and SCCP methods available

bit D: Interworking indicator (Note)
0 no interworking encountered (No. 7 signalling all the way)
1 interworking encountered

bit E: End-to-end information indicator (Note)
0 no end-to-end information available
1 end-to-end information available

bit F: ISDN user part indicator (Note)
0 ISDN user part not used all the way
1 ISDN user part used all the way

bits G-L: Spare

bits M-P: Reserved for national use

Note – Bits B-F constitute the protocol control indicator.

3.21 *Index*

The format of the index parameter field is shown in Figure 19/Q.763.

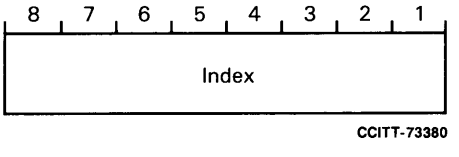

FIGURE 19/Q.763

Index parameter field

The code used in the index parameter field is a number in pure binary representation, which identifies one of several possible closed user groups accessible to a subscriber.

3.22 *Information indicators*

The format of the information indicators parameter field is shown in Figure 20/Q.763.

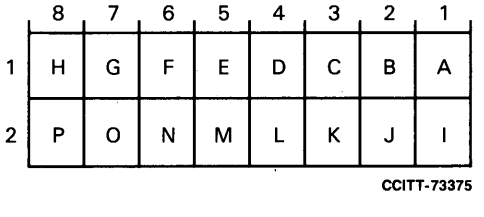

FIGURE 20/Q.763

Information indicators parameter field

The following codes are used in the information indicators parameter field:

bits C B A: Calling party address response indicator
- 0 0 0 calling party address not included
- 0 0 1 calling party address not available
- 0 1 0 spare
- 0 1 1 calling party address included, hold not provided
- 1 0 0 calling party address included, hold provided
- 1 0 1 to 1 1 1 spare

bits E D: Called party address response indicator
- 0 0 called party address not included
- 0 1 called party address not available
- 1 0 spare
- 1 1 called party address included

bit F: Calling party's category response indicator
- 0 calling party's category not included
- 1 calling party's category included

bit G: Charge information response indicator
- 0 charge information not included
- 1 charge information included

bits I H: Original address response indicator
- 0 0 original address not included
- 0 1 original address not available
- 1 0 spare
- 1 1 original address included

bit J: Index response indicator
- 0 index not included
- 1 index included

bits K-P: Spare

3.23 *Information request indicators*

The format of the information request indicators parameter field is shown in Figure 21/Q.763.

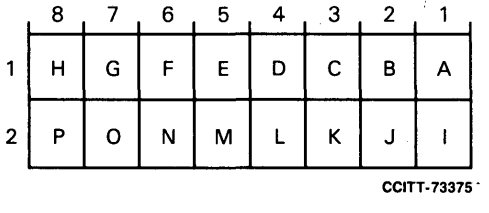

FIGURE 21/Q.763

Information request indicators parameter field

The following codes are used in the information request indicators parameter field:

bits B A: Calling party address request indicator
- 0 0 calling party address not requested
- 0 1 calling party address requested, hold not required
- 1 1 calling party address requested, hold required

bit C: Called party address indicator
0 called party address not requested
1 called party address requested

bit D: Calling party's category request indicator
0 calling party's category not requested
1 calling party's category requested

bit E: Charge information request indicator
0 charge information not requested
1 charge information requested

bit F: Original address request indicator
0 original address not requested
1 original address requested

bit G: Index request indicator
0 index not requested
1 index requested

bit H: Malicious call identification request indicator
0 malicious call identification not requested
1 malicious call identification requested

bit I: Reverse holding indicator
0 reverse holding of the connection not requested
1 reverse holding of the connection requested

bits J-P: Spare

3.24 *Nature of connection indicators*

The format of the nature of connection indicators parameter field is shown in Figure 22/Q.763.

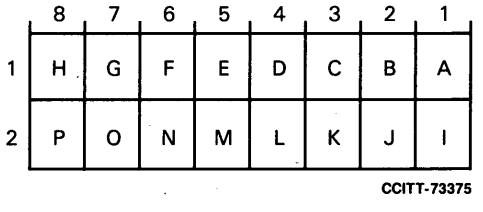

FIGURE 22/Q.763

Nature of connection indicators parameter field

The following codes are used in the nature of connection indicators parameter field:

bits B A: Satellite indicator
0 0 no satellite circuit in the connection
0 1 one satellite circuit in the connection
1 0 spare
1 1 spare

bits D C: Continuity check indicator
0 0 continuity check not required
0 1 continuity check required on this circuit
1 0 continuity check performed on a previous circuit
1 1 spare

bit E: Echo suppressor indicator
0 outgoing half echo suppressor not included
1 outgoing half echo suppressor included

bits F-H: Spare

3.25 *Optional forward call indicators*

The format of the optional forward call indicators parameter field is shown in Figure 23/Q.763.

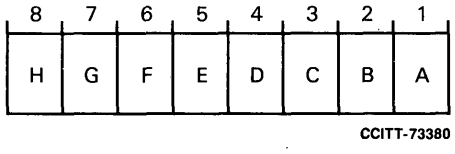

FIGURE 23/Q.763

Optional forward call indicators parameter field

The following codes are used in the optional forward call indicators parameter field:

bits B A: Closed user group call indicator
- 0 0 closed user group check successful
- 0 1 ordinary call
- 1 0 closed user group call, outgoing access allowed
- 1 1 closed user group call, outgoing access not allowed

bit C: Call rerouting indicator
- 0 non-rerouted call
- 1 rerouted call

bit D: Call forwarding indicator
- 0 call not forwarded
- 1 call forwarded

bit E: CCBS call indicator
- 0 not a CCBS call
- 1 CCBS call

bit F: Calling party address presentation restricted indicator
- 0 calling party address presentation allowed
- 1 calling party address presentation restricted

bit G: Calling party address incomplete indicator
- 0 calling party address complete
- 1 calling party address incomplete

bit H: Called party address request indicator
- 0 called party address not requested
- 1 called party address requested

3.26 *Original address*

The format of the original address parameter field corresponds to the format shown in Figure 8/Q.763.

The following codes are used in the subfields of the original address parameter field:

a) Odd/even indicator: see § 3.6 a).

b) Nature of address indicator: see § 3.6. b).

c) Address signals: see § 3.6 c), as applicable.

d) Filler: see § 3.6 d).

3.27 *Range and status*

The format of the range and status parameter field is shown in Figure 24/Q.763.

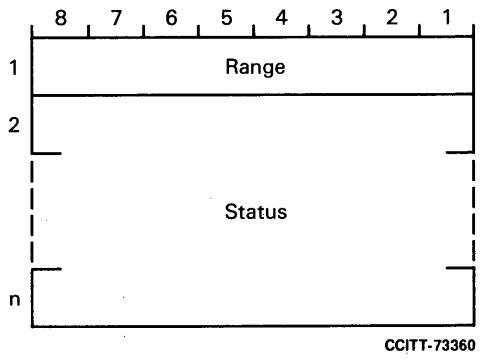

FIGURE 24/Q.763

Range and status parameter field

The following codes are used in the subfields of the range and status parameter field:

a) *Range*

A number in pure binary representation ranging from 0 to 255. Range code 0 indicates absence of the status field. The number represented by a non-zero range code + 1 indicates the range of circuits affected by the message.

b) *Status*

The status subfield contains from 1 to 256 status bits numbered from 0 to 255. Status bit 0 is located in bit position 1 of the first status subfield octet. Other status bits follow in numerical order. The number of relevant status bits in a given status subfield is equal to range +1.

Each status bit is associated with a circuit identification code such that status bit n is associated with circuit identification code m + n, where m is the circuit identification code contained in the message.

The status bits are coded as follows:

- in circuit group blocking messages
  - 0 no blocking
  - 1 blocking
- in circuit group blocking acknowledgement messages
  - 0 no blocking acknowledgement
  - 1 blocking acknowledgement
- in circuit group unblocking messages
  - 0 no unblocking
  - 1 unblocking
- in circuit group unblocking acknowledgement messages
  - 0 no blocking acknowledgement
  - 1 unblocking acknowledgement
- in circuit group reset acknowledgement messages
  - 0 no blocking
  - 1 blocking for maintenance reasons

3.28 *Redirection address*

The format of the redirection address parameter field corresponds to the format shown in Figure 8/Q.763.

The following codes are used in the redirection address parameter field:

a) Odd/even indicator: see § 3.6 a).

b) Nature of address indicator: see § 3.6 b).

c) Address signal: see § 3.6 c), as applicable.

d) Filler: see § 3.6 d).

3.29 *Redirection indicator*

The format of the redirection indicator parameter field is shown in Figure 25/Q.763.

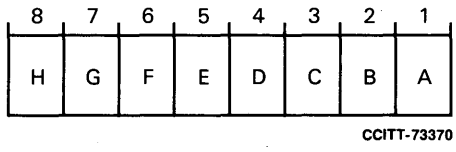

FIGURE 25/Q.763

Redirection indicator parameter field

The following codes are used in the redirection indicator parameter field:

bits C B A:	Redirection indicator
0 0 0	no redirection
0 0 1	call rerouted
0 1 0	call rerouted, connected party address restricted
0 1 1	call forwarded
1 0 0	call forwarded, connected party address restricted
1 0 1 to 1 1 1	spare
bits D-H:	Spare

3.30 *Signalling point code*

The format of the signalling point code parameter field is shown in Figure 26/Q.763.

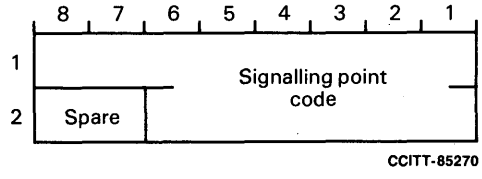

FIGURE 26/Q.763

Signalling point code

The signalling point code is a pure binary representation of the code allocated to a node in the signalling network.

3.31 *Subsequent address*

The format of the subsequent address parameter field is shown in Figure 27/Q.763.

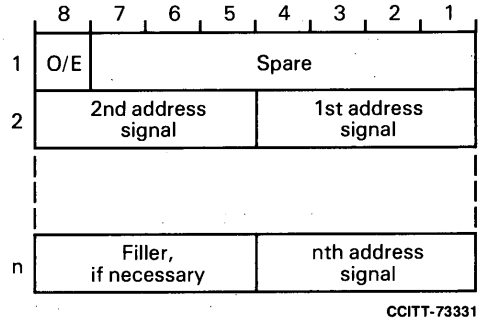

FIGURE 27/Q.763

Subsequent address parameter field

The following codes are used in the subfields of the subsequent address parameter field:

a) Odd/even indicator: see § 3.6 a).

b) Address signal: see § 3.6 c), as applicable.

c) Filler: see § 3.6 d).

3.32 *Transmission medium requirements indicators*

The format of the transmission medium requirements indicators parameter field is shown in Figure 28/Q.763.

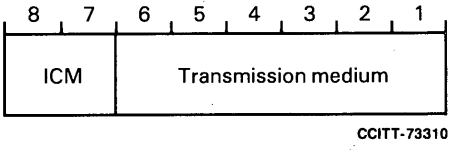

FIGURE 28/Q.763

Transmission requirement indicators parameter field

The following codes are used in the subfields of the transmission medium requirement indicators parameter field.

a) *Transmission medium indicator*

000000	spare
000001	64 kbit/s non-transparent
000010	64 kbit/s transparent
000011 to 111111	spare

b) *In call modification (ICM) indicator*

00	spare
01	voice only call
10	data only call
11	voice/data call with in-call modification

3.33 *User service information* (Note)

The format of the user service information parameter field is shown in Figure 29/Q.763.

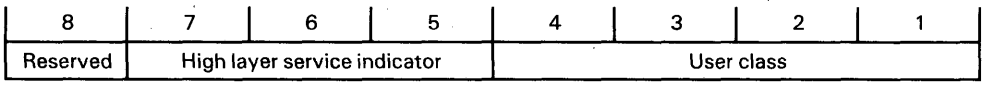

FIGURE 29/Q.763

User service information parameter field

The following codes are used in the subfields of the user service information parameter field:

a) *User class (circuit switched)*

0000	spare
0001	600 bit/s
0010	2400 bit/s
0011	4800 bit/s
0100	9600 bit/s
0101	48 000 bit/s
0110 to 1111	spare

b) *High layer service indicator* (for further study)

A code indicating a specific high layer service, e.g. Teletex.

Note – The extension of this parameter field and its relationship with the transmission medium requirements indicators parameter field are for further study.

3.34 *User-to-user information*

The format of the user-to-user information parameter is for further study.

4 ISDN user part messages and codes

4.1 *General*

4.1.1 In the following the format and coding of ISDN user part messages is specified.

For each message a list of the relevant parameters is given in a tabular form.

4.1.2 For each parameter the table also includes:

- *a reference* to the section where the formatting and coding of the parameter content is specified;
- *the type* of the parameter. The following types are used in the tables:
  F = mandatory fixed length parameter;
  V = mandatory variable length parameter;
  O = optional parameter of fixed or variable length;
- *the length* of the parameter. The value in the table includes:
  - *for type F parameters* the length, in octets, of the parameter content;
  - *for type V parameters* the length, in octets, of the length indicator and of the parameter content. The minimum and the maximum length are indicated;
  - *for type O parameters* the length, in octets, of the parameter name, length indicator and parameter content.

    For variable length parameters the minimum and maximum length is indicated.

4.1.3 For each message type, type F parameters and the pointers for the type V parameters must be sent in the order specified in the following tables.

The routing label and circuit identification code fields, which are transmitted ahead of the message type field if required are not shown. Parameter names, pointers to variable mandatory fields and length indicators appear in the message in accordance with Figure 3/Q.763 and are not shown explicitly in Tables 5-23/Q.763.

TABLE 5/Q.763

Message type: Address complete

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Backward call indicators	3.3	F	2
Called party address	3.6	O	4-11
Call reference	3.5	O	7
Connection request	3.15	O	9
User-to-user information	3.34	O	Note
Redirection indicator	3.29	O	3

Note – For further study.

TABLE 6/Q.763

Message type: Answer

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Backward call indicators	3.3	F	2
Call reference	3.5	O	7
User-to-user information	3.34	O	Note

Note – For further study.

TABLE 7/Q.763

Message type: Closed user group selection and validation request

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Called party address	3.6	V	3-10
Calling party address	3.7	V	3-10
Index	3.21	O	3
Call reference	3.5	O	7

TABLE 8/Q.763

Message type: Closed user group selection and validation response

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Closed user group check response indicators	3.12	F	1
Called party address	3.6	V	3-10
Calling party address	3.7	V	3-10
Index	3.21	O	3
Closed user group interlock code	3.13	O	6
Call reference	3.5	O	7

TABLE 9/Q.763

Message type: Continuity

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Continuity indicators	3.16	F	1

TABLE 10/Q.763

Message type: Facility information

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Facility indicator	3.18	F	1
Facility information indicator	3.19	F	1
Called party address	3.6	O	3-10
Calling party address	3.7	O	3-10
Call reference	3.5	O	7

TABLE 11/Q.763

Message type: Facility reject

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Facility indicator	3.18	F	1
Cause indicator	3.9	F	1
Called party address	3.6	O	3-10
Calling party address	3.7	O	3-10
Compatibility information	3.14	O	Note
Call reference	3.5	O	7

Note – For further study.

TABLE 12/Q.763

Message type: Information

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Information indicators	3.22	F	1
Calling party's category	3.8	O	3
Calling party address	3.7	O	4-11
Called party address	3.6	O	4-11
Charge information	3.10	O	Note
Call reference	3.5	O	7
Connection request	3.15	O	9
User-to-user information	3.34	O	Note
Address presentation restricted indicators	3.2	O	3

Note – For further study.

TABLE 13/Q.763

Message type: Information request

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Information request indicators	3.23	F	1
Call reference	3.5	O	7
Connection request	3.15	O	9

TABLE 14/Q.763

Message type: Initial address

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Nature of connection indicators	3.24	F	1
Forward call indicators	3.20	F	2
Calling party's category	3.8	F	1
Transmission medium requirements	3.32	F	1
Called party address	3.6	V	3-10
Call reference	3.5	O	7
Calling party address	3.7	O	4-11
Optional forward call indicators	3.25	O	3
Original address	3.26	O	4-11
Closed user group interlock code	3.13	O	6
Connection request	3.15	O	9
Compatibility information	3.14	O	Note
User-to-user information	3.34	O	Note
Address presentation restriction indicators	3.2	O	3
User service information	3.33	O	3

Note – For further study.

TABLE 15/Q.763

Message type: Subsequent address

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Subsequent address	3.31	V	3-10
User-to-user information	3.34	O	Note

Note – For further study.

TABLE 16/Q.763

Message type: Unsuccessful backward set-up information

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Cause indicator	3.9	F	1
Redirection indicator	3.29	O	1
Redirection address	3.28	O	4-11
Called party address	3.6	O	4-11
Call reference	3.5	O	7
Address presentation restricted indicators	3.2	O	3
Signalling point code (Note)	3.30	O	4
Closed user group interlock code	3.13	O	6

Note – For national use only.

TABLE 17/Q.763

Message type: Delayed release
Forward transfer
Pause
Release
Resume

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Call reference	3.5	O	7

TABLE 18/Q.763

Message type: **Blocking**
Blocking acknowledgement
Continuity check request
Release complete
Released
Reset circuit
Unblocking
Unblocking acknowledgement

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1

TABLE 19/Q.763

Message type: **Call modification completed**
Call modification request
Reject connect modify

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Call modification indicators	3.4	F	1
Call reference	3.5	O	7

TABLE 20/Q.763

Message type: **Circuit group blocking**
Circuit group blocking acknowledgement
Circuit group unblocking
Circuit group unblocking acknowledgement

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Circuit group supervision message type indicator	3.11	F	1
Range and status	3.27	V	3-35

TABLE 21/Q.763

Message type: **Reset circuit groupe** (Note 1)
Reset circuit group acknowledgement (Note 2)

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Range and status	3.27	V	3-35

Note 1 – In this message, the status subfield is not present.

Note 2 – In these messages, the status subfield is not present when the range code is zero.

TABLE 22/Q.763

Message type: **Facility accepted**
Facility deactivated
Facility request

Parameter	Reference (§)	Type	Length (octets)
Message type	2.1	F	1
Facility indicator	3.18	F	1
Called party address	3.6	O	3-10
Calling party address	3.7	O	3-10
Compatibility information	3.14	O	Note
Call reference	3.5	O	7

Note – For further study.

TABLE 23/Q.763

Message type: Pass along

Parameter	Reference §	Type	Length (octets)
Message type	2.1	F	1
Any of the messages defined in Tables 5-22/Q.763			

Recommendation Q.764

SIGNALLING PROCEDURES

1 General

1.1 *Relationship with other Recommendations*

This Recommendation describes the basic signalling procedures for the set-up and cleardown of national and international ISDN connections. The messages and signals are defined in Recommendation Q.762 and their format and content are given in Recommendation Q.763.

1.2 *Numbering*

The procedures described assume that the ISDN uses the international numbering plan defined for the ISDN and thus provides a basic voice service between ISDN terminals and telephony terminals which may be interconnected via the existing international telephony network.

1.3 *Address signalling*

In general, the call set-up procedure described is standard for both voice and non-voice connections using en bloc address signalling for calls between ISDN terminals. Overlap address signalling is also specified.

1.4 *Basic procedures*

The basic call control procedure is divided into three phases; call set-up, the data/conversation phase and call cleardown. Messages on the signalling link are used to establish and terminate the different phases of a call. Standard inband supervisory tones and/or recorded announcements are returned to the caller on voice connections to provide information on call progress. Calls originating from ISDN terminals may be supplied with more detailed call progress information by means of additional messages in the access protocol supported by a range of messages in the network.

1.5 *Layout of Q.764*

The procedures specified in § 2 of this Recommendation relate to basic calls (i.e. calls not involving user facilities). Section 3 of this Recommendation specifies the procedures relating to end-to-end signalling connections. The additional requirements to be met in the case of calls involving user facilities and network utilities are specified in § 4 of this Recommendation.

2 Basic call control and signalling procedures

2.1 *Successful call set-up*

2.1.1 *Forward address signalling – en bloc operation*

2.1.1.1 *Actions required at originating exchange*

a) *Circuit selection*

When the originating exchange has received the complete selection information from the calling party, and has determined that the call is to be routed to another exchange, selection of a suitable, free, inter-exchange circuit takes place and an initial address message is sent to the appropriate destination. Appropriate routing information is either stored at the originating exchange or at a remote database to which a request may be made.

Examination of the set-up message from the calling party will determine the requirements for the connection, e.g. 64 kbit/s and SS No. 7 signalling for data or voice/data connections and the ability to request In Call Modification. This information (e.g. transmission medium requirement and forward call indicators) will be included in the initial address message to permit correct routing at intermediate exchanges. The seizing function at the receiving exchange is implicit in the reception of the Initial Address Message.

b) *Address information sending sequence*

The sending sequence of address information on international calls will be the country code (not sent to an incoming international exchange) followed by the national (significant) number. On national connections, the address information may be the local number or the national (significant) number as required by the Administration concerned. For calls to international operator positions (Code 11 and Code 12) refer to Recommendation Q.107.

The end of pulsing (ST) signal will be used in en bloc operation.

c) *Initial Address Message*

The Initial Address Message (IAM) in principle contains all the information that is required to route the call to the destination exchange and connect the call to the required user.

All IAMs will include a Protocol Control Indicator (PCI). The originating exchange will set the parameters in the PCI to indicate:

(i) the type of end-to-end signalling that can be accommodated (§ 3),

(ii) the availability of CCITT No. 7 signalling,

(iii) the use of the Integrated Services User Part and

(iv) whether further information is available on request e.g. calling line identity.

The originating exchange may also include in the IAM:

(i) a local reference and point code (of the originating exchange) to enable the destination exchange to establish an end-to-end connection (§ 3),

(ii) the calling party address if this is to be passed forward without being requested and

(iii) other information related to user facilities and network utilities.

d) *Transfer of information by end-to-end protocol*

As an alternative to the inclusion of call set-up user facility information in the initial address message, any such information not to be examined at intermediate exchanges may be passed end-to-end from the originating exchange to the destination exchange (see § 3.)

e) *Completion of transmission path*

Through connection of the transmission path will be completed at the originating exchange immediately after the sending of the Initial Address Message, except in those cases where conditions on the outgoing circuit prevent it (see § 2.1.7).

2.1.1.2 *Actions required at an intermediate exchange*

a) *Circuit selection*

An intermediate exchange, on receipt of an Initial Address Message, will analyse the destination address and the other routing information (§ 2.1.1.1 a)) to determine the routing of the call. The intermediate exchange then seizes a free inter-exchange circuit and sends an Initial Address Message to the succeeding exchange.

When no echo suppressor or nature-of-circuit indication is received from a preceding circuit using a signalling system with fewer facilities, the indicators will be considered as received "no" unless positive knowledge is available.

b) *Initial Address Message*

An intermediate exchange will examine the Protocol Control Indicator (§ 2.1.1.1 c)) and, if the call is still permitted, modify the parameters in the PCI according to the capabilities that can be provided, e.g., if a Telephone User Part has been used instead of an ISDN User Part, the PCI should be modified to indicate to succeeding exchanges that different user parts have been utilised.

c) *Completion of transmission path*

Through connection of the transmission path will be completed at an intermediate exchange immediately after the Initial Address Message has been sent, except in those cases where condition on the outgoing circuit prevents it (see § 2.1.7).

d) *Congestion*

In the case of congestion at an intermediate exchange, it will send an unsuccessful backward set-up information message to the preceding exchange indicating congestion and initiating release of the call at that exchange.

2.1.1.3 *Actions required at the destination exchange*

a) *Selection of called party*

Upon receipt of an Initial Address Message the destination exchange will analyse the destination address to determine to which party the call should be connected. It will also check the called party's line condition and perform various checks, using for example the Service Indication received from the calling terminal, to verify whether or not the connection is allowed. These checks will include correspondence of compatibility checks, e.g. checks associated with user facilities.

At this point, certain call set-up information may need to be obtained by an end-to-end protocol. Examination of the Protocol Control Indicator will show whether an end-to-end interchange is feasible and which end-to-end technique may be used (§ 3).

In the case where the connection is allowed, the destination exchange will alert the called party using the set-up message in accordance with the applicable interface protocol.

b) *Connection not allowed*

If the call cannot be connected due to, for instance, the called party being busy, a call supervision message indicating the reason is sent to the preceding exchange.

2.1.2 *Forward Address Signalling – Overlap operation*

2.1.2.1 *Actions required at originating exchange*

a) *Circuit selection*

When the originating exchange has received sufficient information from the calling party to determine that the call is to be routed to another exchange, selection of a suitable, free, inter-exchange circuit takes place and an Initial Address Message is sent to the appropriate destination. The Initial Address Message generally includes all of the information required by the next exchange to route the call.

Examination of the set-up message from the calling party will determine the requirements for the connection (e.g. 64 kbit/s and SS No. 7 signalling for data or voice/data connections and the ability to request In Call Modification). This information (e.g. transmission medium requirement and forward call indicators) will be included in the Initial Address Message to permit correct routing at intermediate exchanges. The seizing function at the receiving exchange is implicit in the reception of the Initial Address Message.

b) *Address information sending sequence*

The text of § 2.1.1.1 b) applies.

c) *Content of Initial and Subsequent Address Messages*

The Initial and Subsequent Address Messages in principle contain all of the information that is required to route the call to the destination exchange and connect the call to the required user. The contents of the Initial and Subsequent Address Messages are the same as described in § 2.1.1.1 c).

All digits required for routing the call through the international network will be sent in the Initial Address Message. On calls with a country code in the address (except in the case of calls to special operators), the Initial Address Message will contain a minimum of 4 digits and should contain as many digits as are available. Within national networks the address information contained within the Initial Address Message may vary depending on the routing requirement within the network.

The remaining digits of the address may be sent individually in one-digit messages or in groups in multi-digit messages. Efficiency can be gained by grouping together as many digits as possible. However, to prevent an increase in post-sending delay in those cases where overlap operation with subscribers' dialling is used, it may be desirable to send the last few digits individually.

Subsequent Address Messages can be sent on the national network as they are received. If, in an interworking situation, a continuity check has to be performed on one or more of the circuits involved in the connection, appropriate measures (e.g. by withholding the last digit(s) of the national number) must be taken at the last common channel signalling exchange to prevent alerting the called party until the continuity of such speech circuits has been verified.

The end-of-pulsing (ST) signal is always sent in the following situations:

i) semi-automatic calls;

ii) test calls; and

iii) when the end-of-pulsing signal is received from a preceding circuit or calling terminal.

In automatic working, the end-of-pulsing signal will be sent whenever the originating or outgoing exchange is in a position to know, by digit analysis, that the final digit has been sent. Digit analysis may consist of an examination of the country code and counting the maximum (or fixed) number of digits of the national number. In other cases, the end-of-pulsing signal is not sent and the end-of-address information is determined by the receipt of one of the address-complete signals from the incoming exchange.

d) *Transfer of Information by end-to-end protocol*

The text of § 2.1.1.1 d) applies.

e) *Completion of transmission path*

Through connection of the transmission path at the originating exchange will be completed:

a) immediately after the sending of the initial address message, or

b) on receipt of the address complete message, or

c) digit analysis or timer indicates that all digits have been received.

2.1.2.2 *Actions required at an intermediate exchange*

a) *Circuit selection*

An intermediate exchange, on receipt of an Initial Address Message, will analyse the address available and the other routing information (see § 2.1.2.1 a)) to determine the routing of the call. The intermediate exchange then seizes a free inter-exchange circuit and sends an Initial Address Message to the succeeding exchange. Any address digits received in Subsequent Address Messages during the circuit selection process may be included in this Initial Address Message. Any Subsequent Address Messages received after the Initial Address Message has been sent, are forwarded to the succeeding exchange as Subsequent Address Message(s).

When no echo suppressor or nature of circuit indication is received from a preceding circuit using a signalling system with fewer facilities the indicators will be considered as received "no" unless positive knowledge is available.

Selection of the outgoing national circuit normally can start at an incoming international exchange on receipt of the Initial Address Message and signalling can proceed on the first national link.

b) *Completion of transmission path*

The text of § 2.1.1.2 c) applies.

c) *Congestion*

The text of § 2.1.1.2 d) applies.

2.1.2.3 *Actions required at the destination exchange*

a) *Selection of called party*

Upon the receipt of all address messages the destination exchange will perform the functions outlined in § 2.1.1.3 a).

b) *Connection not allowed*

The text of § 2.1.1.3 b) applies.

2.1.3 *Calling Party Address*

The Calling Party Address can either be included in the Initial Address Message (§§ 2.1.1.1 c) and 2.1.2.1 c)) or requested by the destination exchange. If the Calling Party Address is required at the destination exchange but is not included in the Initial Address Message, the destination exchange will analyse the Protocol Control Indicator to determine if the request and response should be conducted by end-to-end or link by link procedures. It may be necessary to withold the sending of the Address Complete Message until the Calling Party Address has been successfully delivered to the destination exchange.

2.1.4 *Address Complete Message*

2.1.4.1 *Return of Address Complete Message from destination exchange*

When the set-up message is sent to the called party it will normally respond with an alerting indication which is passed backwards through the network as the Address Complete Message. (However, see Note 1 following Figure 3/Q.764.)

2.1.4.2 *Receipt of Address Complete Message at intermediate exchange*

Upon receipt of an Address Complete Message an intermediate exchange will send the corresponding Address Complete Message to the preceding exchange.

2.1.4.3 *Receipt of Address Complete Message at originating exchange*

When the originating exchange receives an Address Complete Message an alerting message is passed to the calling party in accordance with the applicable interface protocol, if possible.

2.1.4.4 *Application of awaiting answer indication*

On voice calls, the ringing tone will be applied to the transmission path at the destination exchange on receipt of the alerting message from the called party.

2.1.4.5 *Address Complete Message with charging information*

The Address Complete Message received from the destination exchange or from a succeeding network may carry charging information.

2.1.4.6 *Address Complete Message with other information*

Additional information can be included in Address Complete Messages (e.g. related to user facilities, § 4).

2.1.4.7 *Return of Address Complete Message in interworking situations*

An Address Complete signal will not be sent until the cross-office check is made, if applicable.

If the succeeding network does not provide electrical called-party's-line-condition signals, the last Signalling System No. 7 exchange shall originate and send an Address Complete signal when the end of address signalling has been determined:

a) by receipt of an end-of-pulsing signal; or

b) by receipt of the maximum number of digits used in the national numbering plan; or

c) by analysis of the national (significant) number to indicate that a sufficient number of digits has been received to route the call to the called party; or

d) by receipt of an end-of-selection signal from the succeeding network (e.g. number received signal in Signalling System No. 4); or

e) exceptionally, if the succeeding network uses overlap signalling and number analysis is not possible, by observing that 4 to 6 seconds have elapsed since the last digit was received, and that no fresh information has been received; in such circumstances, transmission to the national network of the last digit received must be prevented until the end of the waiting period which causes an Address-Complete signal to be sent over the international circuit. In this way, it is ensured that no national Answer Signal can arrive before an address-complete signal has been sent.

If in normal operation, delay in the receipt of an Address-Complete signal from the succeeding network is expected, the last common channel signalling exchange will originate and send an Address-Complete signal 15 to 20 seconds after receiving the latest Address Message. The time-out condition is an upper limit considering the clauses of § 2.9.8.3 (20 to 30 seconds – waiting for address-complete signal timer – for outgoing international exchanges in abnormal release conditions).

2.1.5 *Answer Message*

2.1.5.1 *Return of Answer Message from destination exchange*

When the called party answers the destination exchange connects through the transmission path and the ringing tone is removed if applicable. Immediately following connection of the transmission path the destination exchange sends an Answer Message to the preceding exchange.

2.1.5.2 *Receipt of Answer Message at intermediate exchange*

Upon receipt of an Answer Message, an intermediate exchange sends the corresponding Answer Message to the preceding exchange and, if it is a controlling node, charging may begin.

2.1.5.3 *Receipt of Answer Message at originating exchange*

When the originating exchange receives an Answer Message indicating the required connection has been completed, charging, if applicable, may begin and a connect indication is passed to the calling terminal in accordance with the applicable interface protocol.

2.1.5.4 *Return of answer from automatic terminals*

When connections are set-up to terminals having an automatic answer feature, the alerting indication may be omitted from the interface protocol. If a destination exchange receives a connect indication in response to the set-up message the Address Complete Message will be sent immediately to the preceding exchange, followed by the answer message as soon as the transmission path is completed.

2.1.5.5 *Answer with charging information*

The initial answer indication received from the destination exchange or from a succeeding network may carry charging information.

2.1.6 *Continuity-check*

Because the signalling in Signalling System No. 7 does not pass over the circuit, facilities should be provided for making a continuity-check of the circuit in the circumstances described below.

The application of the continuity-check depends on the type of the transmission system used for the circuit.

For transmission systems having some inherent fault indication features giving an indication to the switching system in case of fault, a continuity-check is not required. This situation occurs when fully digital circuits are applied.

For analogue circuits with pilot supervision it is sufficient to perform the continuity-check on a statistical basis or by test calls (see Recommendation Q.724, § 7.5). For analogue circuits not using pilot supervision and for mixed circuits, i.e. analogue and digital circuits, the continuity-check should be performed on a per call basis. Within mixed connections, i.e. connections composed of circuits with and without continuity-check on a per call basis, it shall be ensured that the continuity signal be forwarded to the destination point although no continuity-check may have been performed on one or more parts of the end-to-end connection.

When an IAM is received with a request for a continuity-check relating to a digital circuit, the following action is taken:

Note – The reception of such a request could only be caused by an abnormal condition such as administrative errors or the occurrence of signalling errors.

a) the continuity check request is disregarded;

b) a continuity-check loop is connected and a maintenance function is alerted. In this case the call may fail since no continuity signal may be received from the distant end (see § i)).

When the circuit type is unknown to a Signalling System No. 7 exchange, in an application where both analogue and digital circuits may be served, a continuity-check loop should always be connected in the following cases:

i) when the exchange has the capability to process IAMs with check requests and such messages are received;

ii) when CCR messages are received.

Means should be provided in System No. 7 to detect circuit identity misunderstanding between System No. 7 exchanges.

For exchanges having both analogue and digital circuits served by Signalling System No. 7, the continuity-check initiated by a continuity-check request message could be used to test for proper alignment of circuit identities. On those exchanges, reception of a continuity check request message should always cause a loop to be attached to the circuit.

Alternative methods for detection of circuit identity misunderstanding in exchanges with all digital circuits may be employed.

The continuity-check is not intended to eliminate the need for routine testing of the transmission path.

The continuity-check of the speech circuit will be done, link-by-link, on a per call basis or by a statistical method prior to the commencement of conversation. Procedures and requirements are specified in Recommendation Q.724, § 7.

The actions to be taken when pilot supervision is used are described in Recommendation Q.724, § 9.

2.1.7 *Completion of transmission path at an interworking exchange*

In general, completion of the transmission path at an interworking point should occur as soon as possible during the call set-up phase. The actual point of switchthrough will vary depending on the interworking signalling system, e.g. whether inband or outband signalling is used or whether a continuity check procedure is applied.

When interworking with other internationally specified signalling systems, the following rules on switch-through should be applied:

No. 7 → No. 7	When no continuity check is to be made on the outgoing circuit, through connection should occur after sending the Initial Address Message. When continuity check is to be made on the outgoing circuit, through connection should happen after residual check tone has propagated through the return path of the speech circuit (Reference Recommendation Q.724, § 7.3).
No. 6 → No. 7 No. 5 → No. 7 R1 → No. 7 No. 7 → No. 6	When no continuity check is to be made on the outoing circuit, through connection can happen after sending the Initial Address Message. When a continuity check is to be made on the outgoing circuit, through connection can happen after residual check tone has propagated through the return path of the speech circuit (Reference Recommendation Q.724, § 7.3).
R2 → No. 7	Through connection should occur after sending address complete.
No. 7 → No. 5 No. 7 → R1	Througn connection can occur after sending ST (End of Pulsing) signal and removal of a possible chek loop.
No. 7 → R2	Through connection should occur after receipt of Address-Complete message.

When a continuity check is made on the outgoing circuit, and early connection is made, there is a possibility that the calling party has its go and return paths temporarily looped (from the instant of through connection to the instant of loop removal of the incoming end of the circuit). This problem can be prevented by using the optional single report continuity-check procedure given in Recommendation Q.724, § 7.3.

2.1.8 *Cross office check*

For digital exchanges, the requirements mentioned in Recommendation Q.504 shall be met. For other exchanges, Administrations shall ensure the reliability of a connection through a switching machine (cross-office check) either on a per call basis or by a statistical method. With either method, the probability of the connection being established with an unacceptable speech path transmission quality should not exceed 0.00001 as the long-term average.

2.1.9 *Charging procedures*

2.1.9.1 *Basic call charging*

Charging will normally begin when the exchange(s) controlling charging receives the Answer Message from the network. Optionally an Administration may wish to begin charging prior to the receipt of the Answer Message for national calls.

2.1.9.2 *Network charging messages*

When the controlling exchange does not have the capability to determine the charge rate for a particular call, charge information, in the form a charging message(s), may be received during call set-up. Also, charge rate information may be returned during call set-up, followed subsequently by further charging messages during the conversation/data phase, should the original rate require to be changed during the call.

2.1.9.3 *Charging for transfer of user-to-user data*

The charging for the transfer of user-to-user data requires further study.

2.1.10 *Forward transfer message*

The forward transfer message may be sent in telephony semi-automatic working in either of the following two cases:

a) following a call switched automatically to a subscriber, or following a call established via a special operator, the controlling operator wishes to call in an assistance operator. On receipt of the forward-transfer message at the incoming international exchange, an assistance operator is called in;

b) following a call via codes 11 and 12, the controlling operator wishes to recall the incoming international exchange. Receipt of the forward-transfer message at the incoming international exchange recalls the incoming operator on calls completed via the operator positions at the exchange.

2.2 *Unsuccessful call set-up*

If at any time in the call set-up the connection cannot be completed an Unsuccessful Backward Set up Information Message is returned. This message contains the reason of call refusal (failure).

2.2.1 *Actions at exchange initiating an Unsuccessful Backward Set up Information Message*

The initiating exchange sends an Unsuccessful Backward Set up Information Message to the preceding exchange and, at the same time, starts the release of the switched path (if established). When the path has been fully disconnected, the exchange sends a released message to the preceding exchange and a timer is started to ensure that a release complete message is received from the preceding exchange within time T_1 (expiration of timer T_1 is covered in § 2.9.6.2).

2.2.2 *Actions at intermediate exchange*

On receipt of an Unsuccessful Backward Set up Information Message from the succeeding exchange, an intermediate exchange immediately starts the release of the switch path and, at the same time, sends an Unsuccessful Backward Set up Information Message to the preceding exchange. When the path has been fully disconnected, a released message is sent to the preceding exchange and a timer is started to ensure that a release complete message is received from the preceding exchange within time T_1 (expiration of this time is covered in § 2.9.6.2). When the path has been fully disconnected and a released message has been received from the succeeding exchange, a release complete message is returned to the succeeding exchange.

2.2.3 *Actions at the controlling exchange*

On receipt of an Unsuccessful Backward Set up Information Message from the succeeding exchange, the controlling exchange starts the release of the switch path. When the path has been fully disconnected and a released message has been received from the succeeding exchange, a release complete message is returned to the succeeding exchange.

In addition, the controlling exchange will:

a) return an indication to the calling subscriber; or

b) attempt to re-route the call set-up; or

c) initiate release procedures to the preceding exchange (if applicable).

2.3 *Normal call release*

The release procedures are based on a three message approach whereby the release message is transmitted through the network as quickly as possible. The same procedures are used in the network irrespective of whether they are initiated by the calling subscriber, the called subscriber or the network. The normal release procedure can be prevented by the network if this is required on a particular call (§ 2.6).

2.3.1 *Release initiated by a calling subscriber*

a) *Actions at originating exchange*

On receipt of a request to release the call from the calling subscriber, the originating exchange immediately starts the release of the switched path and, at the same time, sends a release message to the succeeding exchange. When the path has been fully disconnected, a released message is sent to the succeeding exchange and a timer is started to ensure that a release complete message is received from the succeeding exchange within time T_1 (expiration of this time is covered in § 2.9.6.2).

b) *Actions at an intermediate exchange*

On receipt of the release message from the preceding exchange, an intermediate exchange will

i) start a timer T_{12}[1)] (expiration of Timer T_{12} is covered in § 2.9.6.3) to ensure that a released message is received from the preceding exchange; and

ii) immediately start the release of the switched path and, at the same time, send a release message to the succeeding exchange. When the path has been fully disconnected, a released message is sent to the succeeding exchange and a timer is started to ensure that a release complete message is received from the succeeding exchange within time T_1 (expiration of this time is covered in § 2.9.6.2). When the path has been fully disconnected and a released message has been received from the preceding exchange, a release complete message is returned to the preceding exchange.

c) *Actions at destination exchange*

On receipt of a release message from the preceding exchange, the destination exchange will:

i) start a Timer T_{12}[1)] (expiration of Timer T_{12} is covered in § 2.9.6.3) to ensure that a released message is received from the preceding exchange; and

1) The value of Timer T_{12} is for further study.

ii) start the release of the switched path. When the path has been fully disconnected and a release message has been received from the preceding exchange, a release complete message is returned to the preceding exchange.

d) *Charging*

Charging is stopped upon receipt of the release message (or released message if a release message has not been received) at the charging exchange(s).

e) *Collision of release messages*

In the case when both the originating and destination exchanges initiate the release of a call, a released message may be received at an exchange from a succeeding or preceding exchange before the release of the switched path is completed (and therefore before the released message is sent). In this case, the exchange will complete the disconnection of the switched path and return a release complete message.

2.3.2 *Release initiated by a called subscriber*

The procedures in § 2.3.1 apply, except that the functions at the originating and destination exchanges are transposed.

2.3.3 *Release initiated by the network*

The procedures in § 2.3.1 apply, except that they can be initiated at any exchange (originating, destination or intermediate).

2.3.4 *Release of address and routing information*

This is for further study (see Recommendation Q.724, § 6.1).

2.4 *Transfer of user-to-user information*

(For further study.)

2.4.1 *Requirements for transfer of user-to-user data*

The requirements for the transfer of user-to-user data via the signalling network during a circuit related connection, if applicable, are given below:

a) the facility to transfer user-to-user data in blocks of up to 32 octets[2)] shall be available during all phases of circuit related connections;

b) during call set-up; the capability to include one block of user-to-user data in a set-up message shall be available;

c) during call set-up, the capability to transfer up to two further blocks of user-to-user data in each direction shall be available between the transmission of the Address Complete and Answer messages;

d) during the conversation/data and cleardown phases of a connection the capability to exchange user-to-user data blocks shall be available, subject to flow control imposed by the originating and terminating nodes.

2.4.2 *Methods of transferring user-to-user data*

The transfer of user-to-user data blocks through the network may be achieved by end-to-end messages (see § 3) and/or within ISDN messages.

2.4.2.1 The user-to-user information outlined in § 2.4.1 b) can either be:

i) included in a data field of the Initial Address Message; or

ii) stored at the originating local exchange until the negotiation procedure outlined in § 2.4.2.4 is completed.

[2)] The transfer of up to 256 octets of user data in national applications is allowed, depending on the maximum length of signal units chosen for the national network, as optionally specified in Recommendation Q.703.

2.4.2.2 The user-to-user information outlined in § 2.4.1 c) is transferred by an end-to-end technique (see § 3).

2.4.2.3 The user-to-user information outlined in § 2.4.1 d) is transferred by an end-to-end technique (see § 3).

2.4.2.4 To determine if a particular network or customer is able to facilitate user-to-user data, the following procedures are specified:

i) the Initial Address Message sent from the originating exchange carries
   a) an indication as to whether the user-to-user transfer service is available to the calling terminal and
   b) an indication as to whether user-to-user data has been received from the calling terminal;

ii) on receipt of the Initial Address Message, the gateway/destination exchange interrogates the user-to-user facilities at the called network/terminal;
   a) if the user-to-user facility exists, and user-to-user data was received from the calling terminal, end-to-end procedures are initiated to transfer the user-to-user data across the network;
   b) if the user-to-user facility exists and user-to-user data was not received from the calling terminal, the Address Complete Message is marked to indicate that the user-to-user facility is possible;
   c) if the user-to-user facility does not exist, the Address Complete Message is marked to indicate that the user-to-user facility is not possible.

2.5 *Pause request/Resume*

2.5.1 *Pause initiated by a calling subscriber*

The pause message indicates a temporary cessation of communication without releasing the call. It can only be accepted during the connection/data phase. A pause message can be either generated in response to a suspend request from a subscriber or generated by the network in response to a clearback message (from an interworking node or from a telephone subscriber). The resume message indicates a request to recommence communication. A request to release the call received from the calling or called subscriber will override the pause/resume sequence and the procedures given in § 2.3 will be followed.

a) Actions at originating exchange

   On receipt of a pause request from the calling subscriber, the originating exchange returns an acknowledgement and sends a pause message to the succeeding exchange.

b) Actions at an intermediate exchange

   On receipt of the pause message from the preceding exchange, the intermediate exchange sends a pause message to the succeeding exchange.

c) Actions at destination exchange

   On receipt of the pause message from the preceding exchange, the destination exchange informs the called party that a pause has been requested.

d) Actions at the pause request controlling exchange

   On receipt of the pause message, the controlling exchange timer starts a to ensure that a resume message is received within timer T_2. If the timer expires, the procedures in § 2.5.5 apply. The value of timer T_2 is in accordance with Recommendation Q.118.

2.5.2 *Pause initiated by a called subscriber*

The procedures in § 2.5.1 apply, except that the functions at the originating and destination exchanges are transposed.

2.5.3 *Resume initiated by a calling subscriber*

Having initiated a pause condition, a calling subscriber may request a reconnection provided that time T_2 has not expired (§ 2.5.1 d)). The procedures in § 2.5.1 items a), b) and c) apply except that the resume message replaces the pause message. On receipt of the resume message, the controlling exchange cancels the timer.

2.5.4 *Resume initiated by a called subscriber*

Having initiated a pause condition, a called subscriber may request a reconnection provided that time T_2 has not expired. The procedures in § 2.5.2 items a), b) and c) apply except that the resume message replaces the pause message. On receipt of the resume message, the controlling exchange cancels the timer.

2.5.5 *Expiration of time T_2*

If a resume message is not received within time T_2 from the subscriber initiating the pause request, then the controlling exchange will initiate the release procedure outlined in § 2.3.3.

2.6 *Delayed Release*

The Delayed Release Signal (DRS) is generated by the network in response to a request to release the call if the network is applying a hold to the connection. The Delayed Release Signal can be sent in either direction.

The local exchange receiving the disconnection request indicates to the terminal that disconnection has been delayed and, sends a Delayed Release Signal to the network. The connection is split, a time out T_3[3] is started (to prevent network lock up) and charging is stopped. At the other end of the connection, the Delayed Release Signal causes an indication to be sent to the terminal indicating that disconnection has been delayed.

Receipt of a new connect demand or a resume message at the network during the held state (after the Delayed Release Signal has been sent) will not cause the network to set up or resume the connection. When the hold condition is removed or the time out T_3[3] matures, the network generates the normal release sequence (§ 2.3.3).

2.7 *In call modification*

At the start of the call, it is required to know whether the call is a voice call without In Call Modification, a data call without In Call Modification or a call (voice or data) with In Call Modification.

Following call set-up with In Call Modification possible, the calling or called party may choose to modify the characteristics of the call during the conversation/data phase. During call set-up, the network will have chosen a suitable route (e.g. 64 kbit/s and CCITT No. 7 signalling) according to information included in the Initial Address Message. If an In Call Modification is required, new information is needed throughout the network to make the connection suitable for the modified call. The recommendation covers the request to modify the call from voice to data and vice versa. Other forms of In Call Modification are for further study. The procedures when In Call Modification is requested simultaneously by both the calling and called parties are also for further study.

2.7.1 *Successful completion*

2.7.1.1 *Actions required at the exchange originating In Call Modification*

a) On receipt of a call modification request from the subscriber, the exchange checks that call modification is allowed and that the necessary resources are available. If acceptable, the resources are reserved and the Call Modification Request is sent to the network. A timer is started to ensure that a Call Modification Complete (CMC) message is received within time T_4[4];

b) on receipt of the Call Modification Complete, the exchange modifies the resource and, when complete, informs the originating subscriber that the modification is complete. The timer T_4[4] is cancelled.

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[3] The value of timer T_3 is for further study.

[4] The value of timer T_4 is for further study.

2.7.1.2 *Actions required at intermediate exchanges*

a) On receipt of the Call Modification Request the exchange performs the functions outlined in § 2.7.1.1 a);

b) on receipt of a Call Modification Complete, the exchange modifies the resource and, when complete, sends a Call Modification Complete to the next exchange.

2.7.1.3 *Actions required at the exchange terminating In Call Modification*

a) On receipt of a Call Modification Request the exchange checks that Call Modification Request is allowed and that the necessary resources are available. If acceptable, the resources are reserved and the call modification indication is sent to the subscriber;

b) after the terminal has changed state and the modification in the exchange has been completed, a Call Modification Complete is returned to the network.

2.7.2 *Successful completion – Echo device required*

The procedures are the same as outlined in § 2.7.1 except that:

i) as the Call Modification Request passes through the network, each exchange examines the outgoing echo device field to determine if an outgoing echo device has been reserved. The first exchange with a suitable outgoing echo device reserves it and marks the field accordingly. Subsequent exchanges will examine the field and determine that further action is unnecessary;

ii) as the Call Modification Request passes through the network, each exchange checks if an incoming echo device is available. If available, an incoming echo device is reserved;

iii) as the Call Modification Complete passes through the network, the first exchange that has reserved an incoming echo device switches in that device and marks the incoming echo device field accordingly. Subsequent exchanges will examine the incoming echo device field and determine that an incoming echo device has been selected by an earlier exchange and so will cancel the reservation of their own incoming echo devices (if applicable);

iv) on receipt of the Call Modification Complete, the exchange that reserved the outgoing echo device switches in that device.

2.7.3 *Failure*

If an exchange fails to change resources on receipt of the Call Modification Complete, a Reject Connect Modify Message (RCM) with reason is sent to preceding and succeeding exchanges. Receipt of a Reject Connect Modify Message at preceding exchanges causes reserved resources to be freed and a reject connect modify indication to be delivered to the subscriber. Receipt of a Reject Connect Modify Message at succeeding exchanges causes each of the exchanges to restore to the previous state (if possible). If the restore fails, then the subscriber originating the In Call Modification can attempt to modify again or disconnect (according to the reason field).

2.7.4 *Not allowed*

If, on receipt of a Call Modification Request an exchange determines that In Call Modification is not allowed, a Reject Connect Modify Message with reason is returned to preceding exchanges. Receipt of the Reject Connect Modify Message at preceding exchanges will cause reserved resources to be freed and a reject connect modify indication to be delivered to the subscriber.

2.8 *Network features*

2.8.1 *Automatic repeat attempt*

Automatic repeat attempt, as defined in Recommendation Q.12, is provided in Signalling System No. 7. An automatic repeat attempt will be made:

i) on detection of dual seizure (at the non-control exchange) (see § 2.9.1.4);

ii) on receipt of the blocking signal after sending an Initial Address Message and before any backward signal has been received (see § 2.8.2);

iii) on receipt of a Reset Circuit signal after sending an Initial Address Message and before a backward signal has been received.

iv) on failure of continuity check when a continuity check is performed;

v) on receipt of an unreasonable signal during call set-up.

2.8.2 *Blocking and Unblocking of circuits and circuit groups*

The circuit Blocking (Unblocking) signal and the group blocking (unblocking) message are provided to permit the switching equipment or maintenance personnel to remove from (and return to) traffic the distant terminal(s) of a circuit or group because of a fault or to permit testing.

Since the circuits served by Signalling System No. 7 have bothway capability, the blocking signal or group blocking message can be originated by either exchange. The receipt of a Blocking signal or two group blocking messages will have the effect of prohibiting calls on the relevant circuit(s) outgoing from the exchange until an Unblocking signal or an appropriate group unblocking message is received, but will not prohibit calls incoming to that exchange. Acknowledgement sequences are always required for the Blocking and Unblocking signals as well as for the group blocking and group unblocking messages using the Blocking-acknowledgement signal, the Unblocking-acknowledgement signal, the appropriate group blocking acknowledgement and the appropriate group unblocking acknowledgement message repectively. The acknowledgement is not sent until the appropriate action, either Blocking or Unblocking has been taken. The Release signal should not override the Blocking signal and return circuits to service which might be faulty. The blocked circuit(s) will be returned to service on transmission of the Unblocking-acknowledgement signal or the appropriate group unblocking acknowledgement message at one exchange and on receipt of the Unblocking acknowledgement signal or the appropriate group unblocking acknowledgement message at the other exchange.

2.8.2.1 *Other actions on receipt of a Blocking signal*

In the event of the receipt of a Blocking signal:

- after an Initial Address Message has been sent, and
- before a backward signal relating to that call has been received,

an automatic repeat attempt will be made on another circuit. The exchange receiving the Blocking signal should release the original attempt in the normal manner after sending the Blocking-acknowledgement signal.

If the Blocking signal is received

- in the outgoing exchange after at least one backward signal relating to that call has been received, or
- in the incoming exchange after the Initial Address Message relating to that call has been received

the exchange will not seize that circuit for subsequent calls.

The fact that the circuit is engaged on a call will not delay transmission of the Blocking (Unblocking)-acknowledgement signal.

If a Blocking signal is sent and subsequently an Initial Address Message is received in the opposite direction, the following action is taken:

- for test calls, the call should be accepted, if possible. In the case where the test call cannot be accepted, the Blocking signal must be returned;
- for calls other than test calls, the Blocking signal must be returned.

Blocking of a circuit by use of the Blocking signal should not exceed five minutes, after which an alarm should be given at each terminal of the circuit. Should a call be in progress on the circuit involved, the five minutes time will commence when that call is cleared. If the work on the circuit must exceed five minutes, the circuit should be withdrawn from service.

2.8.2.2 *Group blocking and unblocking messages*

The following group blocking (unblocking) messages and the appropriate acknowledgement messages are provided:

- maintenance oriented group blocking (unblocking) message;
- hardware failure oriented group blocking (unblocking) message;
- software generated group blocking (unblocking) message.

The range of circuits to be blocked (unblocked) is dependent on the coding of the range field:

- if the range field is not coded all zero the circuits indicated in the status field have to be blocked (unblocked);
- if the range field is coded all zero all circuits of the pre-determined circuit group have to be blocked (unblocked).

The same rule applies on the acknowledgements.

Since the effect of erroneous group blocking (unblocking) messages generated by undetected errors may cause serious implications on the quality of service, each group blocking (unblocking) message has to be sent twice. Therefore, at the receiving exchange actions only take place after a group blocking (unblocking) message is received twice within 5 seconds.

For the circuits blocked for maintenance reasons the same conditions apply and the same actions have to be taken as described in § 2.8.2.1.

For the circuits blocked for reason of hardware failure or software generated alarm the following actions will be taken:

- the maintenance personnel have to be alerted;
- all interconnected circuits have to be released by the appropriate signals;
- the affected circuits are set to the condition idle/hardware or software blocked without any exchange of clearing signals.

2.9 *Abnormal conditions*

2.9.1 *Dual seizure*

Since Signalling No. 7 circuits have the capability of bothway operation, it is possible that the two exchanges will attempt to seize the same circuit at approximately the same time.

2.9.1.1 *Unguarded interval*

The exchange must detect dual seizure and take action as defined in § 2.9.1.4.

2.9.1.2 *Detection of dual seizure*

A dual seizure is detected by an exchange from the fact that it receives an Initial Address Message for a circuit for which it has sent an Initial Address Message.

2.9.1.3 *Preventive Action*

Different methods for circuit selection can be envisaged to minimize the occurrence of dual seizure. In the following, two methods are described. Further study is required to determine the field of application of each method and to ensure that the two methods do interwork satisfactorily.

Other methods for circuit selection may also be used provided that they give the same degree of protection against dual seizure also when one of the methods specified is used at the other end.

Method 1

An opposite order of selection is used at each terminal exchange of a bothway circuit group.

Method 2

Each terminal exchange of a bothway circuit group has priority access to the group of circuits which it is controlling (see § 2.9.1.4). Of this group the circuit which has been released the longest is selected (first-in, first-out). In addition each terminal exchange of a bothway circuit group has non-priority access to the group of circuits which it is non-controlling. Of this group the latest released circuit is selected (last-in, first out).

For call control purposes a bothway circuit group can be subdivided into subgroups in an exchange.

It is necessary to take preventive action in cases where Signalling System No. 7 uses a signalling data link with long propagation time.

2.9.1.4 *Action to be taken on detection of dual seizure*

Each exchange will control one half of the circuits in a bothway circuit group. On detection of a dual seizure, the call being processed by the control exchange for that circuit will be completed and the received Initial Address Message will be disregarded.

Under these conditions, the call being processed by the control exchange will be allowed to mature. The call being processed by the non-control exchange will be backed off and the switch-path released. A Release signal will not be sent. The non-control exchange will make an automatic repeat attempt on the same or on an alternative route.

For the purpose of resolution of dual seizure on bothway circuits, the exchange with the higher signalling point code will control all even-numbered circuits (circuit identification code) and the other exchange the odd-numbered circuits. The designation of control may also be used for maintenance control purposes.

2.9.2 *Interruption control on digital inter-exchange circuits*

When fully digital circuits are provided between two exchanges, which have some inherent fault indication feature giving an indication to the switching system when faults on transmission systems are detected, the switching system should inhibit selection of the circuits concerned for the period the fault conditions persist.

2.9.3 *Reset of circuits and circuit groups*

In systems which maintain circuit status in memory there may be occasions when the memory becomes mutilated. In such a case the circuits must be reset to the idle condition at both exchanges to make them available for new traffic. Since the exchange with the mutilated memory does not know whether the circuits are idle, busy outgoing, busy incoming, blocked, etc., reset circuit signals or a circuit group reset message should be sent as appropriate for the affected circuits.

2.9.3.1 *Reset circuit signal*

If only a few circuits are concerned a reset circuit signal should be sent for each affected circuit.

On receipt of a reset circuit signal the unaffected exchange will:

a) accept the signal as a Released signal and respond by sending a Release Complete signal, after the circuit has been made idle, if it is the incoming or outgoing exchange on a connection in any state of call set-up or during a call;

b) accept the signal as a Released signal and respond by sending a Release Complete signal if the circuit is in the idle condition;

c) if it has previously sent a Blocking signal, or if it is unable to release the circuit as described above, respond by the Blocking signal. If an incoming or outgoing call is in progress, this call should be disconnected and the circuit returned to the idle (blocked) state. A Released or Release Complete signal may be sent. The Blocking signal should be acknowledged by the affected exchange. If the acknowledgement is not received, the repetition procedure specified in § 2.9.4 should be followed;

d) if it had previously received the Blocking signal, respond by disconnecting any connected call, remove the blocked condition and restore the circuit to the idle state. If an outgoing call had been in progress, respond with a Released or, in all other cases, a Release Complete signal;

e) if a Reset-Circuit signal is received after the sending of an Initial Address Message but before receipt of a backward signal relating to that call, clear the circuit and make an automatic repeat attempt on another circuit if appropriate;

f) if a Reset-Circuit signal is received after having sent a Reset-Circuit signal, respond by a Release Complete signal. The circuit should be restored to traffic;

g) send an appropriate clearing signal on an interconnected circuit (e.g. release).

The affected exchange will then reconstruct its memory according to the received acknowledgement to the Reset-Circuit signal, and respond to the signals is the normal way i.e. release complete in response to a released signal, Blocking acknowledgement is response to a Blocking signal.

In addition, an interconnected circuit may be cleared by the use of an appropriate signal. If no acknowledgement to the Reset-Circuit signal is received before 4-15 seconds, the Reset-Circuit signal should be repeated. If an acknowledgement for the signal is not received within 1 minute after the initial Reset-Circuit signal, maintenance personnel should be notified to permit manual restoration procedures. However, the sending of the Reset-Circuit signal should continue at 1-minute intervals until maintenance intervention occurs.

2.9.3.2 *Circuit group reset message*

If a considerable number of circuits or all circuits are affected by the memory mutilation, circuit group reset messages should be used to make them available for new traffic.

Since the effect of erroneous circuit group reset messages generated by undetected errors may cause serious implications on the quality of service, each circuit group reset message has to be sent twice.

On receipt of two circuit group reset messages within 5 seconds for the same circuit group or parts thereof the unaffected exchange will:

i) if the range field is not coded all zero
   a) restore the circuits involved to the idle state;
   b) send the appropriate group blocking message(s) if it had previously sent a hardware failure oriented and/or software generated group blocking message;
   c) respond by a circuit group reset-acknowledgement message in which the status indicator bits of the circuits available for service or blocked for reasons of hardware failure or a software generated alarm are coded 0 and the status indicator bit of all circuits blocked for maintenance reasons are set to 1;

ii) if the range field is coded all zero
   a) send the appropriate group blocking message(s) if it had previously sent a hardware failure oriented and/or software generated group blocking message;
   b) start the restoration of the circuits on a per circuit basis in the same way as after receipt of a reset circuit signal for each circuit within the group;
   c) respond by a circuit group reset-acknowledgement message indicating that the restoration of the circuits concerned has started;

iii) independent from the coding of the range field the following actions should take place in the unaffected exchange after receipt of two circuit group reset signals within 5 seconds
   a) if it had previously received a blocking signal(s) or a group blocking message(s) for one or more of the circuit(s) involved the blocked condition will be removed and the circuits will be made available for service;
   b) if a circuit group reset message is received after having sent a circuit group reset message or a reset circuit signal(s) the circuits involved in both the sent and the received message/signal(s), are made available for service;
   c) appropriate signals should be sent on interconnected circuits to release them.

The affected exchange will then reconstruct its memory according to the possibly received blocking messages and the received circuit group reset-acknowledgement message. It will respond to the possibly received group blocking messages in the normal way.

If no acknowledgement to a circuit group reset message is received before 4-15 seconds the circuit group reset message should be repeated (twice). If an acknowledgement for the message is not received within 1 minute after sending the initial circuit group reset message maintenance personnel should be notified to permit manual restoration procedures. However, the sending of the circuit group reset message should continue at 1 minute intervals until maintenance intervention occurs.

2.9.4 *Failure in the blocking/unblocking sequence*

An exchange will repeat the Blocking (Unblocking) signal or the group blocking (unblocking) messages on failure to receive the appropriate acknowledgement in response to one of these signals/messages before 4-15 seconds. (See § 2.8.2.)

If an acknowledgement is not received within a period of one minute after sending the initial Blocking or Unblocking signal or group blocking (unblocking) messages, maintenance personnel should be alerted, the repetition of the Blocking (Unblocking) signal or group blocking (unblocking) messages should be continued at one minute intervals until maintenance intervention occurs and the circuit(s) taken out of service as appropriate.

2.9.5 *Receipt of unreasonable signalling information*

The Message Transfer Part of the signalling system will avoid mis-sequencing, or double delivery, of messages with a high reliability (Recommendation Q.706, § 2). However undetected errors at the signalling link level and exchange malfunctions may produce signalling information 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 Released signal is received relating to an idle circuit it will be acknowledged with a Release Complete Signal;

b) if a Release or Release Complete signal is received relating to an idle circuit it will be discarded;

c) if a Release Complete signal is received relating to a busy circuit for which a Released signal has not been sent, the circuit will be released and a Released signal will be sent. The possibility of maintaining the connection is for further study;

d) if a Blocking signal is received for a blocked circuit, a Blocking-acknowledgement signal will be sent;

e) if an Unblocking signal is received for an unblocked circuit, an Unblocking-acknowledgement signal will be sent,

f) if a blocking-acknowledgement signal for which no blocking signal has been sent is received:

- relating to a circuit blocked by receiving a blocking signal, the blocking-acknowledgement signal will be discarded,
- relating to a circuit which is not blocked by receiving a blocking signal, an unblocking signal will be sent;

g) if an unblocking-acknowledgement signal for which no unblocking signal has been sent, is received:

- relating to a circuit blocked by sending a blocking signal, the blocking signal will be sent,
- relating to a circuit which is not blocked by sending a blocking signal, the unblocking-acknowledgement signal will be discarded;

h) if other unreasonable signalling information is received, the following actions will be undertaken:

- if the circuit is idle, the reset-circuit signal is sent;
- if the circuit is seized by a call, after receipt of a backward signal required for the call set-up, the unreasonable signalling information is discarded;
- if the circuit is seized by a call, before receipt of a backward signal required for the call set-up, the reset-circuit signal is sent. If the circuit is seized by an incoming call, the call will be released. If the circuit is seized by an outgoing call, an automatic repeat attempt is provided on another circuit.

Except in certain cases (see § 2.9.1) any other unreasonable signalling information received will be discarded. If the discarding of the signallinon prevents a call from being completed, that call will eventually be informatiby the expiry of a time out. Possible further actions to be taken on released unreasonable signalling information are for further study.

2.9.6 *Loss of messages in the release sequence*

2.9.6.1 *Loss of release message*

If a Released Message is received relating to a busy circuit for which a Release Message for unsuccessful backward set-up message has not been received, the exchange will initiate release procedures to the succeeding exchange and, after releasing the circuit, return a Release Complete Message to the preceding exchange.

2.9.6.2 *Failure to receive a "Release Complete" (RLC) message – Time T_l*

If a Release Complete (RLC) is not received in response to a Released (RLSD) signal before 4-15 seconds the exchange will retransmit a Released signal.

If after repeating the Released signal for a period of one minute a Release Complete Message is not received, the exchange shall:

i) send a reset circuit signal;

ii alert the maintenance personnel;

iii) cease sending the Released signal;

iv) remove the circuit from service;

v) the sending of the reset circuit signal shall continue at 1 minute intervals until maintenance action occurs.

2.9.6.3 *Failure to receive a Released message – Time T_{12}*

If a Released message is not received within time T_{12} (§§ 2.3.1. b and c) the exchange shall:

i) send a reset circuit signal;

ii) alert maintenance personnel;

iii) remove the circuit from service;

iv) the sending of the reset circuit signal shall continue at 1 minute intervals until maintenance action occurs.

2.9.7 *Failure to receive a response to set-up information or general request message*

The exchange will release the connection and the maintenance function may be informed.

2.9.8 *Other Failure Conditions*

2.9.8.1 *Inability to release in response to a Release Message*

If an exchange is unable to return the circuit to the idle condition in response to a Release Message, it should immediately remove the circuit from service, alert maintenance personnel and send the blocking signal. Upon receipt of the blocking-acknowledgement signal, the Release Complete Message is sent in acknowledgement of the Released Message.

2.9.8.2 *Call-failure*

The call-failure indication is sent in an unsuccessful backward set-up information message (§ 2.2) whenever a call attempt fails and other specific signals do not apply.

Reception of the unsuccessful backward set-up information message at any Signalling System No. 7 exchange will cause the unsuccessful backward set-up message information message to be sent to preceding exchanges. If the signalling does not permit the unsuccessful backward set-up message to be sent, the appropriate signal, tone or announcement is sent to preceding exchanges.

2.9.8.3 *Abnormal release conditions*

If the conditions for normal release as covered in § 2.3 are not fulfilled, release will take place under the following conditions:

i) *Outgoing international or national controlling exchange*

The exchange shall:

a) release all equipment and the connection on failure to meet the conditions for normal release of address and routing information before 20-30 seconds after sending the latest address message;

b) release all equipment and release the connection on failure to receive an answer signal within the interval specified in Recommendation Q.118.

ii) *Incoming international exchange*

An incoming international exchange shall release all equipment and the connection into the national network and send back an unsuccessful backward set-up information message in the following cases:

- on failure to receive a continuity or continuity-failure signal if applicable before 10-15 seconds (waiting for continuity or continuity-failure signal timer) after receipt of the initial address message; or
- on failure to receive a backward signal from a national network (where expected) before 20-30 seconds (waiting for address-complete signal timer) after receipt of the latest address messsage; or
- on receipt of an unsuccessful backward set-up information message after an address complete signal has been generated.

The procedures for unsuccessful backward set-up information message are detailed in § 2.2.2.

iii) *Transit exchange*

The exchange shall release all equipment and the connection and send back the unsuccessful backward set-up information message in the following cases:

- on failure to receive a continuity or continuity-failure signal if applicable before 10-15 seconds after receipt of the initial address message; or
- on failure to meet the conditions for normal release as covered in § 2.3 before 20-30 seconds after sending the latest address message.

The procedures for unsuccessful backward set-up information message are detailed in § 2.2.2.

2.9.8.4 If messages are lost during an end-to-end transfer, appropriate actions will be taken according to the type of end-to-end technique being used.

2.9.8.5 For calls involving the SCCP, expiration of the call supervision timer (concerned with IAM call set up) will result in the SCCP being notified of an error condition.

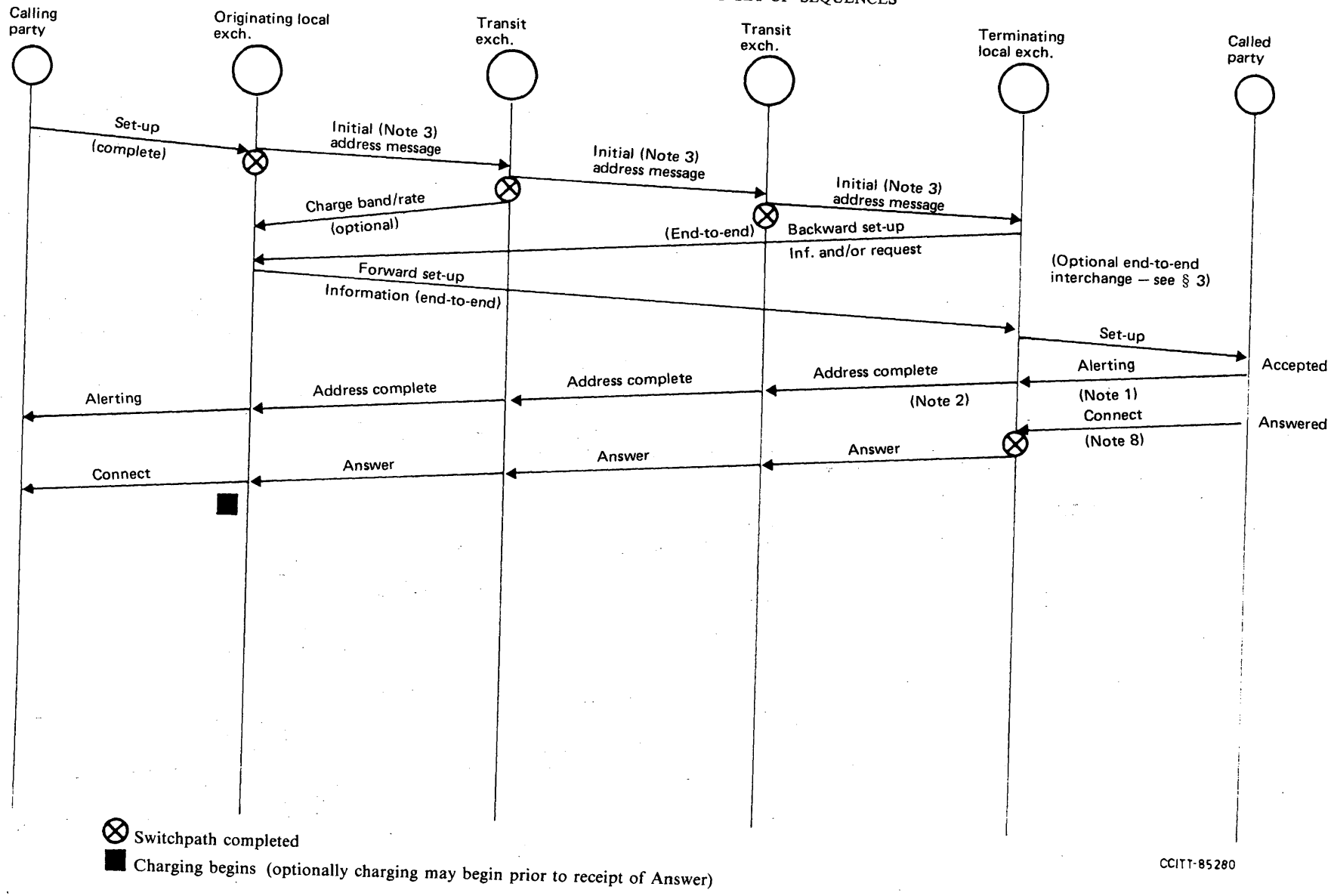


FIGURE 1/Q.764

Successful ordinary call (en block operation)

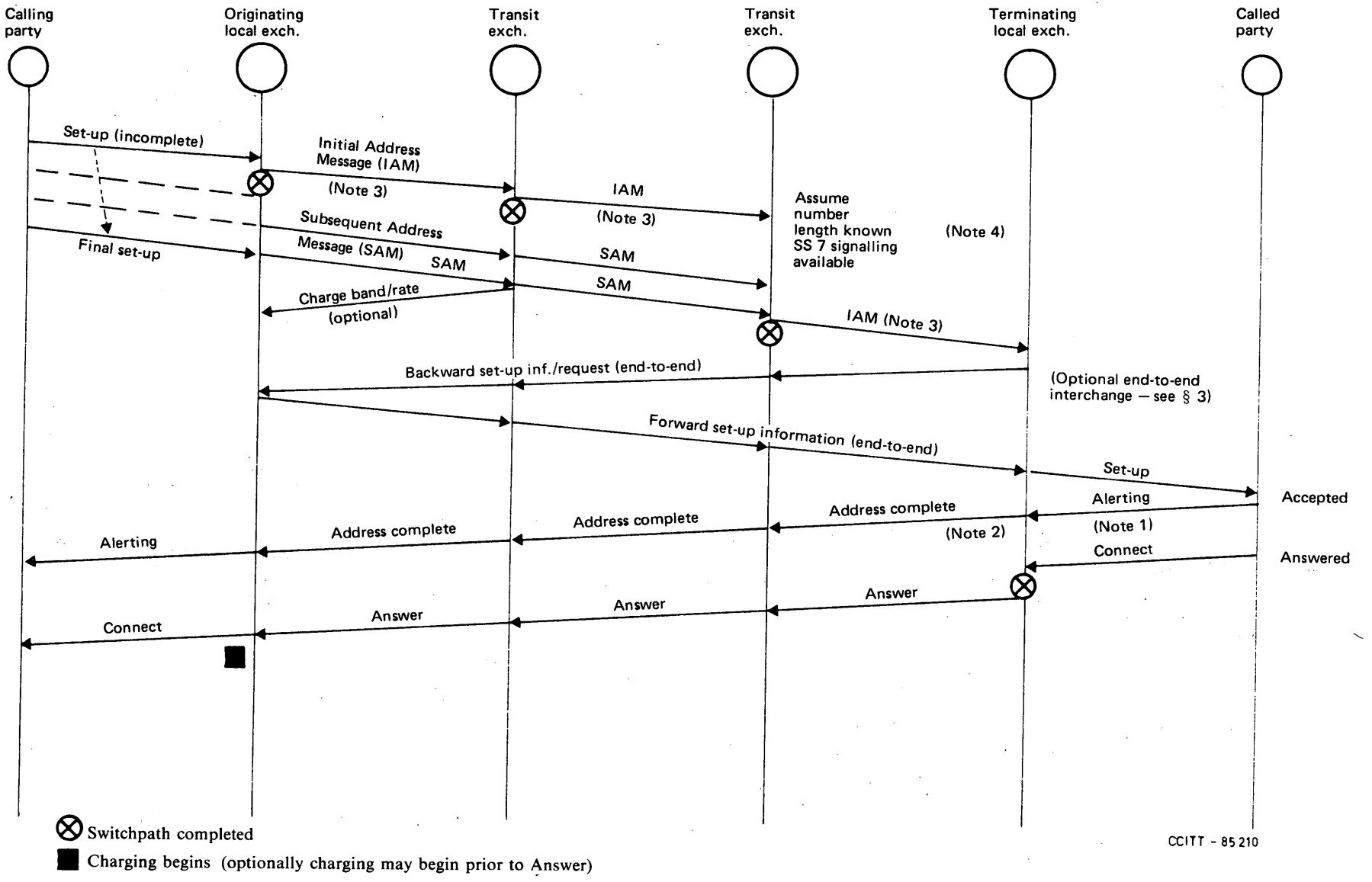


FIGURE 2/Q.764

Successful ordinary call (overlap operation)

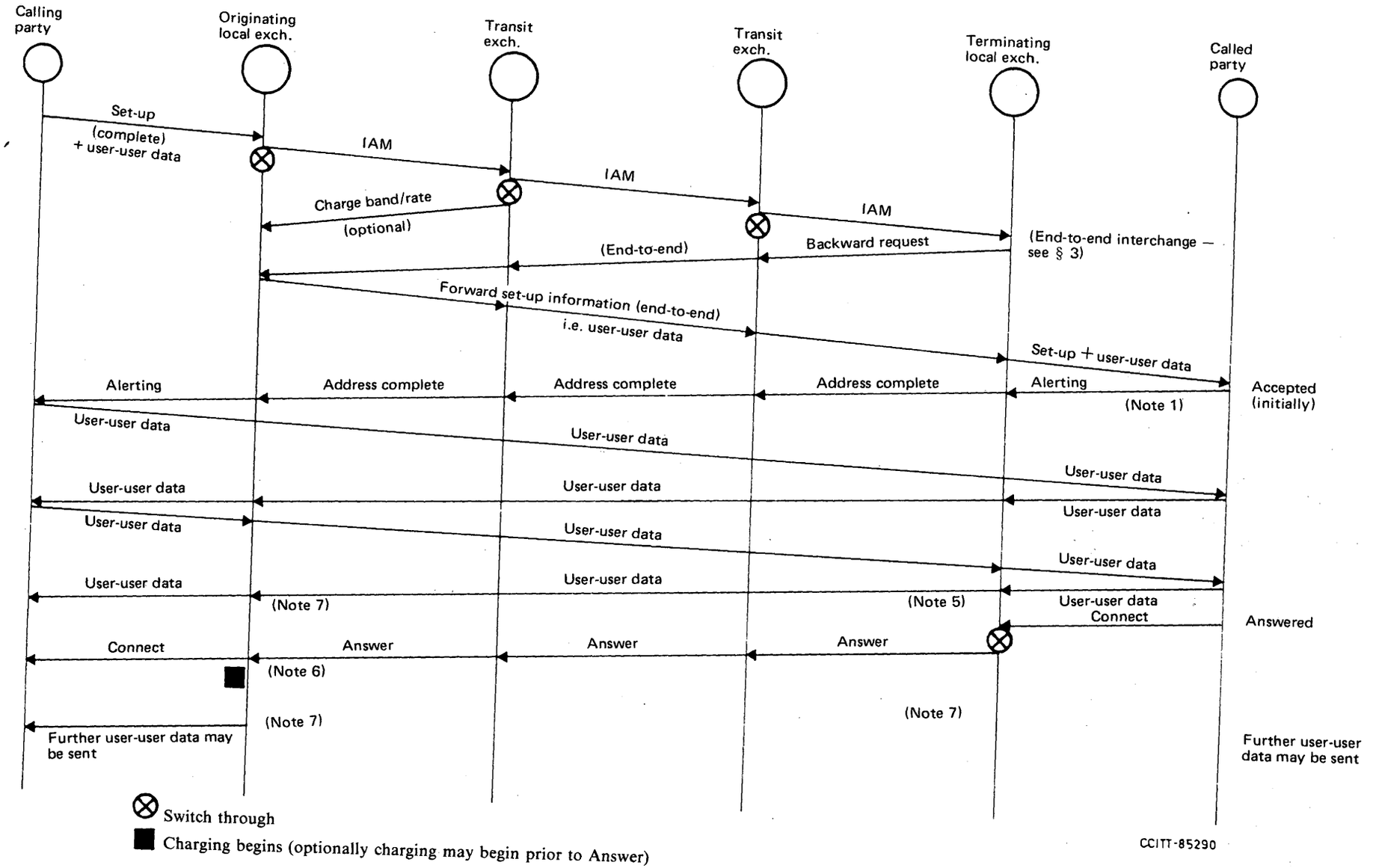


FIGURE 3/Q.764

Transfer of user-user data on call set-up

Notes relative to Figures 1-3/Q.764

Note 1 — The Alerting (Call Confirmation) message may not be given by a called terminal having automatic answer. Under these circumstances the Address Complete message will be sent as soon as the Connect (Call Acceptance) message is received and the Answer message shall follow as soon as through connection of the speech path has been completed.

Note 2 — For telephony calls within the ISDN, ringing tone will be applied by the terminating exchange after sending the Address Complete message. For data calls, application of ringing tone is not required.

Note 3 — The continuity check may be applicable on an intermediate circuit if analogue circuits are used.

Note 4 — This example assumes that the number length is known at the second transit exchange in order to illustrate the addition of SAMs to the IAM received. This function does not have to be performed in this way.

Note 5 — The call may be rejected by the user at this point following interchanges of User-User data. E.g. as a result of a failed compatibility check.

Note 6 — Charging for the transfer of User-User data requires further study.

Note 7 — Flow control of User-User data is achieved by the originating and destination exchanges by the use of "Receive-Ready" and "Receive Not Ready" messages throughout the conversation/data phase.

Note 8 — Access protocol example is for point to point operation only.

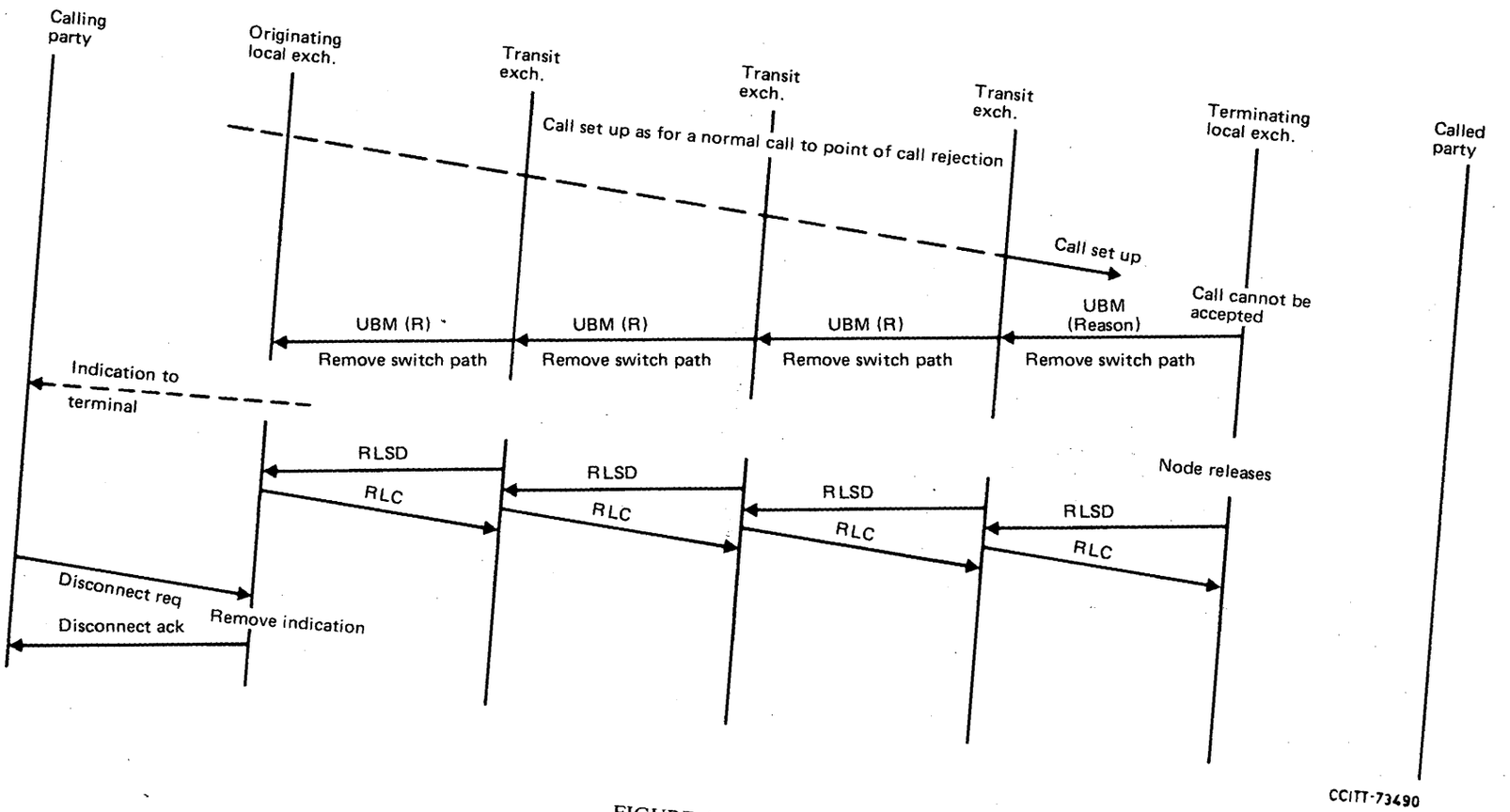


FIGURE 4/Q.764

Unsuccessful call set-up – no re-routing

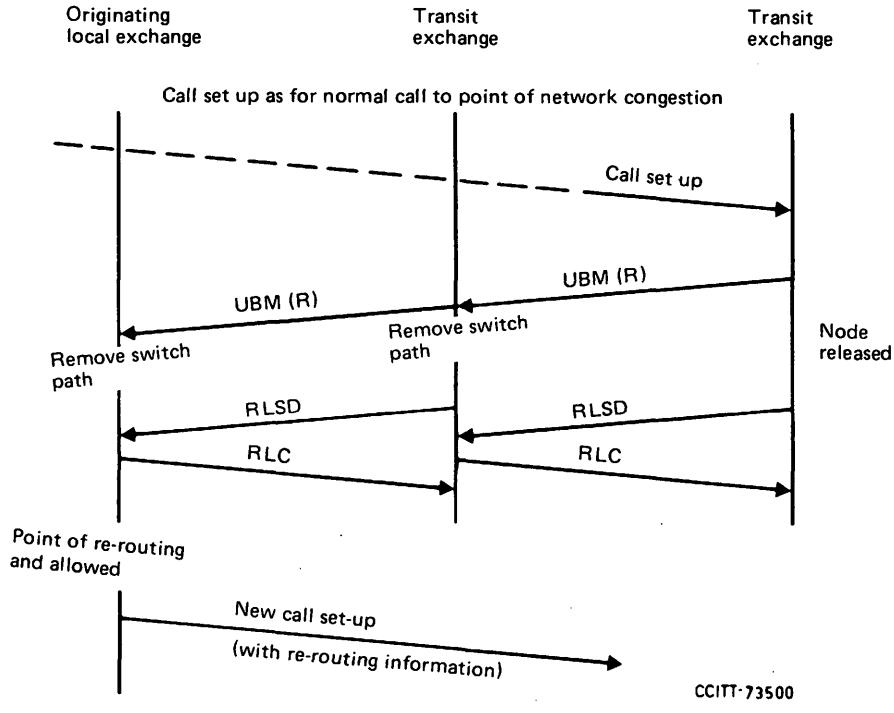


FIGURE 5/Q.764

Unsuccessful call set-up – with re-routing

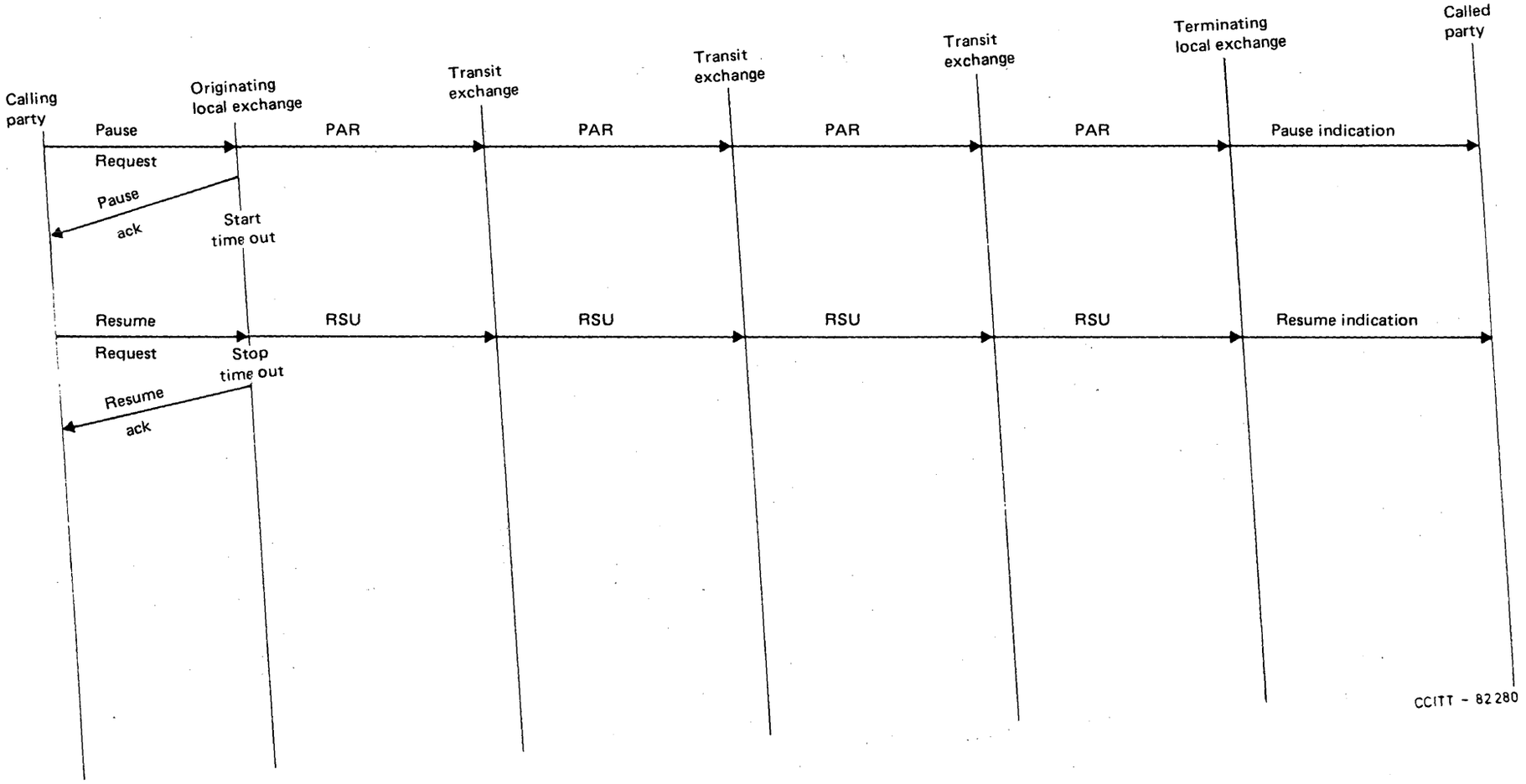


FIGURE 6/Q.764

Pause request and resume

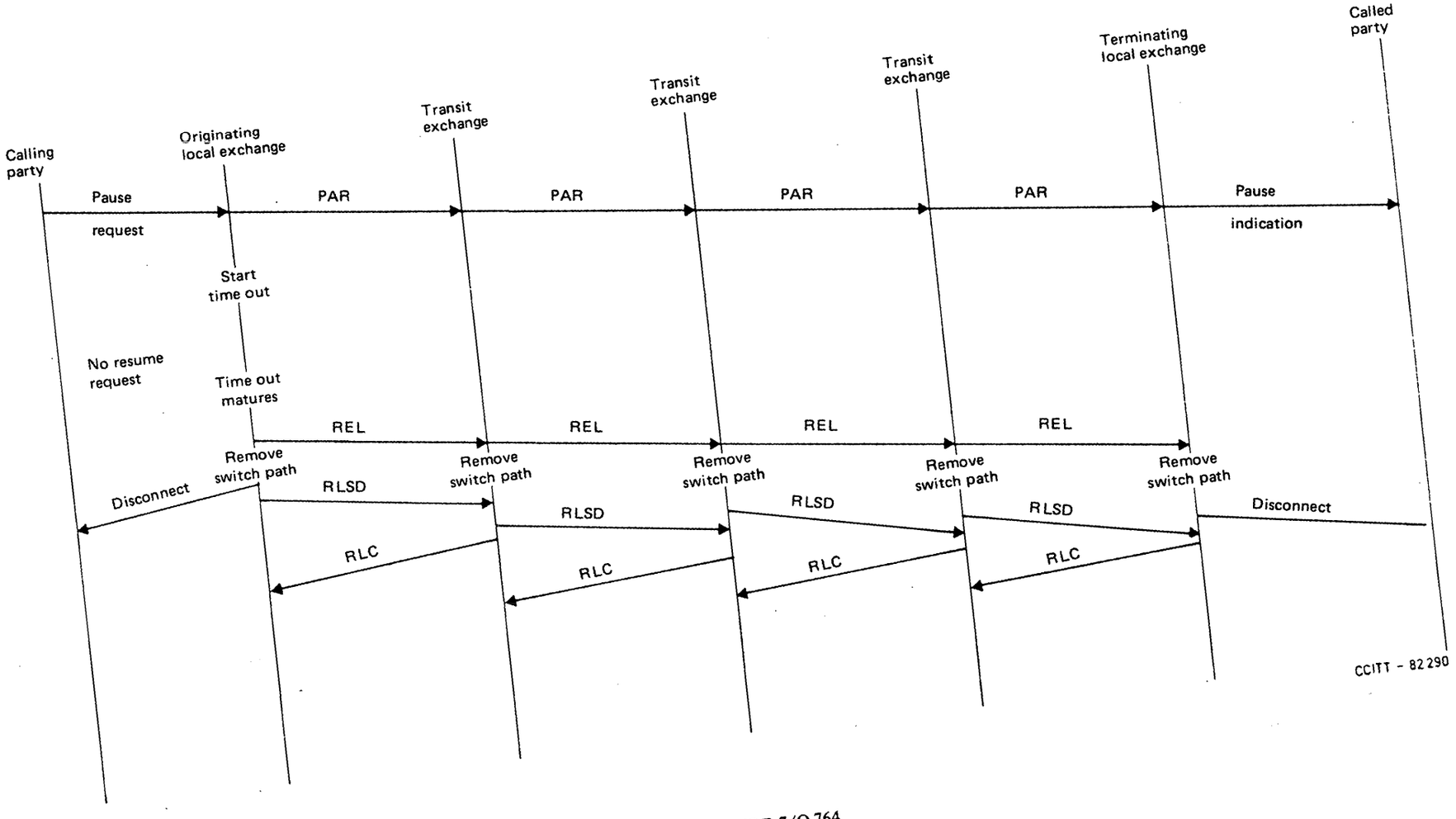


FIGURE 7/Q.764

Pause request with no reconnection

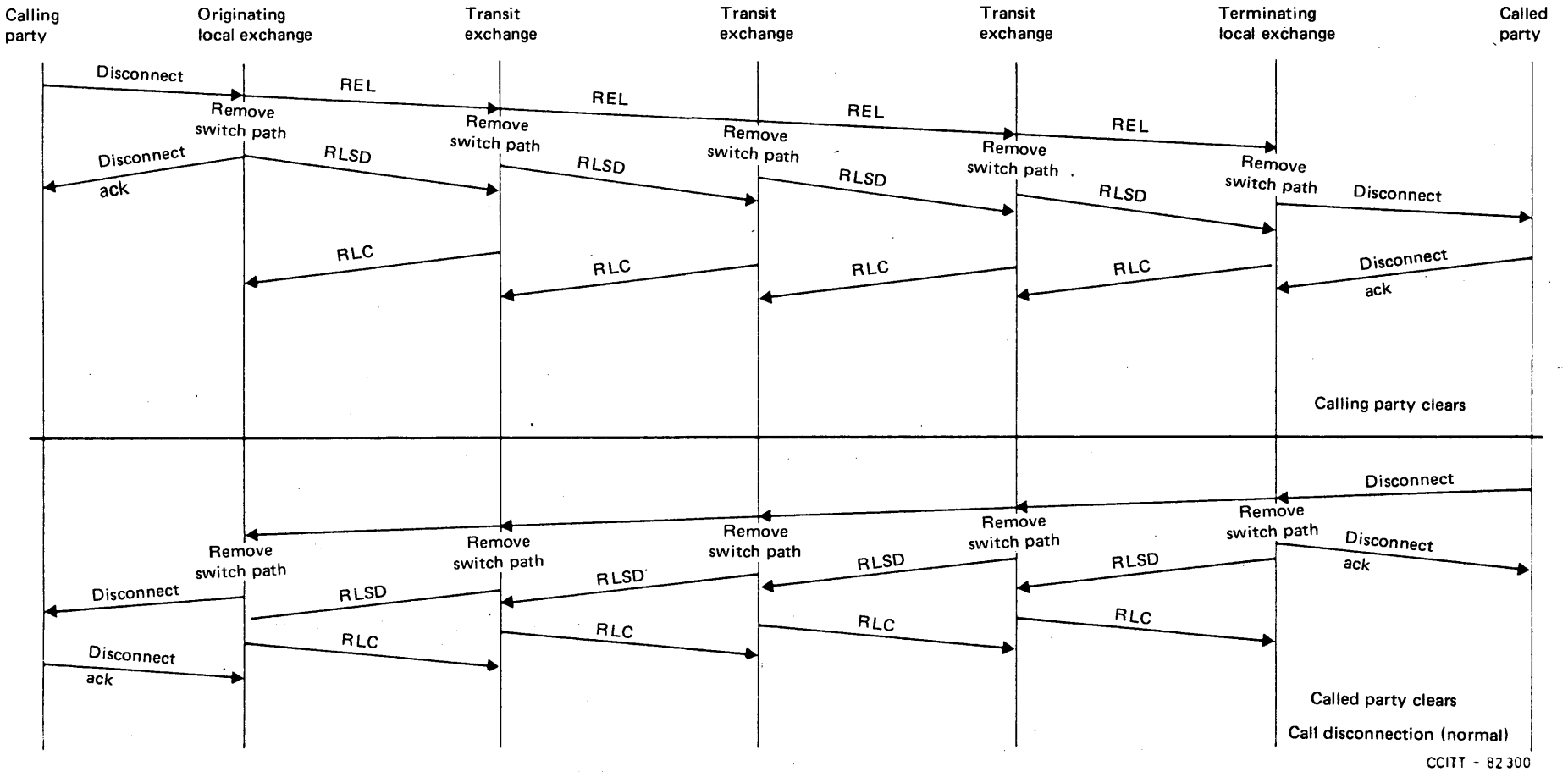


FIGURE 8/Q.764

Normal call release

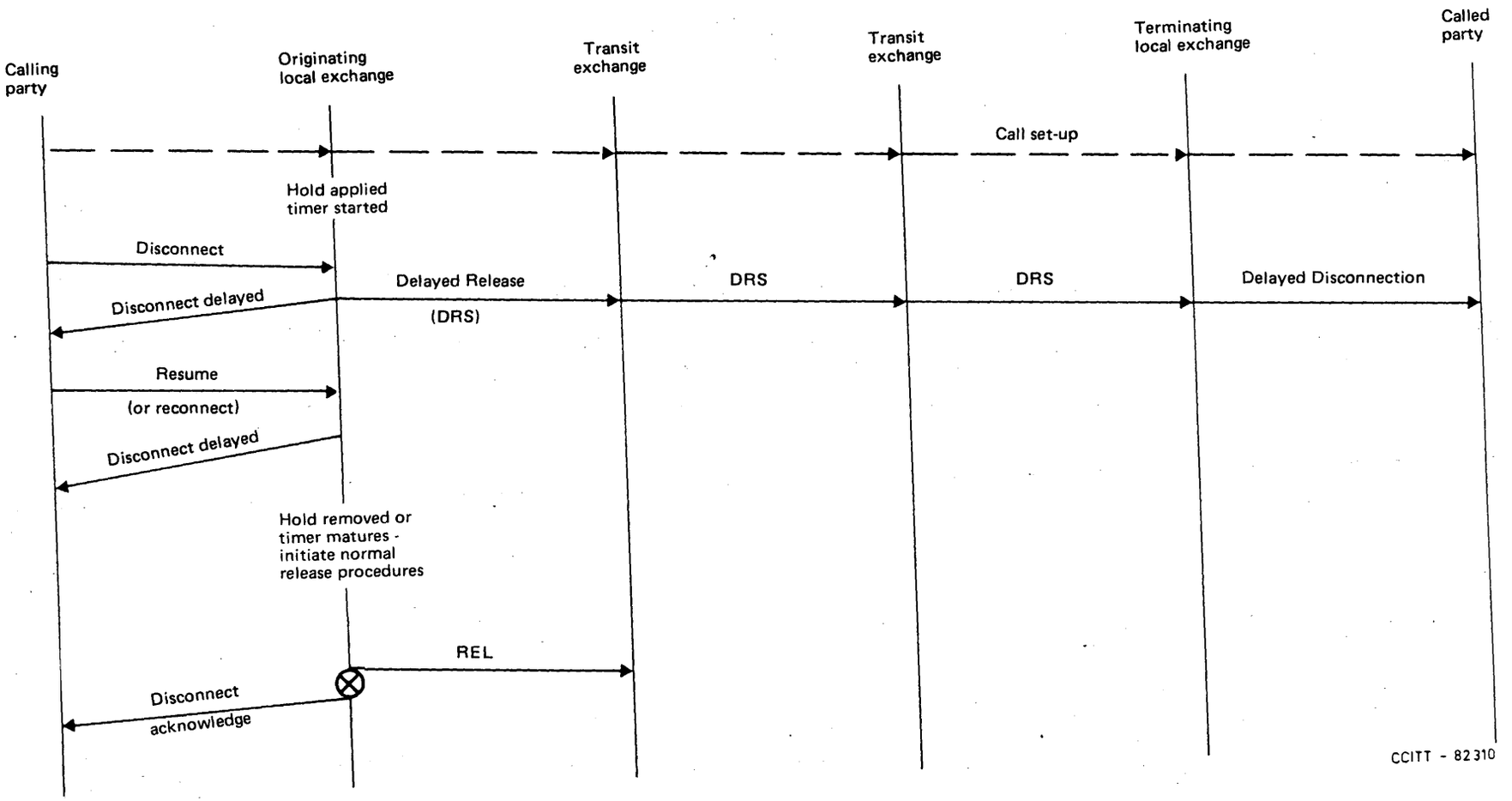


FIGURE 9/Q.764

Delayed release

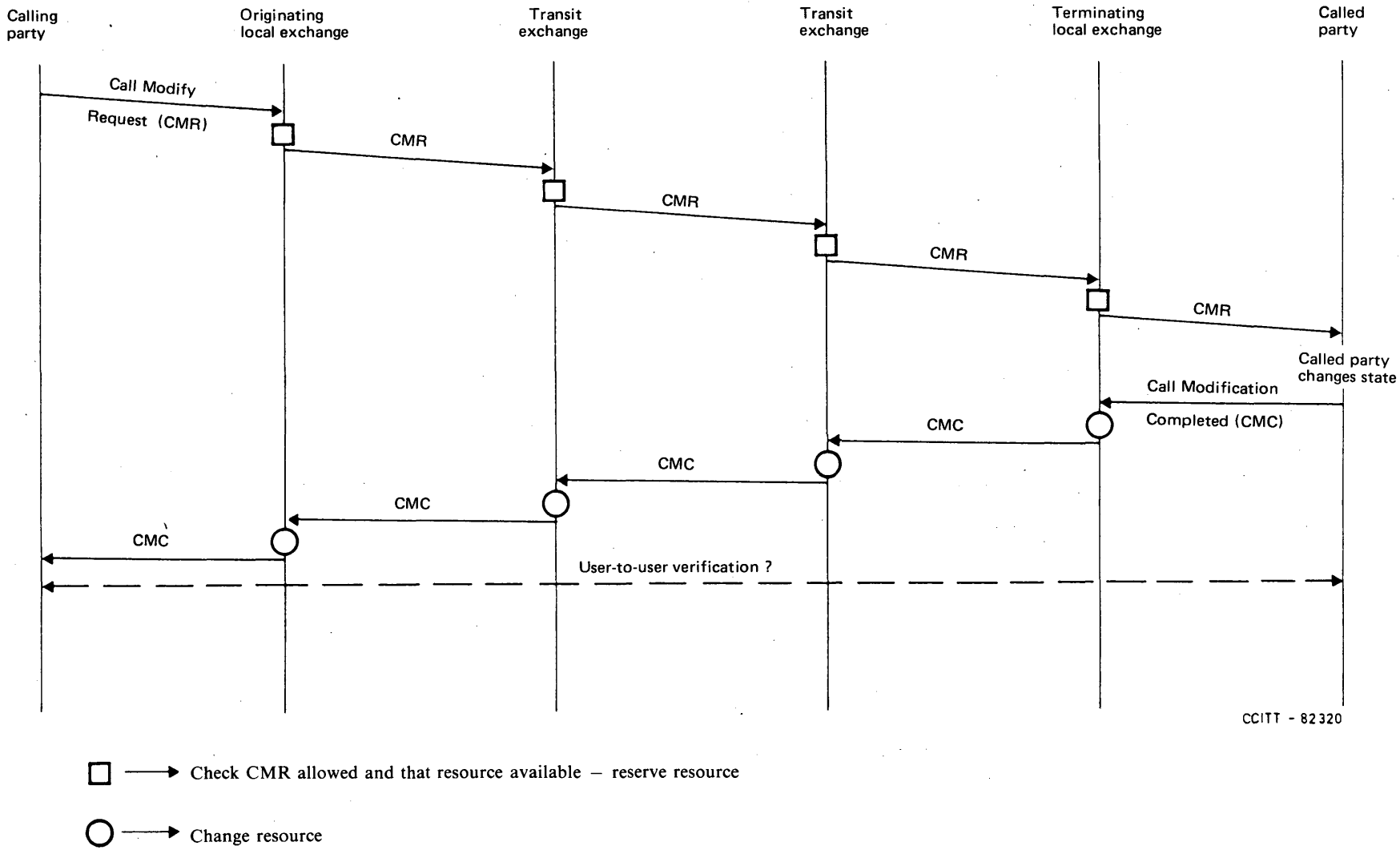


FIGURE 10/Q.764

In Call Modification – Successful

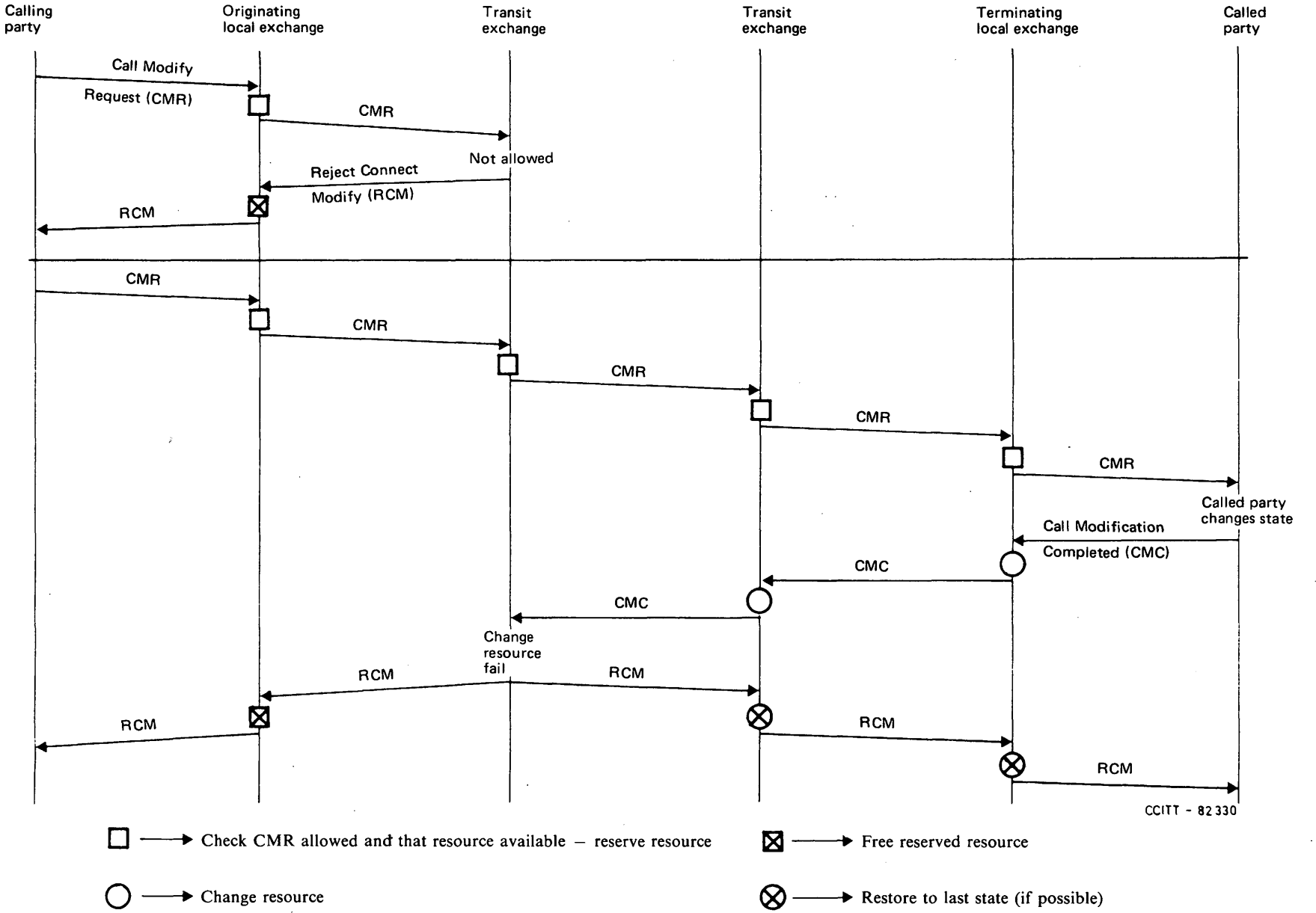


FIGURE 11/Q.764

In Call Modification – not allowed and failed

3 End-to-end signalling

3.1 *Introduction*

End-to-end messages contain only information which is relevant for the two "endpoints" of a circuit-switched connection. "Endpoints" are signalling points (with user functions) within the Signalling System No. 7 network.

Two methods are available for ISDN end-to-end signalling:

a) the pass-along method; and

b) the Signalling Connection Control Part (SCCP) method.

The choice of method is, to some extent, dependent on the size and architecture of the signalling network. Both methods may coexist in a given network.

Although the pass-along method and the SCCP method are specified for circuit-switched connections, it is possible to establish end-to-end signalling paths where the actual physical circuits do not exist. The detailed procedures for such non-circuit related use of the pass-along method are not yet specified in this Recommendation.

Pass-along signalling between two endpoints presently relies on the existence of a circuit-switched connection between the same two endpoints, while the SCCP method is independent of the existence of a circuit-switched connection and in general, requires the allocation of a circuit independent call reference to a call.

3.2 *Pass-along method*

In the pass-along method, use is made of an end-to-end connection which in fact is being set up whenever a physical connection between two end points is established. The end-to-end connection in this case consists of a number of connection sections in tandem which run in parallel with and use the same identification code as the circuits in the physical connection. The association of incoming and outgoing circuits in a transit exchange also establishes the coupling of the connection sections related to these circuits.

The pass-along method defines, section by section, the appropriate label for the message to be passed along end to end; but the content of pass-along messages is neither evaluated (except the message type code) nor changed within intermediate exchanges. The pass-along message group is characterized by a special message type code.

In a connection in which System No. 7 is used exclusively, pass-along messages may be sent in either the forward or backward direction.

A forward pass-along message may be sent after either a backward pass-along or address-complete message has been received and before the physical connection is released.

Call control path information (see § 3.5) included in the initial address and address-complete messages is used to indicate to the connection endpoints whether or not the call control path can support pass-along message transfer (e.g., whether or not Signalling System No. 7 is used in all parts of the connection between the endpoints).

A pass-along message that has been received at a transit exchange and cannot be transferred to the subsequent exchange is discarded without affecting call states and timers in that exchange.

3.3 *SCCP method*

In the SCCP method the ISDN User Part employs the services of the signalling connection control part (SCCP) for the transfer of end-to-end signalling information.

3.3.1 *Call reference*

A call reference is allocated to a call by the ISDN User Part when a possible need for an end-to-end transfer of signalling information exists and this transfer is to be performed by the SCCP. References for a given call are allocated independently in the two concerned signalling points and are exchanged during call set-up. The call reference consists of a call identity and the point code where the call identity is established.

Identification of a call between two signalling points A and B is initiated by signalling point A selecting a call identity CIA and sending it together with the point code of A, PCA, in the initial address message to signalling point B. Signalling point B then allocates its own identity CIB to the call and returns it in a message together with the signalling point code of B, PCB and call identity CIA to signalling point A. Subsequent call related end-to-end signalling information transfers from signalling point A to signalling point B contain call identity CIB and are routed directly using destination point code PCB. Conversely, information transfers from signalling point B to signalling point A contain call identity CIA and are routed using destination point code PCA.

A linkage of call references at network boundaries has to be provided.

Connections relating to a call may be released independently of each other irrespective of whether they are physical (circuit-switched connections) or logical (SCCP connections). With the release of the last connection (physical or logical) the call references are released. The release of call references without a connection requires further study.

3.3.2 *Connectionless service*

For connectionless service, the ISDN User Part transfers the data to be transmitted to the SCCP together with a request for the appropriate protocol class of service. The signalling information formatting, transfer and delivery of this data to the distant ISDN User Part is controlled entirely by the SCCP. The association between the transferred information and a call is made by the ISDN User Part, which transfers the call reference as part of signalling information for this purpose.

3.3.3 *Connection-oriented service*

Two methods of establishing an end-to-end signalling connection are provided and are described in §§ 3.3.3.1 and 3.3.3.2.

3.3.3.1 *Connection request sent by the SCCP*

In this case, the ISDN User Part behaves like any other user of the SCCP, that is, it transfers a request for connection set-up together with destination address and protocol class of service information to the SCCP. The SCCP then initiates the set up of an end-to-end connection by formatting and sending a connection request message to the destination signalling point. The SCCP also informs the ISDN User Part when connection set-up is complete.

3.3.3.2 *Connection request embedded in an ISDN User Part message*

A connection request may be carried embedded in one of the forward or backward set-up messages which are used by the ISDN User Part to set up a physical connection. The necessary information for a connection request is formed by the SCCP and passed to the ISDN User Part. Embedded connection requests are responded to by the SCCP at the destination point, e.g., by returning a connection confirmation message.

If end-to-end connection set-up is to be initiated in the forward direction, e.g., from the originating local exchange, the connection request is carried in the initial address message. Conversely, connection set-up in the reverse direction is initiated by transmitting a connection request in either an address complete message or, if the end-to-end connection is required before address complete can be sent, in a backward set-up message.

3.3.3.3 *Protocol class of service*

The protocol class of service is assumed to be 2. If the connection to be set up by an embedded connection request is of protocol class 3 or 4, the ISDN User Part set-up message must include explicit protocol class and credit indications as well as the SCCP source local reference. The need for protocol classes greater than 2 is for further study.

3.3.3.4 *Coupling of connection sections*

End-to-end connections may consist of a number of connection sections in tandem. The coupling of two connection sections at the tandem signalling points is performed by the SCCP.

For this purpose, embedded connection requests received by the ISDN User Part in a tandem point are passed to the SCCP. The SCCP, in turn, furnishes the ISDN User Part with a connection request for the new connection section in order that it may be included in an outgoing call set-up message.

3.4 *Use of the Protocol Control Indicator (PCI)*

The Protocol Control Indicator is a control information field concerning the end-to-end signalling procedures. It has to be examined to determine the possibility of using the pass-along method or the SCCP method (when an embedded connection request is not included) for the end-to-end transfer of messages. The PCI field is provided within the IAM and the ACM.

The following indications are provided:

a) Information available that could be transmitted (end-to-end) to the other endpoint;

b) Signalling System No. 7 path between the two endpoints, no interworking along the route (and the opposite);

c) Pass-along method available;

d) SCCP method available;

e) ISDN User Part is used all the way.

3.5 *Operation of the pass-along method*

Figure 12/Q.764 illustrates the operation of the pass-along protocol. In this figure the PCI is the Protocol Control Indicator in the IAM; a certain value requires an end-to-end interchange in the set-up phase. "Interworking" in the IAM or ACM indicates that the control path is not wholly Signalling System No. 7.

3.6 *Operation of the SCCP method – connectionless service*

The procedures for connectionless transfer of information are in accordance with those described in Recommendations Q.711-Q.714, signalling connection control part of Signalling System No. 7.

3.7 *Operation of the SCCP method – connection-oriented service*

3.7.1 *Connection request sent by the SCCP*

The procedures for connection set up initiated by a connection request sent by the SCCP are in accordance with those described in Recommendations Q.711-Q.714, signalling connection control part of Signalling System No. 7.

3.7.2 *Connection request embedded in an ISDN User Part message*

3.7.2.1 *Actions at the originating endpoint*

The originating endpoint is the exchange in which the connection request originates.

The following actions are performed in an originating end endpoint

i) The ISDN User Part requests the SCCP to establish a signalling connection to the called address with embedded transfer of the connection request.

ii) The SCCP forms a connection request and sends it to the ISDN User Part[1].

iii) The ISDN User Part transmits a connection request in either:
   - the initial address message, if the originating end point is also the originating point of the call, or
   - in a backward call set up message (e.g., an address complete message) if the originating endpoint is also the terminating point of the call.

iv) The SCCP informs the ISDN User Part of successful or unsuccessful end-to-end connection set up depending on whether a connection confirmation or a connection refused message was received, respectively, in response to the connection request transmitted within an ISDN User Part message.

[1] The SCCP process enters the "connection pending" state.

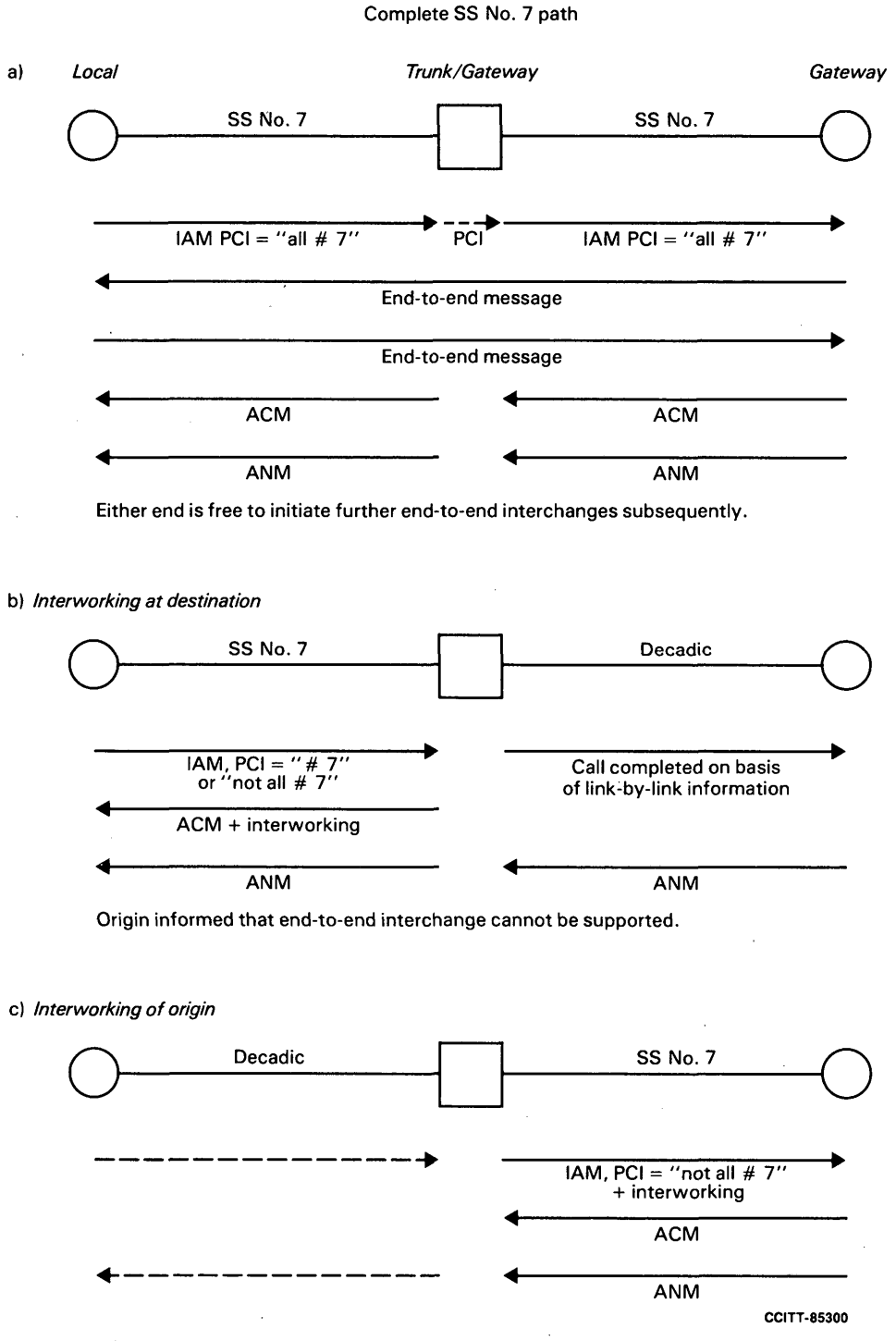


FIGURE 12/Q.764

Operation of end-to-end protocol (pass along method)

3.7.2.2 *Actions at an intermediate point*

An intermediate point is an exchange in which two connection sections belonging to the same end-to-end connection are coupled.

The following actions are performed in an intermediate point:

i) Upon receiving an embedded connection request in either an initial address message or a backward set-up message (BSM), the ISDN User Part transfers the received connection request to the SCCP.

ii) On receiving the connection request from the ISDN User Part, the SCCP performs the necessary coupling and forms a connection request for a new connection section[2)].

iii) The ISDN User Part transmits the connection request in a message of the same type as that in which the SCCP call request was received, i.e., in either an initial address or backward set-up message.

iv) The SCCP informs the ISDN User Part of successful or unsuccessful set up depending on whether a connection confirmation or a connection refused message was received, respectively, in response to the embedded connection request.

3.7.2.3 *Actions at the terminating endpoint*

The terminating endpoint is the exchange in which the connection request terminates.

The following actions are performed at a terminating endpoint:

i) On receiving an embedded connection request in either an initial address message or backward set-up message, the ISDN User Part passes the received connection request to the SCCP.

ii) On receiving the connection request from the ISDN User Part, the SCCP initiates connection confirmation or connection refusal depending on the availability or non-availability respectively of resources to establish the connection. Connection confirmation or connection refusal is initiated in accordance with the procedures described in Recommendation Q.714, signalling connection control part procedures.

iii) If resources are available, the SCCP informs the ISDN User Part of a request to establish an end-to-end connection.

iv) The ISDN User Part may either accept or refuse the request and informs the SCCP accordingly. The SCCP then either completes connection set up or releases the connection in accordance with the procedures described in Recommendation Q.714.

3.8 *Interface elements between ISDN User Part and SCCP (embedded transfer)*

The ISDN User Part may either use the pure primitive interface to the SCCP or, in addition, the functional interface as designed in draft Recommendation Q.711.

Three interface elements are defined for this functional interface:

a) the Request Type 1;

b) the Request Type 2;

c) the Reply.

The contents of these three interface elements are shown in Annex A to Section 3 of Recommendation Q.764.

Figure 13/Q.764 indicates the usage of the interface elements during set up of a circuit-switched connection together with an SCCP connection.

2) The SCCP allocates an outgoing local reference, informs the ISDN User Part of its value and associates the incoming and outgoing local references and their corresponding point codes. The SCCP process enters the "connection pending" state.

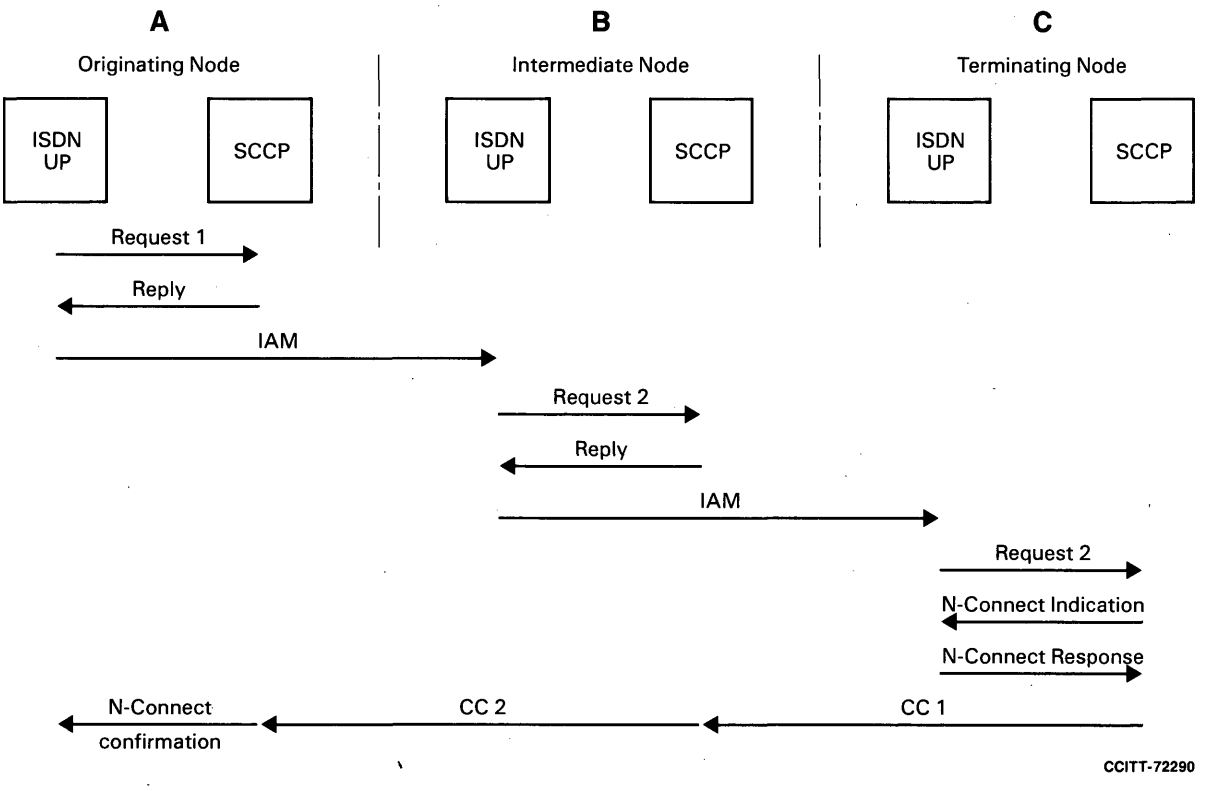


FIGURE 13/Q.764

Set up, resources available, coupling in B

ANNEX A

(to Section 3 of Recommendation Q.764)

Examples of the set up of an SCCP connection by the ISDN User Part

Figures A3-1/Q.764 through A3-6/Q.764 give examples for usage of the two methods for set up of SCCP connection controlled by the ISDN User Part. Square brackets [ ] indicate the ISDN User Part Call Reference(s) and round brackets ( ) indicate SCCP messages.

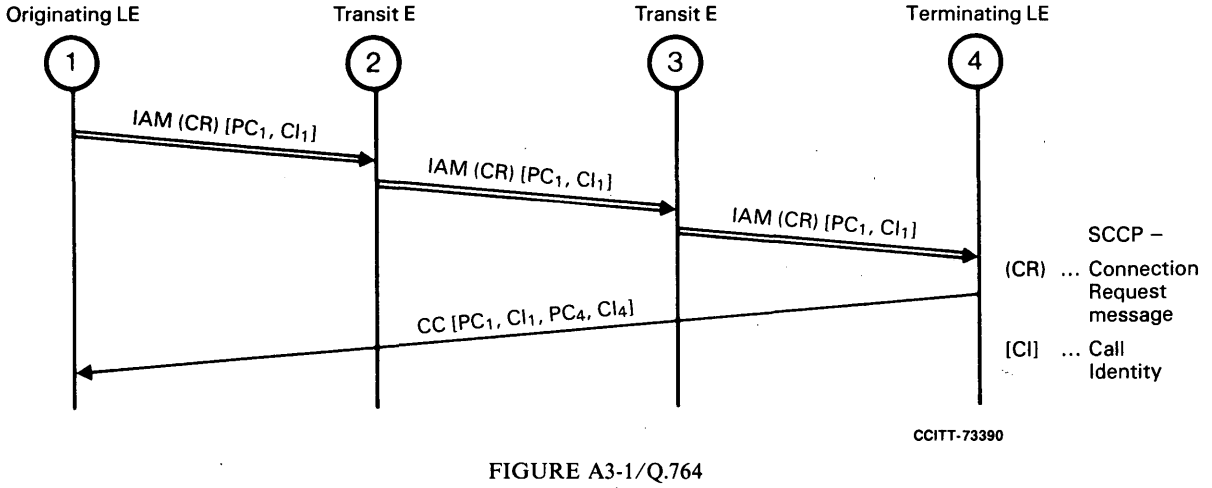


FIGURE A3-1/Q.764

Set up of an end-to-end signalling connection, SCCP-type
Case 1: Set-up element implicitly transferred within IAM

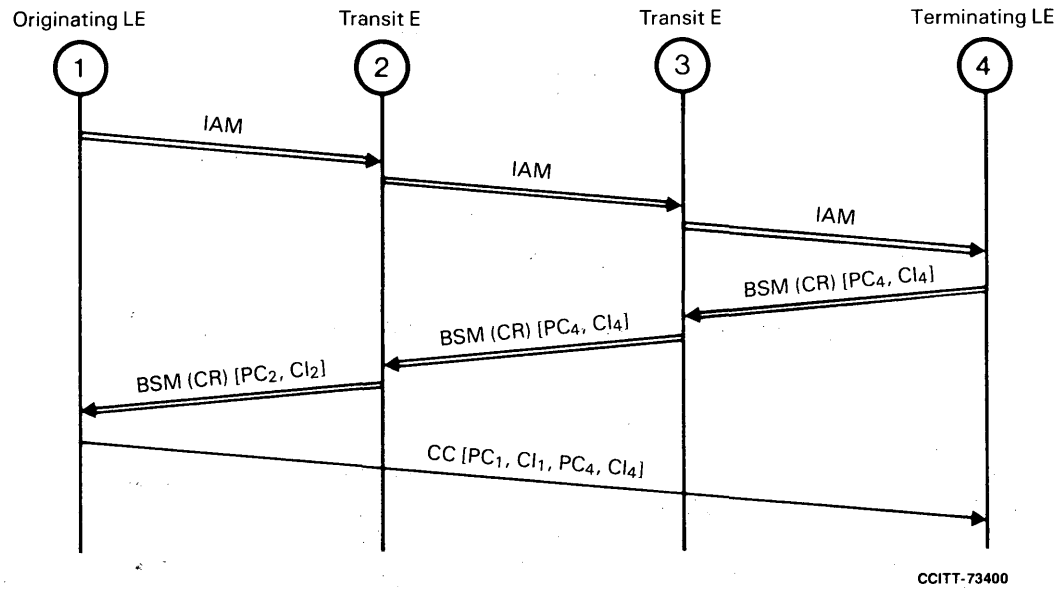
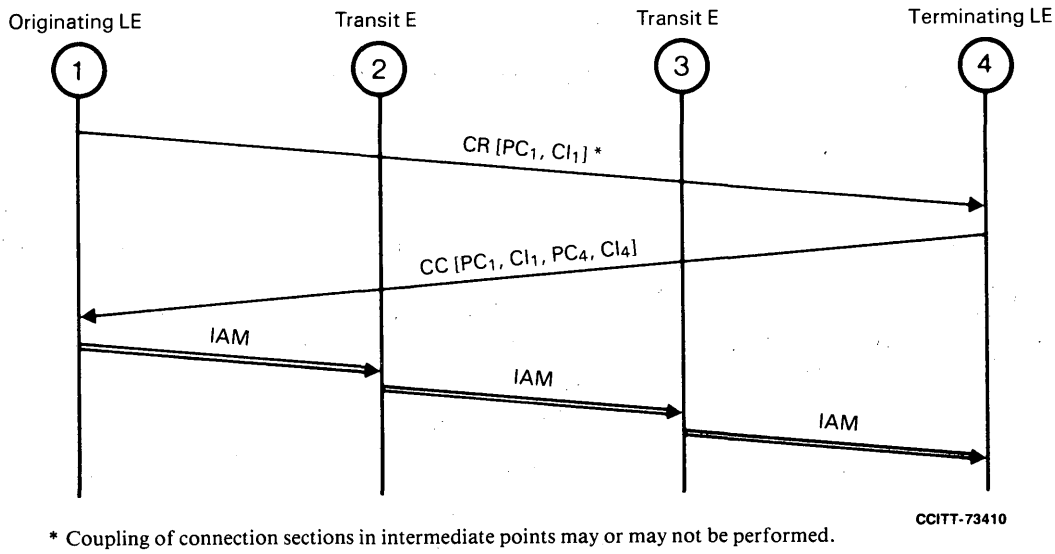


FIGURE A3-2/Q.764

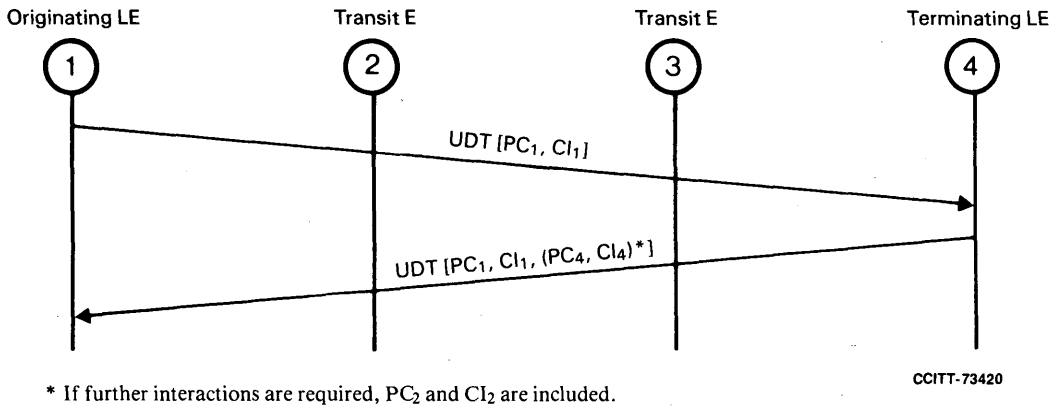
Set up of an end-to-end signalling connection, SCCP-type
Case 2: Set-up element implicitly transferred within BSM



* Coupling of connection sections in intermediate points may or may not be performed.

FIGURE A3-3/Q.764

Set-up of an end-to-end signalling connection, SCCP-type
Case 3: Explicit set up



* If further interactions are required, PC_2 and CI_2 are included.

FIGURE A3-4/Q.764

Usage of the connectionless service for the transfer of ISDN-UP - end-to-end message

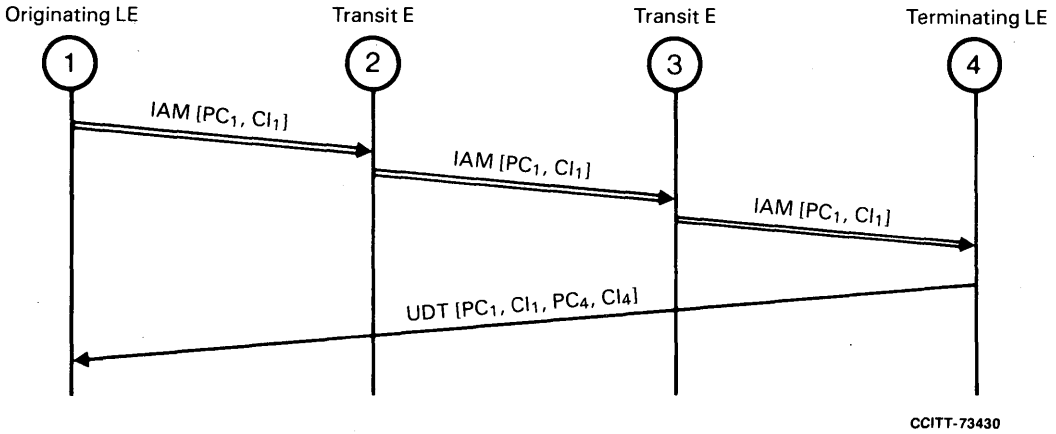


FIGURE A3-5/Q.764

Usage of the connectionless service after transfer of the Call Identity within an IAM

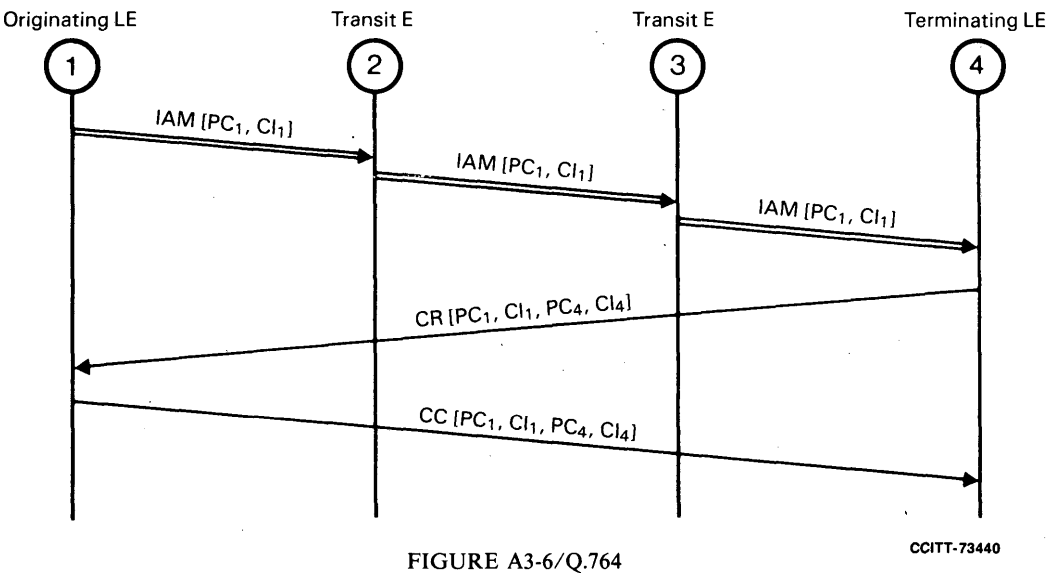


FIGURE A3-6/Q.764

Set up of an end-to-end signalling connection, SCCP-type
Case 4: Explicit, after IAM

ANNEX B

(to § 3 of Recommendation Q.764)

Contents of the interface elements between the ISDN User Part and the SCCP

These interface elements are defined in the SCCP Recommendations Q.71x series and are included here for information.

B.1 *Contents of the REQUEST Type 1*

The REQUEST Type 1 interface element may contain the following parameters:

- connection identification;[3)]
- receipt confirmation selection;
- expedited data selection;
- quality of service parameter set.

B.2 *Contents of the REQUEST Type 2*

The REQUEST Type 2 interface element may contain the following parameters:

- protocol class;
- credit;
- connection identification[3)];
- source local reference;
- originating signalling point code;
- reply request;
- refusal indicator[3)].

B.3 *Contents of the REPLY*

The REPLY interface element may contain the following parameters:

- source local reference;
- protocol class;
- credit;
- connection identification[3)].

4 User facilities

4.1 *Closed user group*

4.1.1 *General*

The Closed User Group (CUG) facilities enable users to form groups with different combinations of restrictions for access from or to the users having one or more of these facilities. The following CUG facilities are standardized:

a) Closed user group – this is the basic facility that enables a user to belong to one or more CUGs.

b) Closed user group with outgoing access – this is an extension to a) which also enables the user to make outgoing calls to the open part of the network, and to users having the incoming access capability (see c) below).

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3) These parameters are for further study.

c) Closed user group with incoming access – this is a variant of a) which also enables the user to receive incoming calls from the open part of the network, and from users having the outgoing access capability (see b) above).

d) Incoming calls barred within the closed user group – this is a supplementary facility to a), b) or c) which, when used, applies per user per CUG.

e) Outgoing calls barred within the closed user group – this is a supplementary facility to a), b) or c) which, when used, applies per user per CUG.

A user may belong to one or more CUGs. In the case where a user belongs to more than one CUG, one of these is nominated as the preferential CUG of that user. Each user belonging to at least one CUG has either the closed user group facility or one or both of the closed user group with outgoing access and the closed user group with incoming access facilities. For each CUG to which a user belongs, either or none of the incoming calls barred within the closed user group or outgoing calls barred within the closed user group facilities may apply for that user. Different combinations of CUG facilities may apply for different users belonging to the same CUG. The application of CUG facilities to PABXs is for further study.

The realization of the CUG facilities is done by the provision of interlock codes and is based on various validation checks at call set-up, determining whether or not a requested call to or from a user having a CUG facility is allowed. In particular, a validation check is performed by verification that both the calling and called parties belong to the same CUG as indicated by interlock codes.

The data for each CUG that a user belongs to, can either be stored at the local exchange to which the user is connected (decentralized administration of CUG data) or in dedicated point(s) in the network (centralized administration of CUG data).

The validation checks at call set-up when using decentralized administration of the CUG data are performed in the originating and destination exchanges. When using centralized administration of CUG data most of the validation checks are made in the dedicated point(s), and a minimum of the CUG data is stored in the local exchanges.

In § 4.1.2 the call set-up procedure based on decentralized administration of CUG data is specified.

In § 4.1.3 the call set-up procedure based on centralized administration of CUG data is specified.

The call control procedure specified in § 4.1.2 based on decentralized administration of CUG data is recommended for national and international use.

The call control procedure specified in § 4.1.3 based on centralized administration of CUG data is recommended for national use.

4.1.2 *Call set-up procedure with decentralized administration of CUG data*

4.1.2.1 *Originating exchange*

The actions at the originating exchange at call set-up from a user belonging to a CUG depend on whether the user belongs to one or more CUGs and on the combination of CUG facilities that applies.

a) CUG selection

For each CUG that a user belongs to, the interlock code assigned to the CUG is stored, associated with the user, at the local exchange. In the case where a user belongs to more than one CUG, a selection of the CUG concerned, and thus of the corresponding interlock code, is required at call set-up. This selection is made on the following criteria.

In the case where the calling party makes a facility request including an index identifying a particular CUG, this CUG is selected by the originating exchange.

In the case where the calling party makes no facility request identifying a particular CUG, the originating exchange selects the preferential (or only) CUG.

Thus in the case where the calling party belongs to a CUG, no facility request concerning CUG facilities is made in the case:

i) where the user belongs to one CUG only;

ii) where a user who belongs to more than one CUG (with or without outgoing access) makes a call within the preferential CUG;

iii) where a user having the closed user group with outgoing access facility makes an outgoing access call.

A facility request is always required for a call within any CUG other than the preferential CUG.

b) Call set-up from a user having the closed user group or the closed user group with incoming access facility

In this case the CUG selection is performed in accordance with § 4.1.2.1 a).

The case where a user has both the closed user group with incoming access and closed user group with outgoing access facilities is handled in accordance with § 4.1.2.1 c).

In the case where the outgoing calls barred within the closed user group facility does not apply for the selected CUG, the call is set up at the originating exchange. The initial address message forwarded to the next exchange then includes the interlock code of the selected CUG together with an indication that the call is a CUG call.

In the case where the outgoing calls barred within the closed user group facility applies for the selected CUG, the call is rejected and the access barred signal is returned to the calling party.

c) Call set-up from a user having the closed user group with outgoing access facility

In this case the call is regarded as either an outgoing access call or a call within the preferential (or only) CUG, unless the calling party makes a facility request identifying a particular CUG for the call.

In the case where the outgoing calls barred within the closed user group facility does not apply for the selected CUG, the call is set up at the originating exchange. The initial address message forwarded to the next exchange then includes the interlock code of the selected CUG together with an indication that the call is a CUG for which outgoing access is allowed.

In the case where the outgoing calls barred within the closed user group facility applies for the preferential (or only) CUG, the call is regarded as an outgoing access call. In this case the call is set up at the originating exchange and no interlock code or CUG call indication is included in the initial address message forwarded to the next exchange.

In the case where the calling party makes a facility request identifying a particular CUG and the outgoing calls barred within the closed user group applies for this CUG, the call is rejected and an access barred signal is sent to the calling party.

4.1.2.2 *Transit exchange*

With the possible exception of some gateway exchanges, each transit exchange sets up a CUG call as an ordinary call. The information related to the CUG facilities received from the preceding exchange, i.e. an interlock code, a CUG call indication and possibly an indication that outgoing access is allowed, is forwarded to the succeeding exchange.

In the case of an international CUG call, no special functions are required at the gateway exchange provided that the international interlock code assigned to the international CUG concerned is used in the national network. However, in the case where a national interlock code other than the applicable international interlock code is used within a national network, interlock code conversion is required at the gateway (or corresponding) exchange.

4.1.2.3 *Destination exchange*

At the destination exchange a validation check of the acceptability of a call is made where either the calling party (as indicated by a CUG call indication in the initial address message received) or the called party belongs to a CUG. The call is connected only in cases where the information received checks with the information stored at the destination exchange, as specified in the following. In cases where a call is rejected because of incompatible CUG information a call supervision message including the access barred signal is sent towards the originating exchange.

a) Calls to a user having the closed user group or the closed user group with outgoing access facility

In this case an incoming call is accepted only when:

i) it is a CUG call, including the case where outgoing access is allowed, and

ii) correspondence is found between the interlock code received and an interlock code associated with the called party, and

iii) the incoming calls barred within the closed user group facility does not apply for the CUG identified by the interlock code received.

If all the above conditions are not met, the call is rejected.

b) Calls to a user having the closed user group with incoming access facility

In this case an incoming call is accepted when it is:

i) an ordinary call;

ii) a CUG call for which outgoing access is not allowed, if both conditions specified in § 4.1.2.3 a), ii) and iii) are met;

iii) a CUG call for which outgoing access is allowed.

c) CUG calls to a user not belonging to any CUG

In the case where the incoming call is:

i) a CUG call for which outgoing access is allowed, it is accepted;

ii) a CUG call for which outgoing access is not allowed, it is rejected.

4.1.3 *Call set-up procedure with centralized administration of CUG data*

In the local exchange an indication is stored, showing whether the user has either none or one of the closed user group or closed user group with incoming access facilities.

4.1.3.1 *Originating exchange*

The actions of the originating exchange depend on whether the user has the CUG facility and whether the user belongs to more than one closed user group.

a) Normal call set-up

In the case where the calling party has a closed user group facility indication, a request for CUG selection and validation is sent in an end-to-end message from the originating exchange to the dedicated point(s) where the additional CUG data, which belongs to the user, is stored.

The request includes the calling party address, the called party address and an index (if applicable). The index is forwarded to the local exchange in a facility request.

The actions at the originating exchange and the information forwarded to the next exchange depend on the information received in the end-to-end message including the response of the CUG selection and validation:

i) access barred indicator: indicating that the validation check was not successful. When receiving this indicator the call is rejected and the access barred signal is sent to the calling party in accordance with the network-user interface protocol;

ii) divergency indicator: indicating that there is divergency between the CUG data associated with the user, stored in the local exchange, and the CUG data associated with the user, stored at the dedicated point(s). When receiving this indicator the originating exchange sets up the call and an indication is given to the maintenance personnel. In this case the initial address message includes no information related to the CUG facility;

iii) closed user group check successful indicator: indicating that the validation check, performed by the dedicated point(s), was successful. When receiving this indicator the originating exchange sets up the call. The initial address message forwarded to the next exchange then includes an indication that the call is a CUG call for which the validation check was successful;

iv) normal call indicator: indicating that the validation check performed by the dedicated point(s) was successful. When receiving this indicator the originating exchange sets up the call. In this case the initial address message includes no information related to the CUG facility;

v) interlock code signal and CUG call with outgoing access indicator: including the international interlock code of the selected closed user group, and an indication that the user has the outgoing access facility. When receiving this indicator the originating exchange sets up the call towards the gateway exchange. The initial address message forwarded to the next exchange then includes the international interlock code of the selected CUG together with an indication that the call is a CUG call for which outgoing access is allowed;

vi) interlock code signal with CUG call indicator: including the international interlock code of the selected CUG. When receiving this information the originating exchange sets up the call towards the gateway exchange. The initial address message forwarded to the next exchange then includes the international interlock code of the selected CUG together with an indication that the call is a CUG call.

b) Abnormal situation

When sending the request a timer T5 is started. In the case of not receiving the response before the timer T5 expires, the originating exchange repeats the sending of the request and restarts the timer T5.

In the case of not receiving the response before the timer T5 expires on the repeat attempt, the call is rejected and an out-of-order signal is returned to the calling party in accordance with the user-network protocol.

4.1.3.2 *Dedicated point(s)*

At the dedicated point(s) the following items are stored for each user in the network having the closed user group facility:

i) the interlock code of CUGs to which the user belongs;

ii) in the case where the user belongs to more than one CUG, an indication showing which CUG is preferential, and a table showing the relation between the index and the concerned CUG;

iii) whether the user has the closed user group with outgoing access facility;

iv) an indication for each closed user group to which the user belongs as to whether the incoming calls barred within the closed user group facility applies and/or the outgoing calls barred within the closed user group facility applies.

a) Normal call set-up

When receiving the request for CUG selection and/or validation, the dedicated point(s) makes the CUG selection and validation checks.

The CUG selection is made in accordance with the criteria as specified in § 4.1.2.1 a) and validation checks are made in accordance with the criteria as specified in § 4.1.2.3.

Depending on which CUG facilities the calling and called party have, whether the calling and the called party belong to the same network and on the result of the validation checks, the following information is included in the response:

i) Closed user group check successful indicator: this indicator is returned to the originating exchange if the following conditions are fulfilled:
   - the calling and the called party belong to the same network, and
   - correspondence is found between the interlock code selected from the information received in the request and an interlock code associated with the called party, and
   - the calling party does not apply the outgoing calls barred within CUG facility and the called party does not apply the incoming calls barred within CUG facility for this particular CUG.

ii) Normal call set-up indicator: this indicator is returned to the originating exchange when the calling party has the closed user group with outgoing access facility and the calling party;
   - makes a call to the open part of the network to which the calling party belongs;
   - applies the outgoing calls barred facility within the closed user group, for the preferential or only CUG;
   - the calling and called party belong to the same network, and the interlock code check is not successful or the called party applies the incoming call barred within the closed user group selected by the user.

iii) Access barred indicator: this indicator is returned to the originating exchange in the following cases:

When the calling party has the closed user group facility and:
   - makes a call to the open part of the network, to which the calling party belongs;
   - applies the outgoing call barred within the closed user group, selected from the information received in the request;

– the interlock code check between the interlock code selected from the information received in the request does not correspond with an interlock code associated with the called party;

– the called party applies the incoming call barred within the closed user group facility for the CUG selected from the information received in the request.

When the calling party has the closed user group with outgoing access facility and applies the outgoing call barred within the closed user group, given by the index received in a facility request.

iv) Interlock code signal with the CUG call indicator. This information is returned to the originating exchange in the case where the called and the calling party do not belong to the same network. The calling party has the closed user group facility, and the calling party does not apply the outgoing call barred within the closed user group for the selected CUG.

v) Interlock code signal with CUG outgoing call access indication. This signal is returned to the originating exchange in the case where the called and calling party do not belong to the same network. The calling party has the closed user group with outgoing access facility, and the calling party does not apply the outgoing call barred within the closed user group for the selected CUG.

b) Abnormal situation

In the case where there is no correspondence between the data associated with a user stored in the local exchange and data associated with the same user stored in the dedicated point(s), it is assumed that the data stored in the dedicated point(s) is more correct than the data stored in the local exchange. As a consequence of this a divergency signal is sent to the originating exchange in the case where there is no CUG data associated with the user stored in the dedicated point(s) and a request is received for that concerned user.

4.1.3.3 *Transit exchange*

a) Normal call set-up

With the possible exception of some gateway exchanges, each transit exchange sets up a CUG call as an ordinary call. The information related to the CUG facilities received from the preceding exchange, i.e. CUG call indication, is forwarded to the next exchange.

In the case of an incoming international CUG call, the initial address message includes the interlock code, CUG call indications and possibly an indication that outgoing access is allowed. The gateway exchange will forward the information received in the initial address message to the dedicated point(s) in a request for CUG validation. As an answer to the request for CUG validation a response is received from the dedicated point(s).

The request for, and the response to, the CUG validation is included in an end-to-end message.

The response includes one of the signals i), ii) and iii), specified in § 4.1.3.1 a). The validation checks performed at the dedicated point(s) are outlined in § 4.1.3.2.

Depending on the signal received in the response, different action will be taken by the gateway exchange:

i) In the case of receiving the access barred indicator, the call is rejected and a call supervision message including the access barred signal is sent to the originating gateway exchange.

ii) In the case of receiving the closed user group check successful indicator, the gateway exchange sets up the call into the national network. The initial address message forwarded to the next exchange includes an indication that the call is a CUG call for which the closed user group check was successful.

iii) In the case of receiving the normal call set-up indicator or divergency indicator, the gateway exchange sets up the call into the national network. The initial address message does not include any information related to the CUG facilities.

b) Abnormal situation

When sending the validation request in an end-to-end message, a timer is started. In the case of not receiving the response before the timer T5, expires, the gateway exchange restarts the timer T5 and repeats the sending of the request.

In the case of not receiving the response before the timer expires on the repeat attempt, the call is rejected and a call supervision message including an out-of-service signal is returned to the originating gateway exchange.

4.1.3.4 *Destination exchange*

a) Normal call set-up

At the destination exchange a validation check of the acceptability of a call is made where either the calling party (as indicated by a CUG call indication in the initial address message received) or the called party belongs to a CUG. The call is connected only in cases where the information received checks with the information stored in the local exchange as specified in the following:

i) Calls to a user having the closed user group facility. In this case an incoming call is accepted only when it is a CUG call for which the closed user group check was successful.

In all other cases the call is rejected and a call supervision message including the access barred signal is returned to the originating exchange.

ii) Calls to a user having the closed user group with incoming access facility or to a user not belonging to any CUG. In this case all CUG calls are accepted.

b) Abnormal situation

In the case of a CUG call arriving at a user which does not have any CUG facilities, the call is accepted (see § 4.1.3.2 b)) but an indication is given to maintenance personnel that there is divergency between the data stored in the dedicated point(s) associated with a user and the data stored in the local exchange associated with the user.

4.1.4 *International interlock code*

Each international CUG is assigned a unique International CUG number (ICN) according to the administrative rules defined in Recommendation X.180.

4.2 *User access to the calling party address identification*

4.2.1 *General*

User access to the calling party address identification is a user facility that enables a user to be informed on incoming calls of the address of the calling party. When provided, the facility applies to all incoming calls except for when the calling party has the calling party address presentation restricted facility or the complete address of the calling party is not available at the destination exchange.

The calling party address is the ISDN number of the calling party.

The calling party address presentation restricted facility enables a user to prohibit the forwarding of the calling party address to the called party.

In the case where a national network does not always provide the calling party address facility, the calling party address is the known part of the ISDN number at the interworking point (e.g. Trunk Code).

In the case where a calling party is a PABX, the network can send the ISDN number of the PABX or the DDI number of the extension as the calling party address.

Information indicating that a subscriber has the user access to the calling party address facility or the calling party address presentation restricted facility is available in the exchange to which the subscriber is connected.

4.2.2 *Call set-up procedure*

The call control procedure and the information included in call control messages vary depending on whether the calling party has indicated a request to use the calling party address presentation restricted facility for this call and whether the calling party address is included in the initial address message.

Two different call control procedures can be used to provide the calling party address facility. Both procedures are specified for international use.

4.2.2.1 *The calling party address is included in the initial address message*

In the case where the calling party has indicated the calling party address restricted facility the initial address message includes the calling party address restricted request indication.

In the case where the complete address of the calling party is not available or not allowed to be forwarded outside the network:

a) in the international network no information regarding the calling party address is included;

b) in national networks, the known part of the calling party address could be included. In this case a calling party address incomplete indicator is included in the message.

The calling party address is sent to the called party in accordance with the user-network interface protocol.

In the case where the destination exchange receives the calling party address restricted request indicator or a calling party incomplete address indicator in the response message, the calling party address is not forwarded to the called party.

4.2.2.2 *The calling party address is not included in the initial address*

In the case where the called party has the user access to the calling party address identification facility, a request is sent towards the originating exchange.

The request is either included in a general information request message or an end-to-end message.

When receiving the request for calling party address the originating/interworking exchange sends a response including the calling party address. In the case where the calling party has the calling party address presentation restricted facility, the response sent from the originating exchange includes the calling party address presentation restricted request indicator. The response is either included in a general information response message or an end-to-end message. The information included in the response, in addition to the calling party address presentation restricted indicator (where applicable), is:

a) in the case where the complete identity of the calling party is known, the originating exchange includes the complete ISDN number of the calling party;

b) in the case where the complete identity of the calling party address is not available or is not allowed to be forwarded outside the network, the response includes:

   i) in international networks, the calling party address unavailable signal;

   ii) in national networks, in addition to the calling party address unavailable signal, the response can include the known part of the calling party address. In this case the response includes the calling party incomplete address indicator.

The calling party address is sent to the called party in accordance with the user-network interface protocol.

In the case where the destination exchange receives the calling party address restricted request indicator or a calling party incomplete address indicator in the response message, the calling party address is not forwarded to the called party.

4.3 *User access to called party address identification*

4.3.1 *General*

Called party address identification is a user facility that enables a user to be informed on outgoing calls of the identity of the user to which the call has been connected.

The called party address is the ISDN number of the user to which the call has been connected.

In the case where the networks, needed for establishing the call, do not provide the called party address identity facility, the called party address identity is the ISDN number at the interworking point (e.g. Country Code, Trunk Code). When the called party has the address presentation restricted facility (e.g., on diversion) the user access to called party address identification facility is not provided.

Information indicating that a subscriber has the called party address identification facility is available at the exchange to which the user is connected.

In the case where the called party is a PABX, the called party address is either the ISDN number of the PABX or the DDI number of the extension to which the call is connected.

4.3.2 *Call set-up procedure*

In the case of a call from a user having the called party address identification facility, the call control information forwarded by the originating exchange at call set-up includes a request for called party address identification. The request is included in the initial address message.

When the destination/interworking exchange receives the request for called party address identification, the destination/interworking exchange returns a response, including the called party address identity. In the case that the called party has the address presentation restricted facility, the exchange also includes the called party address presentation restricted indicator. The response is included in an end-to-end message:

a) in the case where the networks needed to establish the call provide the called party address identification facility, the called party address identity is the complete ISDN number of the user to which the call is connected;

b) in the case where the networks needed to establish the call do not provide for the called party address identification facility, the response includes the identity of the network at the interworking point and an indication showing that the called party address identity is not complete.

4.4 *Redirection of calls*

4.4.1 *General*

The redirection of calls facility enables a user to have calls to an ISDN number, for which the facility is subscribed, redirected to another predetermined number during periods when the facility is activated.

The redirection of calls rejected facility enables a user to have redirected calls to an ISDN number automatically rejected during periods when the facility is activated.

The redirection of calls information prohibited facility enables the user who has activated the redirection of calls facility to prevent the calling party from being informed that the call is redirected.

Depending on the possibilities offered by the Administration, facility activation and deactivation may be made:

a) by the user by means of user controlled activation and deactivation procedures;

b) by the network at predetermined times;

c) by the Administration on request of the user.

User-controlled procedures for inquiry of the status of the facility (i.e. whether the facility is activated or deactivated) may also be provided.

A call may only be redirected once. Redirected calls are subject to the same restrictions as other calls where a closed user group is involved.

4.4.2 *Call set-up procedure not involving other facilities affecting the procedure*

Information that a subscriber has the redirection of calls rejected facility is stored at the exchange to which the user is connected. When a redirected call arrives at such a user, the call is rejected.

Information that a subscriber has the redirection of calls information prohibited facility is stored at the exchange, where the user is connected, together with the redirection address.

Information that a subscriber has the redirection of calls facility activated is stored, together with the redirection address, at the exchange to which the user is connected. When such a user is called, the call is set up to the redirection address in accordance with the following.

4.4.2.1 *The redirection address is at the same exchange*

In this case the destination exchange connects the call to the redirection address and returns an address complete message including the call forwarding indicator. In the case where the original called party has the redirection of calls information prohibited facility activated, the address complete message includes the redirection of calls information prohibited indicator. When receiving the call forwarding indicator and the redirection address, the originating exchange informs the calling party that the call has been redirected, except for the case when the address complete message includes the redirection of calls information prohibited indicator (in this case, no information related to the redirection of calls facility is sent to the calling party).

In the case where the user at the redirection address has the redirection of calls or the redirection of calls rejected facility activated, the destination exchange rejects the call and returns an indication in an unsuccessful backward set-up message.

4.4.2.2 *The redirection address is at another exchange*

In this case the call is set-up to the redirection address in accordance with one of the following procedures depending on the arrangements in the destination network and the information received in the initial address message.

In the case where the PCI field in the initial address message indicates that there is no uninterrupted common channel signalling capability between the originating exchange and the destination exchange for this call set-up, the call forwarding procedure is recommended to be used.

This means that the first destination exchange must examine the PCI field before determining which procedure – call rerouting or call forwarding – should be used for the redirected call.

a) The following procedure – call rerouting – is based on the principle that the call is released back to an intermediate or originating exchange, from where a new call is set up to the new destination exchange. In the case of an international call it is released back to the originating exchange or an intermediate transit exchange (e.g. gateway exchange). In the case of a national call it is released back to the originating exchange or to an intermediate transit exchange.

   i) The first destination exchange returns towards the originating exchange a call supervision message including the redirection address, the call rerouting request indicator and a redirection of calls information prohibited indication (if applicable). In the case of national networks, the call supervision signal can also include the calling party address (if applicable) and the calling party presentation restricted indicator (if applicable).

      In the case where the initial address message received at the first destination exchange includes an international call indicator, the redirection address includes the country code.

   ii) Each intermediate exchange receiving the call supervision message including call rerouting request indicator and redirection address, releases the established connection towards the original called exchange, and analyses the received information in the message.

   iii) In the case where the analysis of the call supervision message indicates that an intermediate exchange should reroute the call, the intermediate exchange sets up a new connection towards the exchange indicated in the redirection address. The initial address message sent towards the new destination exchange includes the call rerouting indicator, the redirection address, the redirection of calls information prohibited indicator (if applicable). In national networks the original called party address, the calling party address and the calling party address presentation restricted indicator could also be included in the initial address message. The intermediate exchange also sends a general information message, including the redirection address, and a call rerouting indicator towards the controlling/originating exchange of the call.

      In other cases the intermediate exchange returns the received call supervision message towards the originating exchange.

      The call rerouting indicator is used to inform the controlling/originating exchange that the original called exchange is not involved in the call. The redirection address could be used to determine the tariff for the redirected call.

   iv) Upon receipt of the redirected call the new destination exchange connects the call or rejects the call in accordance with § 4.4.2.1. The call rerouting indicator is used by the new destination exchange to prevent a further redirection. The original called party address could be used for special acceptance tests or be sent to the called party.

   v) In the case where the call is connected to the redirection address, the destination exchange will return an address complete message to the originating exchange, including the call rerouting indicator and the redirection of calls information prohibited indicator (if applicable). The call rerouting indication is used to inform the calling party that the call is redirected. In the case where the address complete message includes the redirection of calls indication prohibited information indicator, no information related to the redirection of calls facility is sent to the calling party.

b) The following procedure – call forwarding – is based on the principle that the connection is extended forward from the destination exchange to the new destination exchange.

i) The first destination exchange sets up the forward connection to the redirection address. The initial address message forwarded includes a call forwarding indicator, the redirection address and redirection of calls information prohibited indicator (if applicable). In national networks the original address, the calling party address (if applicable) and the calling party address presentation prohibited indicator(s) (if applicable) could also be included in the initial address message.

ii) Upon receipt of the redirected call the new destination exchange connects or rejects the call in accordance with § 4.4.2.1. The call forwarding indicator received is used to prevent a further redirection. The first called party address could be used for special acceptance tests or be sent to the calling party.

iii) In the case where the call is connected to the redirection address, the destination exchange will send an address complete message including the call forwarding indicator and the redirection of calls information prohibited indicator (if applicable). The call forwarding indicator is used to inform the originating/controlling exchange that the call forwarding procedure is being adopted. It could also be used to indicate to the calling party that the call is redirected. In the case, when the address complete message includes the redirection of calls information prohibited indicator, no information relating to the redirection of calls facility is sent to the calling party.

iv) When the first destination exchange receives a message e.g. the request for calling party address, from the new destination exchange, it sends it further backwards to the originating exchange.

4.4.3 *Calls involving other facilities affecting the procedure*

4.4.3.1 *Calls involving a closed user group facility*

Redirected calls are subject to the restrictions applying for the closed user group (CUG) facilities:

– In the case where the call is a CUG call, or the originally called party has a CUG facility, the call is rejected before redirection unless the validation check requirements applying for the CUG facility(ies) concerned are satisfied.

– In the case where the call is a CUG call, or the user at the redirection address has a CUG facility, the call is rejected unless the validation check requirements applying for the CUG facility(ies) concerned are satisfied.

a) Call set-up procedures for decentralized administration of CUG data

In the case where:

i) the call is a CUG call, and

ii) the redirection address is at an exchange other than the first destination exchange, and

iii) the procedure for setting up the call to the redirection address is in accordance with § 4.4.2.2 a) (i.e. the call rerouting procedure) the first destination exchange has to send the CUG information received (e.g. the CUG call indication and the interlock code) back to an originating/intermediate exchange together with the call rerouting indicator and the redirection address to enable the originating/intermediate exchange to include this CUG information in the initial address message sent to the new destination exchange;

iv) the procedure for setting up the call to the redirection address is in accordance with § 4.4.2.2 b) (i.e. call forwarding procedure). The first destination has to send the CUG information received (e.g. the CUG call indication and the interlock code) forward to the new destination exchange in the initial address message.

b) Call set-up procedures for centralized administration of CUG data

In the case where a CUG call arrives at a user which has activated the redirection of calls facility, the same request-response procedure is used between the first destination exchange and the dedicated point(s) as between the originating exchange and the dedicated point(s) described in § 4.1.3. Before initiating the request-response procedure, the destination exchange must have the calling party address and the index available.

In the case where the calling party address is included in the initial address message, the first destination exchange sends a request for the index to the originating exchange.

In the case where the calling party address is not included in the initial address message, the first destination exchange sends a request for the index and the calling party address to the originating exchange.

The request is either included in a general information message or in an end-to-end message.

The response to the request for calling party address (if required) and the index (if applicable) is sent in a general information message or in an end-to-end message.

When all the information is available at the first destination exchange, the request for CUG selection and validation is made to the dedicated point(s). The request includes the new destination address, the calling party address and an index (if applicable).

In the case where an access barred signal is received in the response message by the first destination exchange, a call supervision message including the access barred signal is sent towards the originating exchange. In other cases depending on which call control procedure is used for the redirection of calls facility in the destination exchange, the call set-up procedure for the redirected call is in accordance with § 4.4.2.2 a) or § 4.4.2.2 b).

In the case that the call rerouting procedure is used, the call supervision message always includes the call rerouting indicator and the rerouting address. In addition, one or more of the following items may be included. CUG check successful indication, CUG call indication with outgoing access and the interlock code.

The exchange which performs the rerouting includes the information received in the call supervision message in the initial address message sent to the new destination exchange. The intermediate exchange also sends a general information message, including the redirection address and a call rerouting indicator, towards the controlling/originating exchange of the call.

In the case that the call forwarding procedure is used, the initial address message forwarded to the new destinating exchange always includes call forwarding indicator, and redirection address, plus none, one or more of the following items: CUG check successful indication, CUG call indication, CUG call indication with outgoing access and the interlock code.

4.4.3.2 *The calling party has the called party address identification facility*

In the case where a call from a user that has the called party address identification facility is redirected, the called party address sent to the calling party is the ISDN number of the redirection address.

4.4.3.3 *The redirection address has the users' access to the calling party identification*

In the case where a redirected call arrives at a user, who has the users' access to the calling party address identification facility, the succeeding actions at the new destination exchange depend on if the calling party address is available at the new destination exchange.

In the case where the calling party address is not available, a request for the calling party address is sent to the preceding exchange(s) in accordance with § 4.2.2.2. When the new destination exchange has the calling party address available, it sends it (and optionally the original called party address) to the new called party unless the calling party address presentation restricted indicator is received at the new destination exchange.

4.4.3.4 *The redirection address has the malicious call identification capability*

In the case where a call arrives at a user marked as an MCI user, the call set-up procedure depends on whether the calling party address and/or the original called party address is included in the initial address message and if the hold option should apply for the call:

a) The hold option does not apply for the call. In this case the call control procedure depends on whether the calling party address and/or the original called party address is included in the initial address. In the case where one or both of the addresses are not available, a request is sent to the preceding exchange(s). The request will indicate which address(es) are requested.

   As a response the preceding (e.g. the originating or the original called) exchange will include the address(es) that has been requested.

b) The hold option applies for the call. In this case a request is sent to the preceding exchange(s) indicating that the holding of the circuit is required. The call set up procedure depends on whether the calling party address and/or the original called party address is included in the initial address message.

In the case where one or both of the address(es) are not available, a request is sent to the preceding exchange(s).

In the response, the preceding (e.g. original called or originating) exchange will include the address(es) that has been requested and apply holding of the circuit.

In the case of interworking, the interworking exchange may send, in addition to the information specified in § 4.4.3.5 b) the original called party address.

When the original called exchange receives the request for calling party address, if both the calling and original called addresses are not available in this exchange, it repeats the request to the originating exchange. When the original called exchange receives the response it repeats the response forwards to the destination exchange.

If the original exchange receives the delayed release message, it sends it to the destination exchange.

4.5 *Connect when free and waiting allowed*

4.5.1 *General*

A user subscribing to the connect when free facility is assigned a number of waiting positions at the local exchange at which incoming calls can wait when the access line(s) to the user is busy. The waiting allowed facility enables a user calling a busy user to wait for completion of the call when the called party becomes free. During waiting the connection is maintained.

4.5.2 *Call set-up procedure*

When a call encounters the busy condition and the called party has the connect when free facility, the destination exchange checks the waiting positions at the called party.

Note – The detailed definition of the free and busy condition in an ISDN is for further study.

a) In the case where a free waiting position exists, the call is placed in the queue and an address complete message including connect when free indication is sent towards the originating exchange.

b) In the case where all waiting positions are occupied, the call is rejected and a call supervision message including subscriber busy indication is sent towards the originating exchange.

The action at the originating exchange depends on whether the calling party has the waiting allowed facility and which signal is received.

a) In the case where the connect when free indication is received and the calling party has the waiting allowed facility, the connect when free signal is sent to the calling party. The calling party can then either wait for completion of the call or clear the call. In the case where the calling party chooses to wait, the connection is maintained. The normal time out for completion of the call at the originating exchange is inhibited. The calling party cannot make or receive another call on the same access line during waiting.

b) In the case where the connect when free indication is received and the calling party does not have the waiting allowed facility, the subscriber busy signal is sent to the calling party and the call is cleared.

c) In the case where the subscriber busy indication is received, the subscriber busy signal is sent to the calling party and the call is cleared: this is also the case when the calling user has the waiting allowed facility.

When the called party becomes free the destination exchange connects the first call in the queue in the normal manner. An answer message indicating that the call has been connected is sent towards the originating exchange.

When sending the answer message indicating that the call has been connected, the destination exchange through connects the call in the normal manner.

The calling party may send a clear request at any time to terminate the waiting which will result in normal network clearing and removal of the call from the queue. The waiting may also be terminated by the destination exchange in some abnormal situations resulting in a clearing sequence towards the calling party.

In the case of interworking with networks which do not provide the waiting allowed facility, the interworking points will translate the connect when free indication to a subscriber busy indication and return it to the originating exchange. The call is then released in the normal manner in the forward direction.

Charging for the waiting time is for further study.

4.6 *Completion of calls to busy subscriber*

4.6.1 *General*

The completion of calls to busy subscriber (CCBS) facility enables a calling party encountering the busy condition to complete the call automatically when the called party becomes free (without repeated dialling).

The calling party activates the user facility by making a request to the exchange to which the calling party is connected. When the facility is activated, the status of the called party address is continuously tested by its local exchange. When the address becomes free the calling party is called and when the calling party answers, the called party is alerted. The time during which the status of the party is tested is limited.

The facility can be deactivated by the calling party. It can be prohibited by the called party.

Note – The detailed definition of the busy and free condition in an ISDN is for further study.

The number of CCBS requests stored in a local exchange is limited.

4.6.2 *Normal call set-up procedures at the originating exchange*

The originating exchange is notified that the called party is busy either by receiving a response message to a previously sent look ahead message or by receiving a call supervision message including the subscriber busy signal. If a signalling point code is received (national use), it may be temporarily stored for later possible use in a future facility request. The normal release procedure for the concerned circuit is initiated (if applicable).

In the case where the calling party activates the facility, a facility request is sent to the destination exchange. The facility request, sent in a facility request message, includes the calling and called party addresses, the CCBS facility indicator and the ISDN service indication signal. In the case that an SCCP connection is maintained after the release of the physical connection, the calling party address/called party address do not need to be included.

Two different signals, facility accepted signal or the called party free signal, can be received as a response to the facility request. In the normal case, the facility accepted signal is received before the called party free signal.

When the originating exchange receives the facility accepted signal, an indication of service activation is sent to the calling party and a timer T6 is started. The timer T6 measures the time the facility request will stay active.

When receiving the called party free signal, indicating that the called party had become free, the timer T6 is stopped (if applicable), the calling party is blocked for outgoing and incoming calls, and a CCBS call is set-up. The CCBS call is set-up as an ordinary call except that a CCBS call indicator is included in the initial address message together with the protocol control indicator.

The calling party is alerted when the originating exchange receives the address complete message.

In the case where the calling party answers, the calling party answer signal is sent together with the called party address to the destination exchange in a facility information message.

4.6.3 *Abnormal situations at the originating exchange*

4.6.3.1 *Timers*

T6[4)] is the time during which the facility is allowed to stay active. At the expiration of the timer T6 the CCBS facility indication together with the calling party address, the called party address and the ISDN Service Indication signal is sent in a facility deactivation message to the destination exchange. The information related to the request is then erased at the originating exchange.

T7[4)] is the time during which the calling party is alerted. In the case where the timer T7 expires, the calling party is unblocked and the normal release procedure is initiated.

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4) The values of timers T6 and T7 are for further study.

4.6.3.2 *Signals*

In the case where the originating exchange receives a facility rejected signal, indicating that the destination exchange is unable to effect the facility request, the originating exchange erases the stored data associated with the request and the calling party is informed.

In the case where the calling party deactivates the CCBS facility, the originating exchange sends the facility deactivation signal together with the calling and called party addresses and the ISDN Service Indication in a facility deactivation message to the destination exchange. The exchange will then erase all information related to the CCBS request.

If the calling party is found busy when receiving the called party free signal, or if the CCBS call attempt fails (e.g., encountering congestion), the originating exchange will erase all information related to the request.

The need for taking another action (e.g. make a repeat attempt or send a signal to indicate the condition) when the calling party is found busy or the CCBS call fails is for further study.

4.6.4 *Call set-up procedure at an intermediate exchange*

The call set-up procedure at the intermediate exchange is not affected by the CCBS facility.

4.6.5 *Normal call set-up procedure at the destination exchange*

When the destination exchange finds the called party busy, it sends a call supervision message or a response to a look ahead message including the subscriber busy signal.

In the case where the destination exchange receives the facility request message for CCBS, a check is made whether the request can be accepted or not.

Reasons for rejecting the request could be that the maximum number of CCBS requests activated at the same time has already been reached, or the called party has activated the CCBS inhibited facility.

In the case where the request is accepted, the destination exchange marks the called party as a CCBS participant, and a check is made whether the called party is free or busy. In the case where the called party is busy, the destination exchange sends the facility accepted message. (The calling party's request is placed in an appropriate position in the queue for the called subscriber together with the calling and called party addresses and the ISDN Service Indication.)

In the case where the called party is free, a facility information message (including the called party free signal, the calling and called party addresses and ISDN Service Indication) will be sent to the originating exchange.

In the case that the called party becomes free, the following actions take place:

i) The timer T8 [5] is started and the called subscriber is blocked for incoming calls.

ii) In the case the CCBS participant makes a call attempt, the timer T8 [5] is stopped and the call attempt can proceed as normal.

iii) When the timer T8 [5] expires, the CCBS participant is blocked for outgoing and incoming calls except for the CCBS call. The destination exchange will send a message including the called party free signal, called and calling party addresses and the ISDN Service Indication to the concerned originating exchange. The timer T9 [5] is started.

iv) In the case where the destination exchange receives an incoming call to a user marked as a CCBS participant, a check is made whether the incoming call is the expected CCBS call. The CCBS call is indicated by a CCBS indicator in the initial address message. In the case where the check is successful an address complete message is sent towards the originating exchange and T9 [5] is stopped.

The CCBS call is handled at the destination exchange in the same way as an ordinary call except that the called party is not alerted.

v) In the case where the calling party answer signal is received at the destination exchange the called party is alerted.

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[5] The values of timers T8 and T9 are for further study.

4.6.6 *Abnormal situations at the destination exchange*

a) In the case where the destination exchange receives the facility deactivation message addressed to a subscriber marked as CCBS participant, it erases the request for CCBS from the queue, the checking for free status is ceased (if applicable) and the timer T9[6] is stopped (if applicable).

b) In the case where T9[6] expires, all information related to this CCBS facility request is erased.

In the case where there are no other CCBS requests the called party is available for incoming and outgoing calls.

In the case where there are requests in the queue, the destination exchange will send the called party free signal to the exchange associated with the next request in the queue.

c) In the case where the destination exchange receives a release signal for the circuit used for a CCBS call before receiving the called party answer signal, the destination exchange will continue the release procedure, unblock the called party and erase all information associated with the CCBS call.

In the case where there are request(s) in the queue, the destination exchange will send the called party free signal to the exchange associated with the next request in the queue.

d) When a normal call arrives at a called party marked as a CCBS participant, a busy signal is sent to the calling party.

4.6.7 *Service interrogation*

During the time the service is activated it should be possible to check if the request is still activated. Two different options are possible:

a) The check is only made in the exchange to which the calling party is connected.

b) The check is made in both exchanges.

In the latter case, a facility information request signal is sent together with the calling and called party addresses and the ISDN service indicator in a facility information request message.

A facility information response message is sent as a reply to the facility information request message.

4.7 *Network access to the calling party address identification*

4.7.1 *General*

The network access to the calling party address identification is a network capability which enables a network to obtain the calling party address from within the network or from another network. The capability is used for example in malicious call identification, charging, etc.

4.7.2 *Malicious call identification (MCI)*

The malicious call identification gives the possibility to obtain, by an appropriate request, the identification of the calling party and the original called party (in the case of a redirected call). The identification request provokes, in the destination exchange, the printout of the following items:

- called party address;
- calling party address and possibly the original called party;
- time and date of the call.

The same printout may be, optionally, obtained in the originating exchange.

The identification request can either be activated before, during or after the conversation phase.

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[6] The value of timer T9 is for further study.

Two different options of the facility are defined, namely:

a) MCI with hold,

b) MCI without hold.

One or both options should be provided in a national network.

In case a) the holding of the connection is requested in addition to the identification of the calling party. The clearing of the connection is subject to called party clearing.

In case b) only the identification of the calling party is requested.

4.7.3 *Call set-up procedure*

4.7.3.1 *Actions at the destination exchange*

In the case of an incoming call to a user having the MCI facility the call set-up procedure depends on whether or not the calling party address is included in the initial address message and which options (without hold or with hold) the called party has been assigned.

a) The calling party address is included in the initial address message:
   - in the case where the called party has the MCI without hold indication the calling party address, and possibly the original called address, is stored in the destination exchange;
   - in the case where the called party has the MCI with hold indication the calling party address, and possibly the original called party address, is stored at the destination exchange and a request for holding of the circuit is sent to the originating exchange.

b) The calling party address is not included in the initial address message:
   - in the case where the called party has the MCI without hold indication, an information request message is sent to the originating exchange requesting the calling party address;
   - in the case where the called party has the hold indication, the information request message will include a request for the holding of the circuit and for the calling party address.

In addition to the information mentioned above the request will also include the MCI request indicator. The request will be sent in a general request message.

4.7.3.2 *Actions at intermediate exchanges*

When receiving the MCI request, the transit exchange will normally repeat the request to the preceding exchange. However, in two cases the transit exchange acts differently:

- In the case of interworking with networks that do not provide the calling party address facility, the relevant transit exchange will send a response including the identity of the transit exchange. The identity of the transit exchange could either be the known part of the calling party address in that exchange or, in national networks, the signalling point code of the transit exchange. In addition to the identity of the transit exchange, the response can also include the identity of the incoming trunk. The interworking exchange may also arrange the holding of the incoming trunk even if not explicitly requested.

  In the case where the information request also includes the hold request, the transit exchange will make the clearing of the circuit subject to the called party clearing.
- In the case where the MCI cannot operate (due to administrative or technical reasons), the relevant exchange includes in the information message the MCI not provided indicator.

4.7.3.3 *Actions at the originating exchange*

On receipt of the information request, the originating exchange sends an information message containing the calling party address and the hold provided information. If holding of the connection is provided the clearing of the circuit will be subject to the called party clearing (i.e. subject to the receipt of the release message from the called party).

4.7.4 *Release procedures*

4.7.4.1 In the case where no holding of the circuit is requested, the normal release procedure will apply.

4.7.4.2 In the case where the holding of the circuit is requested, the following procedures apply:

a) If the calling party hangs-up first the originating exchange will apply the hold of the connection and stop the charging (if applicable). Moreover the originating exchange may send forward the delayed release signal.

When receiving the delayed release signal, an intermediate exchange stops the charging (if applicable) and forwards the delayed release clear signal to the succeeding exchange.

When receiving the delayed release signal, the destination exchange starts a timer T10. The purpose of this timer is to allow release of the network hold in the case that the called party does not activate MCI or release the call.

The value of T10 is a national option.

b) Regardless of whether or not the calling party has attempted to release the call, one of the following procedures applies:

i) In the case where the facility request is made before the called party disconnects, no release message will be sent until appropriate action has been taken (e.g. maintenance action). If applicable T10 is stopped when the facility request is received.

ii) When the called party disconnects, the destination exchange may start a timer T11 to allow a facility request to be made after the conversation has been terminated.

The actions at the destination exchange will depend on whether a facility request has been made or not.

- In the case where the facility request was not made, the expiration of the timer T11 will result in sending of the release message. The timer T10 is stopped (if applicable).
- In the case where the called party makes the facility request before the timer T11 expires, no release signals will be sent until appropriate actions have been taken. The timers T11 and T10 (if applicable) are stopped when the facility request has been received.

Recommendation Q.766

PERFORMANCE OBJECTIVES IN THE INTEGRATED SERVICES DIGITAL NETWORK APPLICATION

1 Introduction

This Recommendation gives the requirements of the Integrated Services Digital Network (ISDN) application call control service supported by Signalling System No. 7.

In Recommendation Q.706, the Message Transfer Part performance is described. The Message Transfer Part supports the ISDN application of Signalling System No. 7 and provision of a signalling network to support the ISDN application must take account of the performance of the Message Transfer Part and the requirements of the ISDN application. For example, taking account of the message transfer times in Recommendation Q.706 and the requirements for message transfer times between two ISDN exchanges, a figure may be derived for the total permissible number of signalling links in tandem for a particular call.

2 Signalling availability

2.1 *Signalling route set availability*

The availability of a signalling route set is determined by the availability of the individual components of the signalling network (signalling links and the signalling points) and by the structure of a signalling network.

The availability of a signalling route set should not be less than 0.99998, corresponding to a downtime of 10 minutes per year for a user signalling relation.

2.2 *Signalling network availability*

The availability of the signalling network should be sufficiently high as to meet the signalling route set downtime objectives stated in § 2.1. The signalling network architecture selected will strongly influence the availability. In general, the greater the number of link sets in tandem in a signalling route set the more redundant signalling paths that will be needed to meet the availability objective for the signalling route set or user signalling relation.

3 Signalling dependability

3.1 *General*

The ISDN application is different from other applications, such as telephony and data, in that there may be multiple paths involved for any given ISDN call. There may be several circuits (e.g. telephone conferencing) for either telephony or data and non-circuit related connections for access to data bases or for terminal-to-terminal control. This diverse set of uses may require closer control of the signalling network resources than might be required for other more simple applications.

3.1.1 *Probability of false operation*

By means of error detection (see Recommendation Q.703) as well as transmission fault indication (see Recommendations G.732 [1] and G.733 [2], it is ensured that, overall, not more than one in 10^8 of all signal units transmitted is accepted that, due to errors, will cause false operation.

3.2 *Probability of signalling malfunction*

Unsuccessful calls may be caused by undetected errors, loss of messages, or messages delivered out of sequence (during emergency situations within the signalling network) and may result in:

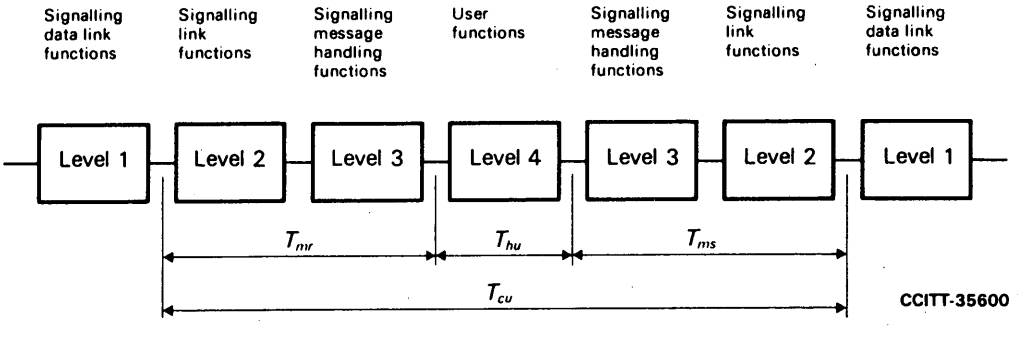
- incomplete call set-up,
- misrouted calls (e.g. connection of wrong numbers),
- calls routed correctly but mishandled (e.g. false clearing),
- inability to access a data base.

Considering the above conditions and the performance for the Message Transfer Part, no more than 2 in 10^5 (provisional value) of all ISDN calls should be unsuccessful due to signalling malfunction.

Note – No more than 1 in 10^5 of all ISDN *circuit connections* should be unsuccessful due to signalling malfunction.

4 Signalling delay

4.1 *Functional reference points and transfer time components*



4.2 *Delays*

4.2.1 **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 therefore includes the queuing delay in the absence of disturbances but not the additional queuing delay caused by retransmission.

4.2.2 **user handling time, T_{hu}**

T_{hu} is the period which starts when the last bit of the message has entered the upper layer functions and ends when the last bit of the derived message has left the upper layer functions.

4.2.3 *Objectives for cross-office transfer time, T_{cu}*

The figures in Table 1/Q.766 are the objectives for the cross-office transfer time T_{cu} for the ISDN signalling points in the signalling network. These figures are related to a signalling bit rate of 64 kbit/s.

TABLE 1/Q.766 [1]

Message type	Exchange call attempt loading	Cross-office transfer time T_{cu} (ms)	
		Mean	95%
Simple (e.g., answer)	Normal +15% +30%	110 165 275	220 330 550
Processing intensive (e.g., IAM)	Normal +15% +30%	180 270 450	360 540 900

[1] Provisional values.

A processing intensive message is one that arrives at an exchange and requires detailed examination (and possibly modification) before it is transmitted to the next exchange.

A simple message is one that requires little or no examination or modification (typically only label translation) before it is transmitted to the next exchange.

4.3 *Effect of retransmission*

As a consequence of correction by retransmission, not more than one in 10^4 signals should be delayed more than 300 ms as a long-term average. This requirement refers to each signalling link.

This requirement is laid down in order to ensure satisfactory answer delays.

5 Signalling system limitations

5.1 *Labelling potential*

5.1.1 *Signalling points*

The label of the Signalling System No. 7 for the ISDN application provides the potential to identify 16 384 signalling points.

5.1.2 *Number of circuits in a user signalling relation*

There may be up to 4096 circuits (4096 channels in each direction) for each user signalling relation.

5.1.3 *Number of SCCP connections in a user signalling relation*

There may be up to 2^{24} SCCP connections available at an ISDN signalling point. All of these may be available for any given user signalling relation, but must be shared over all signalling relations.

5.2 *Number of ISDN call identities at a signalling point*

There may be up to 2^{24} (value for further study) simultaneous ISDN calls at a signalling point with the 2^{24} call identities available. The use of ISDN call identities is for further study.

References

[1] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*, Vol. III, Fascicle III.3, Rec. G.732.

[2] CCITT Recommendation *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*, Vol. III, Fascicle III.3, Rec. G.733.

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SECTION 7

MONITORING AND MEASUREMENTS FOR THE MTP

Recommendation Q.791

MONITORING AND MEASUREMENTS FOR THE MTP

1 General

1.1 *Introduction*

1.1.1 In order to effectively manage the resources provided by the Message Transfer Part (MTP) of a Signalling System No. 7 network, it is necessary to monitor and measure the present and estimate the future performance, utilization, and availability of these resources. The principles and scope of this recommendation are:

- measurements made on the MTP are known as "raw" or primitive measurements and in general only these measurements are specified in this recommendation;
- the recommended primitive measurements and, at times other derived measurements, whose computation using the primitive measurements is described, are those required for the effective management of the resources of the MTP;
- a basic subset of MTP measurements is recommended for international networks, but it is intended that this subset also be useful for national networks, which, however, may need additional measurements;
- monitoring and measuring are considered to be passive processes and although the results of monitoring and measuring may be used to invoke test and maintenance actions and procedures, it is left to other recommendations, e.g. Recommendation Q.795, to provide details of such actions and procedures;
- Recommendation Q.791 is not intended to provide signalling network testing and maintenance procedures; it is left to other Recommendations to provide such procedures, e.g. Recommendations Q.707, Q.795, etc.

1.2 *Local and global view*

1.2.1 The MTP measurement can provide both a local view and a global network view of the performance of the MTP. The primitive measurements which provide the two views are not necessarily different. Rather the global view is the result of a summary of measurements from more than a single signalling point so that the behaviour of the MTP is centrally observable. A global view of the performance of the MTP, in general, becomes more useful as the network becomes larger (i.e. more signalling points or multiple users).

1.3 *Grouping of measurements*

1.3.1 Each primitive measurement is classified for the purpose of guidance into one or more categories, called operations, maintenance and administration which will indicate its general area of use (see Sections 2 and 5).

1.3.2 A tabular listing of the primitive measurements according to the resource being measured is provided (see § 3). The tabular listing of the primitive measurements includes for each measurement an indication of the appropriate man-machine categories (operations, maintenance and administration) and reference to the pertinent Q.701-Q.706 Recommendations.

1.4 *Guidelines for uses of measurements*

1.4.1 The measurements may be used singly, or in conjunction with other measurements. It is not the intent of the recommendation to specify the computations and algorithms to be applied to the primitive measurements. Guidelines however are provided (see § 5) for some uses of measurements for international signalling so that, for example, the view at both ends of an international link is consistent.

2 Definition of terms

2.1 *Operations (O)*

2.1.1 The operation of MTP resources involves measurements that are used in real time, or retained for short time intervals. Operations activities include signalling network surveillance.

2.1.2 Signalling network management measurements include those which monitor and measure the MTP response to abnormal conditions. (Requires further study.)

2.1.3 Signalling network surveillance measurements include those which monitor and measure the MTP resources to ensure that the appropriate quality of service and performance is maintained. (Requires further study.)

2.2 *Maintenance (M)*

2.2.1 Maintenance of the MTP resources may involve the monitoring of the facility and equipment resources and maintaining quality of service by expediting preventive and corrective effort when the measurements indicate a problem.

2.3 *Administration (A)*

2.3.1 The administration of MTP resources involves measurements that are used on a long-term basis and are in general retained external to the MTP resources (see Recommendation Q.795, § 2.3).

2.3.2 MTP administration activities include planning and dimensioning (engineering) the MTP resources, including determination of the resource quantities, e.g. number of links in a link set, and resource configuration, e.g. routing.

3 Listing of measurements

3.1 *General*

3.1.1 The recommended measurements are presented in Tables 1 to 6. Explanatory notes relating to the contents of these Tables are given below.

3.1.2 The obligatory column is used to indicate those measurements which must be provided at an SP. The additional ACT/PERM column indicates whether these measurements are permanently activated, or activated on demand. In non-obligatory cases, if the measurement is provided, the administration must also decide whether the measurement will be activated on demand or permanently active.

3.1.3 The count items in the Tables, identified in the Units column as "events/SP", "MSUs/SL", etc., implies the total count of events in the specified period.

3.1.4 The event items in the Tables which are recorded "on occurrence" are intended to be recorded with a time stamp, giving the unique network time when the event indicator was generated (see Recommendation Q.795, § 2.4). The resolution and accuracy of the time stamp should be as high as possible, to increase the ability to resolve complex and rapid sequences of events.

3.1.5 The periods specified in the Duration of Measurement column are provisional.

3.2 *Table 1/Q.791*

3.2.1 The measurement of Signalling Link (SL) failure is recommended (Item 1.2). However, the specific cause for the failure (Items 1.3-1.6) is an additional optional measurement.

3.3 *Table 3/Q.791*

3.3.1 The notation "3/2" in the Level column indicates that the measured octets are those transferred across the Level 3/Level 2 boundary in the appropriate direction.

3.3.2 The inclusion of the opening flag and the check bits (Item 3.2) is for further study.

3.3.3 The signalling link congestion (Items 3.6-3.11) refers to link status "congested" at Level 3. A link is marked at Level 3 as congested when a congestion threshold is reached at the transmit side (see Recommendation Q.704, § 3.6 on Signalling Network Congestion and § 10 on Signalling Traffic Flow Control).

4 Operations and maintenance part support

4.1 The measurements defined in this Recommendation are intended to be controlled through the use of the operations and maintenance application part defined in Recommendation Q.795. Recommendation Q.795 defines the functions needed to initiate and stop the measurements and the procedures to handle the transfer of data after collection. Long-term measurement collection procedures are defined in § 2.3 of Recommendation Q.795 and on-occurrence measurement reporting procedures in § 2.4.

5 Uses of measurements

5.1 *Introduction*

5.1.1 This section provides a context for the measurements listed in Tables 1 – 6/Q.791. It describes briefly the operational, maintenance and administrative activities likely to be associated with a Signalling System No. 7 network and how the measurements may be used to support these activities.

5.1.2 A list of supporting measurements (if any) follows each description. Each measurement is identified by its table number followed by a decimal point and the sequence number of the measurement within the Table (e.g. Item 1.1 is the first measurement of Table 1/Q.791).

5.2 *Operational uses*

5.2.1 *Surveillance of network status*

5.2.1.1 This activity is concerned with surveillance of the network as a whole, in order to coordinate and assign priorities to maintenance actions. The information to support this activity will come from indicators of the operational and congestion status. These indicators may be found in the tables designated as Usage "O" and Duration of Measurement "on-occurrence".

5.2.2 *Monitoring of link and network traffic performance*

5.2.2.1 This activity is concerned with ensuring that congestion levels and the numbers of discarded messages are within specification. If, for example, the number of MSUs discarded due to a routing data error exceeds limits, the Routing Verification Test described in Recommendation Q.795 could be initiated to identify the source and type of routing data error.

5.2.2.2 Discarded message counts may be gathered signalling point by signalling point and added together to give a total network performance measure.

5.2.2.3 One aspect of traffic performance can be monitored by measuring the amount of time that a given link is congested. The link loading or congestion duration must match the criteria upon which provisioning of links has been based.

Measurements to monitor links:

- number of SIF and SIO octets transmitted (Item 3.1);
- cumulative duration of SL congestion (Item 3.7).

Measurements of MSUs discarded:

- due to congestion (Item 3.10);
- due to routing data error (Item 5.5).

5.2.2.4 Duration measurements in Table 4 measure signalling link set and route set availability, by individual signalling link set and route set. These measurements identify the effects of congestion or failure upon the surrounding network.

5.3 *Maintenance uses*

5.3.1 *Introduction*

5.3.1.1 The activities described in this section relate basically to the detection of degraded performance and to the maintenance of a particular signalling point and the signalling links associated with that signalling point. They may be used on a near real time basis, or may be monitored over a period of days or weeks to detect unfavourable trends. They are designed so that one signalling point can monitor its own status without relying on measurements from adjacent signalling points.

5.3.2 *Detection of increases in link SU error rates*

5.3.2.1 This activity ensures that the signalling data link error rate is not rising beyond specification. The SU Error Rate Monitor is the basic instrument for monitoring signalling data link performance.

5.3.2.2 Operational measurements counting error events provide supplementary information to warn of impending failures or give a running assessment of signalling data link quality.

Measurements:

- number of SUs in error (monitors incoming performance); (Item 1.8);
- number of NACKs received (monitors outgoing performance). (Item 1.9).

5.3.2.3 Counting total Signal Unit errors allows the estimation of Signalling Data Link bit error rates (see Recommendation Q.706, § 3.1) assuming that errors are random. The estimate uses measurement 1.1, duration of link in the in-service state, multiplied by the link transmission rate.

5.3.3 *Detection of marginal links performance*

5.3.3.1 The SU Error Rate Monitor applies to lost alignment as well as corrupted data. Usually both conditions are caused by degraded performance of the transmission facility. Alignment and proving failures often indicate a marginally performing link.

Measurements:

- SL alignment failure or proving failure. (Item 1.7).

5.3.3.2 This activity is concerned with detecting routing instabilities caused by marginal link performance.

Measurements:

- automatic changeovers. (Item 1.10).

5.3.4 *Detection of link failure events in either direction*

5.3.4.1 By "link failure" is meant an event which causes a particular link to be unavailable for signalling (i.e. a failure at Level 1 or Level 2). Signalling link failure measurements are summarized not only for specific link sets, but also across many different link sets, where these may involve common transmission systems or signalling points. The distribution of failure and degradation sources may be randomly located but if specific network elements appear to be common to a large number of the failures, then they are suspect as a significant failure source, requiring further maintenance action.

Measurements:

- number of link failures. (Items 1.2, 1.3, 1.4, 1.5, 1.6).

5.3.5 *Detection of routing and distribution table errors*

5.3.5.1 In operation, the Signalling System No. 7 routing tables will be updated frequently as the network changes. It is necessary to keep track of routing problems on a routine basis (see Recommendation Q.795, § 2.2).

Measurements:

- number of MSUs discarded due to a routing data error. (Item 5.5).

5.3.6 *Component reliability and maintainability studies*

5.3.6.1 These studies are concerned with calculating the mean time between failures (MTBF) and mean time to repair (MTTR) for each type of component in the Signalling System No. 7 network. It may be useful for some purposes, to have MTBF and MTTR data by Signalling System No. 7 function.

Measurements:

- number of link failures; (Items 1.2, 1.3, 1.4, 1.5, 1.6);
- duration of signalling link unavailability due to link failure. (Item 2.7).

5.4 *Administrative uses*

5.4.1 *Monitoring of link and signalling point utilization*

5.4.1.1 This activity is concerned with tracking message flows to ensure that they are not beginning to exceed stated link and signalling point capacities. It also ensures that existing routing is resulting in proportionate utilization of all available capacity.

Measurements by link:

- number of message signal units received (Item 3.5);
- number of SIF and SIO octets received (Item 3.4);
- number of message signal units transmitted (Item 3.3);
- number of SIF and SIO octets transmitted (Item 3.1);
- total duration of link in service state (Item 1.1).

Measurements by signalling point:

- number of received SIF and SIO octets (Items 6.1, 6.3, 6.4, 6.6);
- number of transmitted SIF and SIO octets (Items 6.2, 6.3, 6.5, 6.6).

5.4.2 *Preparation of traffic forecasts*

5.4.2.1 This activity is concerned with the calculation of values which will be entered into provisioning tables to determine future equipment quantities required. The data to be used are those already collected to support activities mentioned in §§ 5.2.2 and 5.4.1. Depending upon implementation, more detailed measurements may be required to provision such items as internal buffers or number of processors where these may vary.

5.4.3 *Network planning*

5.4.3.1 This activity requires longer-term traffic forecasts, based as much upon marketing intentions as upon extrapolations of existing patterns. Nevertheless, to understand existing patterns, planners need knowledge of traffic origins and destinations.

5.4.3.2 The measurements in Table 6 indicate how much traffic is being originated at the measured signalling point, and how much traffic has that signalling point as a destination. These measurements are useful for calculating traffic flows by origin-destination pair.

5.4.3.3 In reality, however, traffic flows do not spread randomly through a network. For each origin, distance and other factors result in a concentration of flows to favoured destinations. As a result, it will be necessary to measure traffic flows on the network by destination.

5.4.3.4 Given the large potential number of destinations, measurements may have to be grouped (see notes at bottom of Table 6/Q.791).

5.4.4 *Evaluation of maintenance force effectiveness*

This activity consists of managerial control of the maintenance function, through examination of failure trends, equipment availabilities and the amount of outage due to manual as opposed to automatic busying of components. The activity is usually carried out with the aid of indices based upon data listed in § 5.3.6.

TABLE 1/Q.791

Monitoring and measurements for the message transfer part
Signalling link performance

Description of measurements	Units	Usage O A M	Duration de measurement	Level	Obligatory [a]	Act. Perm.	References
1.1 Duration of Link in the In-Service State	secs/SL [b]	O A M	30 min	2	Yes	perm.	
1.2 SL Failure-All Reasons	event/SL	M	on occur.	2	Yes	perm.	
1.3 SL Failure-Abnormal FIBR/BSNR	event/SL	M	on occur.	2	No		Q.703, § 5.3
1.4 SL Failure-Excessive delay of ack	event/SL	M	on occur.	2	No		Q.703, § 5.3.1
1.5 SL-Failure-Excessive error rate	event/SL	M	on occur.	2	No		Q.703, § 10.2.2
1.6 SL-Failure-Excessive duration of congestion	event/SL	M	on occur.	2	No		Q.703
1.7 SL alignment failure or proving failure	events/SL	M	30 min	2	No		Q.703, § 10.3.3
1.8 Number of Signal Units in error	events/SL	M	30 min	2	Yes	perm.	Q.703, § 4
1.9 Number of negative ack. received	events/SL	M	30 min	2	No		
1.10 Automatic changeovers	events/SL	M	30 min	3	No		Q.704, § 5
	event/SL	O	on occur.	3	No		
1.11 Automatic changeback	event/SL	O M	on occur.	3	No		Q.704, § 6

[a] See § 3.1.2 (applies to all tables).

[b] SL = Signalling Link.

TABLE 2/Q.791

Monitoring and measurements for the message transfer part
Signalling link availability

Description of measurements	Units	Usage O A M	Duration of measurement	Level	Obligatory	Act./ Perm.	References
2.1 Duration of SL unavailability (for any reason)	secs/SL	O A M	30 min	3	Yes	Perm.	
2.2 Local manual changeovers	events/SL event/SL	M O	30 min on occur.	3	No		Q.704, § 5
2.3 Remote manual changeovers	events/SL event/SL	M O	30 min on occur.	3	No		Q.704, § 5
2.4 Manual changeback	event/SL	O M	on occur.	3	No		Q.704, § 6
2.5 Duration of SL inhibition due to local management actions	secs/SL	M	30 min	3	No		
2.6 Duration of SL inhibition due to remote management actions	secs/SL	M	30 min	3	No		Q.704, § 3.2.2
2.7 Duration of SL unavailability due to link failure	secs/SL	M	30 min	3	No		Q.704, § 3.2.2
2.8 Duration of SL unavailability due to local blocking	secs/SL	M	30 min	3	No		Q.704, § 3.2.6 b)
2.9 Duration of SL unavailability due to remote blocking	secs/SL	M	30 min	3	No		Q.704, § 3.2.6 a)
2.10 Start of remote blocking	event/SL	O M	on occur.	3	No		Q.704, § 3.2.6 a)
2.11 Stop of remote blocking	event/SL	O M	on occur.	3	No		Q.704, § 3.2.6 a)
2.12 Remote blocking	events/SL	O M	5 min 30 min	3 3	No No		Q.704, § 3.2.6 a)

TABLE 3/Q.791

Monitoring and measurements for the message transfer part
Signalling link utilization

	Description of measurements	Units	Usage O A M	Duration of measurement	Level	Obligatory	Act./ Perm.	References
3.1	Number of SIF and SIO octets transmitted	octets/SL	O A M	30 min	3/2	Yes	act.	Q.703, § 2.3.8
3.2	Octets retransmitted	octets/SL	A	30 min	2	No		Q.703, § 5
3.3	Number of message signal units transmitted	MSUs/SL	A	30 min	3/2	No		
3.4	Number of SIF and SIO octets received	octets/SL	O A M	30 min	3/2	Yes	act.	
3.5	Number of message signal units received	MSUs/SL	A	30 min	3/2	No		
3.6	SL congestion indications	events/SL	A M	30 min		No		Q.704, § 3.6
			O	5 min		No		
		event/SL	O	on occur.		No		
3.7	Cumulative duration of SL congestion	secs/SL	A M	30 min	3	No		
3.8	Start of SL congestion	event/SL	O	on occur.	3	No		
3.9	Stop of SL congestion	event/SL	O	on occur.	3	No		
3.10	MSUs discarded due to SL congestion	MSUs/SL	O	30 min	3	Yes	perm.	
3.11	Number of congestion events resulting on loss of MSUs	events/SL	M	30 min	3	No		
		event/SL	O	on occur.	3	No		

TABLE 4/Q.791

Monitoring and measurements for the message transfer part
Signalling link set and route set availability

	Description of measurements	Units	Usage O A M	Duration of measurement	Level	Obligatory	Act./ Perm.	References
4.1	Unavailability of signalling linkset	events/linkset	O M	30 min	3	No		
4.2	Duration of unavailability of signalling linkset	secs/linkset	O M	30 min	3	No		
4.3	Start of linkset failure	event/linkset	O M	on occur.	3	No		
4.4	Stop of linkset failure	event/linkset	O M	on occur.	3	No		
4.5	Initiation of broadcast TFP due to failure of measured linkset	event/linkset	O M	on occur.	3	No		Q.704, § 12
4.6	Initiation of broadcast TFA for recovery of measured linkset	event/linkset	O M	on occur.	3	No		Q.704, § 12
4.7	Unavailability of signalling route set (to a given destination) due to TFP receipt	event/route set	O M	30 min	3	No		
4.8	Duration of unavailability in 4.7	secs/route set	O M	30 min	3	No		
4.9	Unavailability of route set to a given destination or set of destinations	events/destination(s)	O A M	30 min	3	Yes	perm.	Q.706, § 1
4.10	Duration of unavailability in 4.9	secs/destination(s)	O A M	30 min	3	Yes	perm.	
4.11	Start of unavailability in 4.9	event/destination(s)	O M	on occur.	3	No		
4.12	Stop of unavailability in 4.9	event/destination(s)	O M	on occur.	3	No		

TABLE 5/Q.791

Monitoring and measurements for the message transfer part
Signalling point status

Description of measurements	Units	Usage O A M	Duration of measurement	Level	Obligatory	Act./ Perm.	References
5.1 Adjacent SP inaccessible	event/SP	O	on occur.	3	Yes	perm.	
		M	30 min				
	events/SP	O	5 min				
5.2 Duration of adjacent SP inaccessible	secs/SP	O	5 min	3	Yes	perm.	
		M	30 min				
5.3 Start of adjacent SP inaccessible state	event/SP	O M	on occur.	3	No		
5.4 Stop of adjacent SP inaccessible	event/SP	O M	on occur.	3	No		
5.5 MSU discarded due to a routing data error [a]	MSUs/SP	A	30 min		Yes	perm.	Q.795
		O M	5 min		Yes	perm.	

[a] The number of MSU discarded is related to the OMAP route validation function for study in the next study period.

TABLE 6/Q.791

Monitoring and measurements for the message transfer part
Signalling traffic distribution (Signalling route utilization)

Description of measurements	Units	Usage O A M	Duration of measurement	Level	Obligatory	Act./ Perm.	References
6.1 Number of SIF and SIO octets received with given OPC	octets/OPC	A	30 min	3	No		
6.2 Number of SIF and SIO octets transmitted with given DPC	octets/DPC	A	30 min	3	Yes	act.	
6.3 Number of SIF and SIO octets handled with given SIO	octets/SIO	A	30 min	3	No		
6.4 Number of SIF and SIO octets received with given OPC and SIO	octets/SIO/OPC	A	30 min	3	No		
6.5 Number of SIF and SIO octets transmitted with given DPC and SIO	octets/SIO/DPC	A	30 min	3	No		
6.6 Number of SIF and SIO octets handled with given OPC, DPC and SIO	octets/SIO/ OPC/DPC	A	30 min	3	No		

Note 1 – Activation of these measurements is recommended on per point code or sets of point codes and/or SIO.

Note 2 – Some of these measurements may be of interest for accounting purposes.

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SECTION 8

OPERATIONS AND MAINTENANCE APPLICATION PART

Recommendation Q.795

OPERATIONS AND MAINTENANCE APPLICATION PART

1 Introduction

The purpose of this document is to provide procedures and protocols related to operations and maintenance information. These procedures and protocols are associated with the application layer of the Open Systems Interconnection model. In addition, they use other procedures and protocols specified by CCITT in the framework of the OSI model.

The operations and maintenance procedures described are generally associated with two types of signalling points. The controlled signalling point(s) are the signalling point(s) to which controls are applied and about which information is collected. The controlling signalling point(s) are the signalling point(s) which are initiating the controls and to which information from the controlled signalling point(s) are directed.

This document is divided into five major sections. The first, is the introduction. The second describes those procedures in OMAP which are currently defined for the signalling network. The third describes those operations and maintenance procedures associated with the exchanges. The fourth describes those common operations and maintenance procedures that are associated with the signalling network and exchanges and the last section describes those capabilities required by OMAP from other parts of the OSI and gives examples of why the capabilities are required.

2 Operations and maintenance procedures for the signalling network

2.1 *Management of routing data*

These procedures deal with the creation, modification, deletion, interrogation, activation and deactivation of routing data. This capability is provided in two basic modes: *multiple* and *single. Multiple mode* provides the capability of dealing with many routing relations, while *single mode* deals with a single routing relation.

2.1.1 *Functions*

2.1.1.1 *Creation*

This function provides a means of adding new routing data associated with routing relations to a node in the network. It could cause additional information to be added to an existing table or it may involve adding a completely new table.

2.1.1.2 *Modification*

This function allows for the modification of existing routing data associated with routing relations within a particular node.

2.1.1.3 *Deletion*

This function is the inverse of creation, in that routing data associated with routing relations will be deleted from the routing tables.

2.1.1.4 *Interrogation*

This function provides a means for requesting the routing data in a specified signalling point.

For example the user can query a signalling point and the signalling point will respond with the respective data. This data can then be compared with the set of data which is expected to be in the signalling point.

2.1.1.5 *Activation*

Activation initiates the use of specified routing data.

The activation of routing relations implies that the new data is actually being used for routing purposes. It may be instantaneous or scheduled for a later time. Activation is accomplished via the activation procedure alone or may be a part of the creation, modification and deletion procedures.

2.1.1.6 *Deactivation*

Deactivation discontinues the use of specified routing data.

If a routing table is erroneously changed, another modification must be made to correct the data in order to continue routing in a sane manner. If a previous version of the table has been retained, the deactivation function may cause this table to be used. Deactivation can be either automatic or may require manual intervention.

2.1.1.7 *Rearrangement*

Rearrangement deals with the coordinated change of a set of routing relations within the signalling network (e.g. when an application is moved from one signalling point to another). This may be handled by requiring that the activation of routing relations in the various signalling points be made (e.g. by an operations and maintenance centre) in a particular order.

2.1.2 *Information elements*

The specification of information elements is left for further study.

2.2 *Routing verification*

These procedures determine whether routing data is accurate within the network by transmitting messages through the network and examining whether the message traverses an expected route. In particular, the tests provided should determine the following for every currently used signalling route between two signalling points:

a) the routes are complete between the two signalling points;

b) there are no loops in the routes between the two signalling points;

c) the number of signalling transfer points traversed does not exceed some predetermined value.

This is accomplished by the propagation of routing verification test messages through the signalling network between the two signalling points (near end and far end) of a signalling relation.

A routing verification test may be initiated in the following ways:

a) an action initiated by either the local maintenance staff or an operations and maintenance centre;

b) after any creation or modification of a routing relation;

c) on a periodic basis to detect cases of mutilation of routing data.

2.2.1 *Functions*

The specification of functions is left for further study.

2.2.2 *Information elements*

The specification of information elements is left for further study.

2.3 *Long-term measurement collection*

These procedures deal with setting up sets of data to be collected in a signalling point over a period of time as defined in Recommendation Q.791. In addition, they handle the request for transfer of that data after collection.

Periodically, at the same time, every signalling point collects the required data. The data collected may be transferred towards the appropriate signalling point(s) (e.g. an operations and maintenance centre) either on demand or on a scheduled basis.

2.3.1 *Functions*

2.3.1.1 *Parameter initialization*

This function initializes, in a signalling point, the destination address(es) to which measurements will be transferred, sets up default parameters describing which indications should be reported and, if scheduled, when the measurements should be transferred.

2.3.1.2 *Parameter modification*

This function allows modifications to the default measurements which are collected in a signalling point. It may not be used to modify the pace which measurements are collected nor to remove those measurements described as being mandatory in Recommendation Q.791. The following list represents the set of modifications currently available and the information elements that must be provided at the controlled signalling point. Other modifications have been left for further study.

a) *Allow measurement collection* is used to indicate that a particular measurement(s) should be collected for a particular controlling signalling point.

   Command, controlling address, measurement 1, measurement 2, ...

b) *Inhibit measurement collection* is used to indicate that a particular measurement(s) should not be collected for a particular controlling signalling point.

   Command, controlling address, measurement 1, measurement 2, ...

2.3.2 *Information elements*

2.3.2.1 *Command* indicates the function to be performed.

2.3.2.2 *Controlling address* is the address of the signalling point from which commands are sent and to which the measurements are transferred.

2.3.2.3 *Measurement* is the name of a particular measurement which should (not) be collected.

2.4 *On-occurrence measurement reporting*

These procedures deal with the transfer and control of the measurements described in Recommendation Q.791 (Monitoring and measurements for the MTP) as being reported on occurrence. The record of an on-occurrence measurement is referred to as an *event indicator* or *indicator.*

2.4.1 *Functions*

2.4.1.1 *Parameter initialization*

This function initializes, in a signalling point, the destination address(es) to which reporting should be made (e.g. an OMC), sets up default parameters describing which indicators should be reported, what thresholds are associated with the indicators and which indicators should be logged along with the establishment of logging files (see § 2.4.1.4).

2.4.1.2 *Parameter modification*

Parameter modification allows modifications to be made to the default indicators which are to be logged and transmitted. In addition, it allows the modification of the destination addresses that are associated with particular indicators. The following list represents the set of modifications available and the information elements that must be provided at the controlled signalling point. Other modifications have been left for further study.

a) *Create a logging file* is used to create a logging file and set the number of event indicators to be logged before overwriting old indicators:

command, controlling address, file name, size.

b) *Change a controlling address* is used to modify a controlling address (e.g. of an OMC) to which reports should be made:

command, old controlling address, new controlling address.

c) *Allow event logging* is used to indicate that a particular indicator(s) should be logged and optionally assign a threshold to the indicator:

command, controlling address, event indicator 1, threshold 1, ...

d) *Inhibit event logging* is used to indicate that a particular indicator(s) should not be logged:

command, controlling address, event indicator 1, event indicator 2, ...

e) *Change event logging threshold* is used to modify a threshold associated with a particular indicator(s) to be logged:

command, controlling address, event indicator 1, threshold 1, ...

f) *Allow event reporting* is used to indicate that a particular indicator(s) should be reported to a controlling address and optionally assign a threshold to the indicator:

command, controlling address, event indicator 1, threshold 1, ...

g) *Inhibit event reporting* is used to indicate that a particular indicator(s) should not be reported:

command, controlling address, event indicator 1, event indicator 2, ...

h) *Change event reporting threshold* is used to modify a threshold associated with a particular indicator(s) to be reported:

command, controlling address, event indicator 1, threshold 1, ...

2.4.1.3 *Event indicator reporting*

This function notifies a specified controlling address of on-occurrence measurements by the transfer of an event indicator. The following information elements are included in each message that is sent for reporting purposes:

event type, affected address, time stamp, additional information.

2.4.1.4 *Recovery of recent on-occurrence measurement history*

In the event of failure of a controlling signalling point (e.g. an operations maintenance centre) or a signalling relation to that controlling signalling point, a recovery procedure is required to allow the controlling signalling point to recover a recent history of on-occurrence measurements in the signalling network. This is accomplished by maintaining a log of the last N event indicators, at the signalling point, which may be requested by the controlling signalling point after recovery.

The logging file may also be used to store event indicators which have not been requested for reporting by the controlling signalling point, for example, measurements with lower thresholds for logging than for reporting.

The maximum number of event indicators logged (N) is for further study.

2.4.2 *Information elements*

2.4.2.1 *Controlling address* is the address of the signalling point from which commands are sent and to which the even indicators are reported.

2.4.2.2 *Controlled address* is the address of the signalling point which is being controlled and from which measurements are being reported.

2.4.2.3 *Affected address* is the address of the signalling point about which an event indicator pertains.

2.4.2.4 *Command* indicates a function to be performed.

2.4.2.5 *File name* is the name of a file at the signalling point where logging is to be performed.

2.4.2.6 *Size (N)* is the maximum number of event indicators that may be recorded in an event log.

2.4.2.7 *Event type* describes the on-occurrence measurement associated with an event indicator.

2.4.2.8 *Threshold* represents some threshold associated with an on-occurrence measurement before its associated event indicator is reported or logged.

2.4.2.9 *Time stamp* represents the unique network time when the event indicator was generated.

2.4.2.10 *Additional information* is any additional information associated with the on-occurrence measurement being indicated (e.g. the link ID of a signalling link experiencing a failure).

2.5 *Delay measurements*

These procedures deal with measuring delays across the signalling network, whether these delays are measured point-to-point or round trip.

2.5.1 *Functions*

The specifications of functions is left for further study.

2.5.2 *Information elements*

The specification of information elements is left for further study.

2.6 *Clock initialization*

The clock initialization procedures provide a means for setting clocks in a signalling point for operations and maintenance and for other purposes. Its main function allows clocks in the network to be set up to a unique network time.

2.6.1 *Functions*

The specification of specific functions has been left for further study.

2.6.2 *Information elements*

The specification of information elements is left for further study.

2.7 *Real-time control*

These procedures allow for automatic or manual controls to be taken in a controlled signalling point based on input from a controlling signalling point. The controlling signalling point may initiate these procedures based on input from procedures like the *on-occurrence measurement reporting* procedures.

2.7.1 *Functions*

The specification of functions is left for further study.

2.7.2 *Information elements*

The specification of information elements is left for further study.

2.8 *Operations*

These procedures provide a capability to perform operations, such as activation of links, within the signalling network.

2.8.1 *Functions*

The specification of functions is left for further study.

2.8.2 *Information elements*

The specification of information elements is left for further study.

2.9 *Testing*

The specification of testing procedures is left for further study.

2.9.1 *Functions*

The specification of functions is left for further study.

2.9.2 *Information elements*

The specification of information elements is left for further study.

2.10 *Other procedures*

The specification of other procedures is left as a topic for further study.

3 Operations and maintenance procedures for the exchanges

This section deals with those procedures associated with the operations and maintenance of exchanges and remains as a topic for further study. A basis for the definition of this section will be Recommendations Q.502, Q.505, Q.506, Q.512, Q.516, Supplement 6 of Fascicle II.3 and Recommendation Z.318.

4 Operations and maintenance procedures for both the Signalling Network and Exchanges

This section deals with those procedures associated with operations and maintenance that are found in common with both the Signalling Network and the Exchanges. The contents of this section remains as a topic for further study.

5 Requirements on the protocols used to support the operations and maintenance procedures

It is assumed that the procedures defined in the previous sections will make use of the protocols defined by CCITT in the various functional layers of the OSI model. This section describes the capabilities required from these layers. No attempt is made to allocate the requirements to specific functional layers of the OSI model.

5.1 *Addressing capability*

This capability allows the user of the OMAP to address applications in nodes in the signalling network or to applications in nodes that may exist in any interconnected network.

5.2 *Distribution capability*

This capability is responsible for delivering information to the appropriate operations and maintenance application within the destination node.

5.3 *Connection-oriented communication capability*

This capability establishes a connection, whether physical or logical, for the purposes of transporting operations and maintenance information between two signalling points. This is required, for example, for the interactions between a controlling signalling point where MML commands are entered and a controlled signalling point where the functions controlled by the MML commands exist.

5.4 *Connectionless communication capability*

The capability allows the transfer of operations and maintenance information between two signalling points without the establishment of a connection. This is required, for example, to transfer event indicators used in the *on-occurrence measurement reporting.*

5.5 *File transfer capability*

This capability provides the means for communications between operations and maintenance applications which require file transfers. This is required, for example, to transport files generated by *long-term measurement collection.*

5.6 *Other capabilities*

Other capabilities which may be required are for further study.

GLOSSARY OF TERMS SPECIFIC TO SIGNALLING SYSTEM No. 7

active signalling link

F: canal sémaphore (à l'état) actif

S: enlace de señalización activo

A signalling link which has successfully completed the initial alignment procedures and carries (or is ready to carry) signalling traffic.

adjacent signalling points

F: points sémaphores adjacents

S: puntos de señalización adyacentes

Two signalling points that are directly interconnected by (a) signalling link(s).

alignment error rate monitoring

F: surveillance du taux d'erreur pendant la procédure d'alignement

S: monitor de tasa de errores en la alineación

A procedure by which the error rate of a signalling link is measured during the initial alignment.

alternative routing (of signalling)

F: acheminement (de signalisation) de secours

S: encaminamiento alternativo (de señalización)

The routing of a given signalling traffic flow in case of failures affecting the signalling links, or routes, involved in the normal routing of that signalling traffic flow.

associated mode (of signalling)

F: mode (de signalisation) associé

S: modo (de señalización) asociado

The mode where messages for a signalling relation involving two adjacent signalling points are conveyed over a directly interconnecting signalling link.

backward indicator bit

F: bit indicateur vers l'arrière

S: bit indicador inverso (hacia atrás)

A bit in a signal unit requesting, by its status change, retransmission at the remote end when a signal unit is received out of sequence.

backward sequence number

F: numéro de séquence vers l'arrière

S: número secuencial inverso (hacia atrás)

A field in a signal unit sent which contains the forward sequence number of a correctly received signal unit being acknowledged.

basic (error correction) method

F: méthode (de correction d'erreur) de base

S: método básico (de corrección de errores)

A non-compelled, positive/negative acknowledgement, retransmission error control system.

changeback

F: retour sur canal sémaphore normal

S: retorno al enlace de servicio

The procedure of transferring signalling traffic from one or more alternative signalling links to a signalling link which has become available.

changeback code

F: code de retour sur canal sémaphore normal

S: código de retorno al enlace de servicio

A field in the signalling network management messages used in the changeback procedure; it is used to discriminate messages relating to different changeback procedures performed at the same time towards the same signalling link.

changeover

F: passage sur canal sémaphore de secours

S: paso a enlace de reserva

The procedure of transferring signalling traffic from one signalling link to one or more different signalling links, when the link in use fails or is required to be cleared of traffic.

check bit

F: bit de contrôle

S: bit de control

A bit associated with a character or block for the purpose of checking the absence of error within the character or block.

check loop

F: boucle pour contrôle de continuité

S: bucle de pruebas de continuidad

A device which is attached to interconnect the Go and Return paths of a circuit at the incoming end of a circuit to permit the outgoing end to make a continuity check on a loop basis.

common channel signalling

F: signalisation par canal sémaphore

S: señalización por canal común

A signalling method in which a single channel conveys by the means of labelled messages, signalling information relating to a multiplicity of circuits or calls and other information such as that used for network management.

continuity check

F: contrôle de continuité

S: prueba (verificación) de continuidad

A check made to a circuit or circuits in a connection to verify that an acceptable path (for transmission of data, speech, etc.) exists.

continuity check transponder

F: répondeur pour contrôle de continuité

S: transpondedor (transmisor-respondedor) para pruebas de continuidad

A device which is used to interconnect the Go and Return paths of a circuit at the incoming end which on detection of a check tone transmits another check tone to permit a continuity checking of a 2-wire circuit.

controlled rerouting

F: retour sous contrôle sur route normale

S: reencaminamiento controlado

A procedure of transferring in a controlled way, signalling traffic from an alternative signalling route to the normal signalling route, when this has become available.

cross-office check

F: contrôle de continuité à travers un commutateur

S: prueba (verificación) de continuidad a través de la central

A check made across the exchange to verify that an acceptable speech path exists.

Data User Part

F: Sous-système Utilisateur Données

S: parte de usuario de datos

The User Part specified for data services.

destination point code

F: code du point de destination

S: código del punto de destino

A part of the label in a signalling message which uniquely identifies, in a signalling network, the (signalling) destination point of the message.

dual seizure

F: prise simultanée

S: doble toma (toma simultánea)

The condition which occurs when in bothway operation two exchanges attempt to seize the same circuit at approximately the same time.

emergency changeover

F: passage d'urgence sur canal sémaphore de secours

S: paso de emergencia a enlace de reserva

A modified changeover procedure to be used whenever the normal one cannot be accomplished, i.e. in case of some failures in the signalling terminal equipment or in case of inaccessibility between the two involved signalling points.

error burst

F: paquet d'erreurs

S: ráfaga de errores

A group of bits in which two successive erroneous bits are always separated by less than a given number (x) of correct bits. The number x should be specified when describing an error burst.

Note – The last erroneous bit in a burst and the first erroneous bit in the following burst are accordingly separated by x correct bits or more.

fill-in signal unit

F: trame sémaphore de remplissage

S: unidad de señalización de relleno

A signal unit containing only error control and delimitation information, which is transmitted when there are no message signal units or link status signal units to be transmitted.

flag

F: fanion

S: bandera

The unique pattern on the signalling data link used to delimit a signal unit.

forced rerouting

F: passage sous contrainte sur route de secours

S: reencaminamiento forzado

A procedure of transferring signalling traffic from one signalling route to another, when the signalling route in use fails or is required to be cleared of traffic.

forward indicator bit

F: bit indicateur vers l'avant

S: bit indicador directo (hacia adelante)

A bit in a signal unit which indicates the start of a retransmission cycle.

forward sequence number

F: numéro de séquence vers l'avant

S: número secuencial directo (hacia adelante)

A signal unit used to identify the transmitted message signal units.

inactive signalling link

F: canal sémaphore (à l'état) inactif

S: enlace de señalización inactivo

A signalling link which has been deactivated and cannot therefore carry signalling traffic.

initial alignment

F: alignement initial

S: alineación inicial

A procedure by which a signalling link becomes able to carry signalling traffic either for the first time or after a failure has occurred.

initial signal unit alignment

F: alignement initial des trames sémaphores

S: alineación inicial de unidades de señalización

Signal unit alignment applicable to activation and to restoration of the link.

integrated digital network

F: réseau numérique intégré

S: red digital integrada

A network in which connections established by digital switching are used for the transmission of digital signals.

integrated services digital network

F: réseau numérique avec intégration des services

S: red digital de servicios integrados

An integrated digital network in which the same digital switches and digital paths are used to establish connections for different services, for example, telephony, data.

interruption control

F: contrôle d'interruption

S: protección contra las interrupciones

A system which monitors a pilot for interruptions on FDM systems and which transmits an indication to the switching equipment.

label

F: étiquette

S: etiqueta

Information within a signalling message used to identify typically the particular circuit, call or management transaction to which the message is related.

length indicator

F: indicateur de longueur

S: indicador de longitud

A six-bit field which differentiates between message signal units, link status signal units and fill-in signal units and in the case that its binary value is less than 63 indicates the length of a signal unit.

link status signal unit

F: trame sémaphore d'état du canal sémaphore

S: unidad de señalización del estado del enlace

A signal unit which contains status information about the signalling link in which it is transmitted.

load sharing (general)

F: partage de charge (en général)

S: compartición de carga (en general)

A process by which signalling traffic is distributed over two or more signalling or message routes, in view of traffic equalization or security.

long-term bit error rate

F: taux d'erreur à long terme sur les bits

S: tasa de errores en los bits a largo plazo

Bit error rate measured over a sufficiently long time period, e.g. one month.

management inhibit

F: inhibition par le gestion

S: inhabilitación (o inhibición) (en gestión de tráfico de señalización)

A procedure included in signalling traffic management used to keep a signalling link unavailable to User Part generated signalling traffic, except for test and maintenance traffic.

medium-term bit error rate

F: taux d'erreur à moyen terme sur les bits

S: tasa de errores en los bits a plazo medio

Bit error rate that can be encountered for relatively short time periods, e.g. some minutes, due to temporary malfunctions of, for example, transmission equipment.

message signal unit

F: trame sémaphore de message

S: unidad de señalización de mensaje

A signal unit containing a service information octet and a signalling information field which is retransmitted by the signalling link control if it is received in error.

Message Transfer Part

F: Sous-système Transport de Messages

S: parte de transferencia de mensajes

The functional part of a common channel signalling system which transfers signalling messages as required by all the users, and which performs the necessary subsidiary functions, for example error control and signalling security.

national indicator

F: indicateur national

S: indicador nacional

Information within a signalling message which permits typically a distinction to be made between national and international messages.

nonassociated mode (of signalling)

F: mode (de signalisation) non associé

S: modo (de señalización) no asociado

The mode where messages for a signalling relation involving two (nonadjacent) signalling points are conveyed, between those signalling points, over two or more signalling links in tandem passing through one or more signalling transfer points.

No. 7 exchange

F: commutateur n° 7

S: central N.° 7

An exchange utilizing Signalling System No. 7.

No. 7 exchange – first

F: premier commutateur n° 7

S: central N.° 7 – primera

The exchange closest to the calling party in each No. 7 section of a connection where, unless it is the calling party's exchange, interworking with other signalling systems takes place.

No. 7 exchange – last

F: dernier commutateur n° 7

S: central N.° 7 – última

The exchange closest to the called party in each No. 7 connection where, unless it is the called party's exchange, interworking with other signalling systems takes place.

normal routing (of signalling)

F: acheminement normal (de signalisation)

S: encaminamiento normal (de señalización)

The routing of a given signalling traffic flow in normal conditions (i.e. in the absence of failures).

originating point code

F: code du point d'origine

S: código del punto de origen

A part of the label in a signalling message which uniquely identifies, in a signalling network, the (signalling) originating point of the message.

pilot

F: onde pilote

S: piloto

Sinusoidal signal transmitted over analogue FDM links for regulation and supervision purposes.

preventive cyclic retransmission (error control) method

F: méthode (de correction d'erreur) avec retransmission cyclique préventive

S: método (de protección contra errores) por retransmisión cíclica preventiva

A noncompelled, positive acknowledgement, cyclic retransmission forward error correction system.

processor outage

F: processeur hors service

S: interrupción del procesador

A situation in which a signalling link becomes unavailable, due to factors at a functional level higher than level 2. This may be because of, for example, a central processor failure. It may also be due to a manually initiated blocking of an individual signalling link.

quasi-associated mode (of signalling)

F: mode (de signalisation) quasi associé

S: modo (de señalización) cuasiasociado

A nonassociated mode (of signalling) in which the (signalling) message route is determined basically, for each signalling message, by information contained in this message (namely in its routing label) and is fixed in normal operation.

random errors

F: erreurs aléatoires

S: errores aleatorios

Errors distributed over the digital signal so that they can be considered statistically independent from each other.

retransmission buffer

F: tampon de retransmission

S: memoria tampón de retransmisión

Storage in the signalling link control for signal units transmitted but not yet positively acknowledged.

retrieval

F: récupération

S: recuperación

The process of transferring all those messages in the retransmission buffer of a signalling link (A), which have not yet been positively acknowledged, to the transmission buffers of alternative signalling links.

route set congestion control

F: contrôle d'encombrement de faisceau de routes sémaphores

S: control de la congestión de un conjunto de rutas

A procedure included in the signalling route management which is used to update the congestion status of a signalling route in a given signalling point.

routing label

F: étiquette d'acheminement

S: etiqueta de encaminamiento

The part of the message label that is used for message routing in the signalling network. It includes the destination point code, the originating point code and the signalling link selection field.

service indicator

F: indicateur de service (utilisateur)

S: indicador de servicio

Information within a signalling message identifying the user to which the message belongs.

service information (octet)

F: octet de service

S: (octeto de) información de servicio

Eight bits, contained in a message signal unit, comprising the service indicator and the sub-service field.

signal unit

F: trame sémaphore

S: unidad de señalización

A group of bits forming a separately transferable entity used to convey information on a signalling link.

signal unit alignment

F: alignement des trames sémaphores

S: alineación de unidades de señalización

Signal unit alignment exists when flags are received at intervals which correspond to integral numbers of octets and which fall within certain upper and lower limits.

signal unit error rate monitoring

F: surveillance du taux d'erreur sur les trames sémaphores

S: monitor de tasa de errores en las unidades de señalización

A procedure by which the error rate of an active signalling link is measured on the basis of a count of correctly checking and erroneous signal units.

(signalling) destination point

F: point (sémaphore) de destination

S: punto de destino (de la señalización)

A signalling point to which a message is destined.

signalling information (field)

F: information de signalisation (domaine d')

S: (campo de) información de señalización

The bits of a message signal unit which carry information particular to a certain user transaction and always contain a label.

signalling link

F: canal sémaphore

S: enlace de señalización

A transmission means which consists of a signalling data link and its transfer control functions, used for reliable transfer of a signalling message.

signalling link blocking

F: blocage d'un canal sémaphore

S: bloqueo de un enlace de señalización

An event causing the unavailability of a signalling link, typically consisting in a "processor outage" condition at one end of that signalling link.

signalling link code

F: code de canal sémaphore

S: código de enlace de señalización

A field of the label in the signalling network management messages, which indicates the particular signalling link to which the message refers among those interconnecting the two involved signalling points.

signalling link error monitoring

F: surveillance des erreurs sur un canal sémaphore

S: monitor de errores en el enlace de señalización

This comprises two functions: initial alignment error rate monitoring and signal unit error rate monitoring.

signalling link failure

F: défaillance d'un canal sémaphore

S: avería (o fallo) del enlace de señalización

An event causing the unavailability of a signalling link, typically consisting in a failure in signalling terminal equipment or in the signalling data link.

signalling link group

F: groupe de canaux sémaphores

S: grupo de enlaces de señalización

A set of signalling links directly connecting two signalling points and having the same physical characteristics (bit rate, propagation delay, etc.).

signalling link management functions

F: fonctions de gestion des canaux sémaphores

S: funciones de gestión de enlaces de señalización

Functions that control and take actions, when required, to preserve integrity of locally connected signalling links, e.g. by reconfiguration of the signalling link sets.

signalling link restoration

F: rétablissement d'un canal sémaphore

S: restablecimiento de enlaces de señalización

An event consisting in the completion of the initial alignment procedure on a signalling link following the removal of the previous causes of failure; if no other causes of unavailability exist (i.e. a signalling link blocked condition) then the signalling link becomes available.

signalling link selection field

F: domaine de sélection du canal sémaphore

S: campo de selección de enlace de señalización

A field of the routing label which is typically used by the message routing function to perform load sharing among different signalling links/link sets.

signalling link set

F: faisceau de canaux sémaphores

S: conjunto de enlaces de señalización

A set of signalling link(s) directly connecting two signalling points.

signalling link unblocking

F: déblocage d'un canal sémaphore

S: desbloqueo de un enlace de señalización

An event consisting in the removal of the previous causes of signalling link blocking; if no other causes of unavailability exist (i.e. a signalling link failed condition), then the signalling link becomes available.

signalling message

F: message de signalisation

S: mensaje de señalización

An assembly of signalling information pertaining to a call, management transaction, etc., that is transferred as an entity.

(signalling) message discrimination

F: discrimination des messages (de signalisation)

S: discriminación de mensajes (de señalización)

The process which decides, for each incoming message, whether the signalling point is destination point or if it should act as signalling transfer point for that message and accordingly, whether the message should be handled to (signalling) message distribution or to (signalling) message routing functions.

(signalling) message distribution

F: distribution des messages (de signalisation)

S: distribución de mensajes (de señalización)

The process of determining, upon receipt of a signalling message at its destination point, to which User Part the signalling message is to be delivered.

signalling message handling functions

F: fonctions d'orientation des messages de signalisation

S: funciones de tratamiento de mensajes de señalización

Functions that, at the actual transfer of a message, direct the message to the proper signalling link or User Part.

(signalling) message route

F: route de message (de signalisation)

S: ruta de mensaje (de señalización)

The signalling link or consecutive links connected in tandem that are used to convey a signalling message from an originating point to its destination point.

(signalling) message routing

F: acheminement des messages (de signalisation)

S: encaminamiento de mensajes (de señalización)

The process for selecting, for each signalling message to be sent, the signalling link to be used.

signalling network

F: réseau sémaphore

S: red de señalización

A network used for signalling by one or more users and consisting of signalling points and connecting signalling links.

signalling network functions

F: fonctions du réseau sémaphore

S: funciones de la red de señalización

The functions which are performed by the Message Transfer Part at level 3 and are common to, and independent of, the operation of individual signalling links. They include the signalling message handling functions and the signalling network management functions.

signalling network management functions

F: fonctions de gestion du réseau sémaphore

S: funciones de gestión de la red de señalización

Functions that, on the basis of predetermined data and information about the status of the signalling network, control the current message routing and configuration of signalling network facilities.

(signalling) originating point

F: point (sémaphore) d'origine

S: punto de origen (de la señalización)

A signalling point in which a message is generated.

signalling point

F: point sémaphore

S: punto de señalización

A node in a signalling network which either originates and receives signalling messages, or transfers signalling messages from one signalling link to another, or both.

signalling point code

F: code d'un point sémaphore

S: código de punto de señalización

A binary code uniquely identifying a signalling point in a signalling network. This code is used, according to its position in the label, either as destination point code or as originating point code.

signalling relation

F: relation sémaphore

S: relación de señalización

A relation between two signalling points involving the possibility of information interchange between corresponding User Part functions.

signalling route

F: route sémaphore

S: ruta de señalización

A predetermined path described by a succession of signalling points that may be traversed by signalling messages directed by a signalling point towards a specific destination point.

signalling route management functions

F: fonctions de gestion des routes sémaphores

S: funciones de gestión de rutas de señalización

Functions that transfer information about changes in the availability of signalling routes in the signalling network.

signalling route-set-test procedure

F: procédure de test de faisceau de routes sémaphores

S: procedimiento de prueba de conjunto de rutas de señalización

A procedure, included in the signalling route management which is used to test the availability of a given signalling route, previously declared unavailable.

(signalling) traffic flow control

F: contrôle de flux de trafic (sémaphore)

S: control del flujo del tráfico (de señalización)

Actions and procedures intended to limit signalling traffic at its source in the case when the signalling network is not capable of transferring all signalling traffic offered by the User Parts, because of network failures or overload situations.

signalling traffic management functions

F: fonctions de gestion du trafic sémaphore

S: funciones de gestión del tráfico de señalización

Functions that control and, when required, modify routing information used by the Message routing function and control the transfer of signalling traffic in a manner that avoids irregularities in message flow.

signalling transfer point

F: point de transfert sémaphore

S: punto de transferencia de señalización

A signalling point with the function of transferring signalling messages from one signalling link to another and considered exclusively from the viewpoint of the transfer.

status field

F: domaine d'état

S: campo de estado

The bits of a link status signal unit which indicate one of the major signalling link states.

Telephone User Part

F: Sous-système Utilisateur Téléphonie

S: parte de usuario de telefonía

The User Part specified for telephone services.

transfer-allowed (procedure)

F: transfert autorisé (procédure de)

S: (procedimiento de) autorización de transferencia

A procedure, included in the signalling route management, which is used to inform a signalling point that a signalling route has become available.

transfer controlled

F: transfert sous contrôle

S: transferencia controlada (o control de transferencia)

A procedure included in signalling route management which does inform a signalling point of the congestion status of a signalling route.

transfer-prohibited (procedure)

F: transfert interdit (procédure de)

S: (procedimiento de) prohibición de transferencia

A procedure, included in the signalling route management, which is used to inform a signalling point of the unavailability of a signalling route.

transfer restricted

F: transfert restreint

S: transferencia restringida (o restricción de transferencia)

A procedure included in signalling route management which does inform a signalling point of the restriction of a signalling route.

transmission buffer

F: tampon d'émission

S: memoria tampón de transmisión

Storage in the signalling link control for signal units not yet transmitted.

User Part

F: Sous-système Utilisateur

S: parte de usuario

A functional part of the common channel signalling system which transfers signalling messages via the Message Transfer Part. Different types of User Parts exist (e.g. for telephone and data services), each of which is specified to a particular use of the signalling system.

user (of the signalling system)

F: utilisateur du système de signalisation

S: usuario (del sistema de señalización)

A functional entity, typically a telecommunication service, which uses a signalling network to transfer information.

ABBREVIATIONS SPECIFIC TO SIGNALLING SYSTEM No. 7[1)]

English	French	Spanish	Meaning
ACM	ACO	MDC	Address complete message Table 3/Q.723, Figure 3/Q.724
ADI	ADI	SDI	Address incomplete signal Table 3/Q.723, Figure 3/Q.724
AERM	STEA	MA	Alignment error rate monitor Figures 7-9/Q.703 and 11-17/Q.703
ANC	RAT	RCT	Answer signal, charge Table 3/Q.723, Figure 3/Q.724
ANN	RST	RST	Answer signal, no charge Table 3/Q.723
BIB	BIR	BII	Backward indicator bit Figures 3/Q.703, 13/Q.703 and 15/Q.703
BLA	BLA	ARB	Blocking-acknowledgement signal Table 3/Q.723
BLO	BLO	BLO	Blocking signal Table 3/Q.723
BSM	DE	MPE	Backward set-up message Table 3/Q.723
BSN	NSR	NSI	Backward sequence number Figures 3/Q.703, 14/Q.703 and 16/Q.703
BSNR	NSR-R	NSIR	Backward sequence number received Figures 7/Q.703, 13/Q.703, 14/Q.703, 16/Q.703
BSNT	NSR-E	NSIT	Backward sequence number of next SU to be transmitted Figures 7-9/Q.703 and 13-16/Q.703, Figures 27 and 30/Q.704.
CBA	RCA	ARS	Changeback acknowledgement signal Table 3/Q.704
CBD	RCO	ORS	Changeback declaration signal Table 3/Q.704
CBK	RAC	COL	Clear-back signal Table 3/Q.723, Figure 3/Q.724
CCF	CCN	FCO	Continuity-failure signal Table 3/Q.723
CCI	CCE	PCL	Continuity check incoming Recommendation Q.724, § 10.3, Figures 3/Q.724, 5/Q.724, 6/Q.724
CCM	SC	MSC	Circuit supervision message Table 3/Q.723
CCO	CCS	PCS	Continuity-check outgoing Recommendation Q.723, § 10.3 Figures 3/Q.724, 4/Q.724
CCR	CCD	PPC	Continuity-check-request signal Table 3/Q.723 Figures 2/Q.724, 3/Q.724, 6/Q.724 and 7/Q.724
CCS	CS	SCC	Common channel signalling Recommendation Q.701, § 1.1
CFL	ECH	SLI	Call-failure signal Table 3/Q.723, Figure 3/Q.724
CGC	EFC	CHC	Circuit-group-congestion Table 3/Q.723, Figure 3/Q.724

[1)] This list of abbreviations is the one appearing in Fasicle VI.6 of the *Yellow Book*, 1980. Study Group XI will bring this list up to date in the Study Period 1985-1988.

English	French	Spanish	Meaning
CHG	TAX	MTA	Charging message Table 3/Q.723
CHM	PR	MPA	Changeover and changeback messages Table 1/Q.704
CIC	CIC	CIC	Circuit identification code Recommendation Q.704, § 13.10.3, Recommendation Q.723, § 2.2.1
CIR	IDD	PIL	Calling-line-identity-request signal Table 3/Q.723
CK	CRT	BCE	Check bits Figure 3/Q.703
CLF	FIN	FIN	Clear-forward signal Table 3/Q.723, Figure 2/Q.724, 3/Q.724, 6/Q.724, 7/Q.724
CLI	IDL	MIL	Calling-line-identity message Table 3/Q.723
CLU	IDN	MIN	Calling-line-identity-unavailable signal Table 3/Q.723
CNP	CLI	CIM	Connection-not-possible signal Table 1/Q.704
CNS	CLN	CIN	Connection-not-successful signal Table 1/Q.704
COA	PCA	APR	Changeover acknowledgement signal Table 1/Q.704
COO	PCO	OPR	Changeover order signal Table 1/Q.704
COT	CCP	CON	Continuity signal Table 3/Q.723, Figure 3/Q.724
CPC	STA	CTL	Call processing control Recommendation Q.724, § 10.2 Figures 1-7/Q.724
CRI	CRE	RPL	Continuity recheck incoming Recommendation Q.724, § 10.1, Figures 1/Q.724, 2/Q.724, 3/Q.724, 6/Q.724, 7/Q.724
CRO	CRS	RPS	Continuity-recheck outgoing Recommendation Q.724, § 10.1, Figures 1-3/Q.724, 6/Q.724
CSM	SA	MSL	Call supervision message Table 3/Q.723
CSS	CLR	ACC	Connection-successful signal Table 1/Q.704
DAEDR	DAD-R	DADR	Delimitation, alignment, error detection (reception) Figures 7/Q.703, 9/Q.703, 11/Q.703, 14/Q.703, 16/Q.703, 17/Q.703, 18/Q.703
DAEDT	DAD-E	DADT	Delimitation, alignment, error detection (transmitting) Figures 12/Q.703, 13/Q.703, 15/Q.703
DCE	ETCD	ETCD	Data circuit terminating equipment Figure 1/Q.702
DLC	CLO	CED	Signalling-data-link-connection-order signal Table 1/Q.704
DLM	CL	MED	Signalling-data-link-connection-order message Table 1/Q.704
DPC	CPD	CPD	Destination point code Recommendation Q.704, §§ 2.2.3, 13.2, Figure 3/Q.704, 14/Q.704, 26/Q.704 Recommendation Q.706, § 3, Recommendation Q.723, § 2.2.1
DUP	SSUD	PUD	Data user part Recommendation Q.701, § 2.1, Figure 2/Q.701
EAM	EXR	MAR	Extended-answer-message indication Table 3/Q.723

English	French	Spanish	Meaning
ECA	PUA	AER	Emergency changeover acknowledgement signal Table 1/Q.704
ECM	PU	MEP	Emergency changeover message Table 1/Q.704
ECO	PUO	PER	Emergency changeover order signal Table 1/Q.704
EUM	EXT	IAL	Extended-unsuccessful-backward set-up information message indication Table 3/Q.723
F	F	BAN	Flag Figure 3/Q.703
FAM	AD	MDA	Forward-address message Table 3/Q.723
FCM	CF	MCF	Signalling traffic flow control messages Table 1/Q.704
FDM	MRF	MDF	Frequency division multiplex Recommendation Q.723, § 2.2.3, Recommendation Q.724, § 9
FIB	BIA	BID	Forward indicator bit Figures 3/Q.703, 13/Q.703, 15/Q.703
FISU	TSR	USR	Fill-in signal unit Figures 7/Q.703, 8/Q.703, 13-16/Q.703, Figures A-2/Q.704, A-3/Q.704, A-8/Q.704
FOT	IOP	INT	Forward-transfer signal Table 3/Q.723
FSM	EA	MEL	Forward set-up message Table 3/Q.723
FSN	NSA	NSD	Forward sequence number Figures 3/Q.703, 13/Q.703
HMDC	ODC	HDCM	Message discrimination Recommendation Q.704, § 14.3, Figures 23-26/Q.704
HMDT	ODT	HDTM	Message distribution Recommendation Q.704, § 14.3, Figures 23-25/Q.704, 28/Q.704, 30/Q.704, 31/Q.704, 42/Q.704, 44-46/Q.704, 2/Q.707
HMRT	OAC	HENM	Message routing Recommendation Q.704, § 14.3, Figures 23/Q.704, 24/Q.704, 26/Q.704, 27/Q.704, 30/Q.704, 31/Q.704, 32/Q.704, 33/Q.704, 42/Q.704, 44/Q.704, 45/Q.704, 46/Q.704, A-6/Q.704, 2/Q.707
HO	HO	EO	Heading code Recommendation Q.704, § 13.3, Figure 16/Q.704, Recommendation Q.707, § 5.3, Figure 1/Q.707, Recommendation Q.723, §§ 3.1 and 3.2
H1	H1	E1	Heading code Recommendation Q.704, § 13.4.3, Figure 16/Q.704, Recommendation Q.723, § 3.1
IAC	CAI	CAI	Initial alignment control Figures 7-9/Q.703, 11/Q.703, 13-17/Q.703, A-8/Q.704
IAI	MIS	MIA	Initial address message with additional information Table 3/Q.723
IAM	MIA	MID	Initial address message Table 3/Q.723, Figures 3/Q.724, 6/Q.724, Table 2/Q.725
ISP	PSI	PSI	International signalling point Recommendation Q.705, § 3, Figure 1/Q.705
L1	N1	N1	Level 1 Figures 12/Q.703, 35/Q.704, 38-40/Q.704, A-2/Q.704, A-3/Q.704, A-5/Q.704

English	French	Spanish	Meaning
L2	N2	N2	Level 2 Figures 8/Q.703, 9/Q.703, 12/Q.703, 13/Q.703, 15/Q.703, 23/Q.704, 24/Q.704, 26/Q.704, 27/Q.704, 30/Q.704, 35/Q.704, 37/Q.704, A-2/Q.704, A-5/Q.704, A-8/Q.704
L3	N3	N3	Level 3 Figures 8/Q.703, 9/Q.704, 13/Q.703, 15/Q.703, 23/Q.704, 24/Q.704, 26/Q.704, 30/Q.704, 31/Q.704, 34/Q.704, 35/Q.704, 37/Q.704, 38/Q.704, 39/Q.704, A-3/Q.704, A-5/Q.704, A-8/Q.704
L4	N4	N4	Level 4 Figures 23/Q.704, 25-27/Q.704, 34/Q.704
LI	INL	IL	Length indicator Recommendation Q.703, § 2.2, Figure 3/Q.703
LLSC	GCSF	CCE	Link set control Figures 29/Q.704, 35-37/Q.704, A-2/Q.704, A-5/Q.704
LOS	LHS	LFS	Line-out-of-service signal Table 3/Q.723, Figure 3/Q.724
LSAC	GCSA	CAE	Signalling link activity control Recommendation Q.704, § 14.6, Figures 28-30/Q.704, 35-41/Q.704, A-2/Q.704, A-3/Q.704, A-4/Q.704, A-5/Q.704, A-7/Q.704
LSC	SET	CEE	Link state control Figures 7-10/Q.703, 13-18/Q.703, Recommendation Q.704, § 14.6, Figures 41/Q.704, A-2/Q.704, A-5/Q.704, A-8/Q.704
LSDA	GCAL	AED	Signalling data link allocation Recommendation Q.704, § 14.6, Figures 35/Q.704, 37-40/Q.704, 42/Q.704, A-2/Q.704, A-4/Q.704, A-5/Q.704
LSDS	GCLR	SED	Stand-by data link selection Figures A-2/Q.704, A-4/Q.704, A-5/Q.704
LSLA	GCAC	AES	Signalling link activation Recommendation Q.704, § 14.6, Figures 35/Q.704, 37/Q.704, 38/Q.704, 41/Q.704, 42/Q.704, A-2/Q.704, A-5/Q.704
LSLD	GCDA	DES	Signalling link deactivation Recommendation Q.704, § 14.6, Figures 35/Q.704, 37/Q.704, 40/Q.704, 41/Q.704, 42/Q.704, A-2/Q.704, A-5/Q.704
LSLR	GCRE	RES	Signalling link restoration Recommendation Q.704, § 14.6, Figures 35/Q.704, 37/Q.704, 39/Q.704, 41/Q.704, 42/Q.704, A-2/Q.704, A-3/Q.704, A-5/Q.704
LSSU	TSE	UEE	Link status signal units Figures 13-16/Q.703
LSTA	GCAT	ATS	Signalling terminal allocation Recommendation Q.704, § 14.6, Figures 35/Q.704, 38/Q.704, 39/Q.704, 40/Q.704, 41/Q.704, A-2/Q.704
MGMT	GES	SGE	Management system Figures 8/Q.703, 27/Q.704, 28/Q.704, 35-37/Q.704, A-2/Q.704, A-7/Q.704, 2/Q.707
MSU	TSM	USM	Message signal unit Recommendation Q.701, § 2.3, Figures 7/Q.703, 8/Q.703, 14/Q.703, 15/Q.703, 16/Q.703, A-8/Q.704
MTP	SSTM	PTM	Message transfer part Recommendation Q.701, § 2.1, Recommendation Q.721, § 1
NACK	ACN	RN	Negative acknowledgement Figures 7/Q.703, 13/Q.703, 14/Q.703
NNC	ERN	CRN	National-network-congestion signal Table 3/Q.723, Figure 3/Q.724
NSP	PSN	PSN	National signalling point Recommendation Q.705, § 3, Figure 1/Q.705

English	French	Spanish	Meaning
OPC	CPO	CPO	Originating point code Recommendation Q.704, §§ 2.2.3 and 13.2, Figures 3/Q.704 and 14/Q.704, Recommendation Q.706, § 3, Recommendation Q.723, § 2.2.1
PCM	MIC	MIC	Pulse code modulation Recommendation Q.702, § 5.3
PCR	RCP	RCP	Preventive cyclic retransmission Tables 1/Q.706, 2/Q.706
POC	SIP	CBP	Processor outage control Figures 8/Q.703, 10/Q.703, A-8/Q.704
RAN	NRP	RRE	Reanswer signal Table 3/Q.723, Figure 3/Q.724
RC	REC	CR	Reception control Figures 8/Q.703, 9/Q.703, 11/Q.703, 13-16/Q.703, A-8/Q.704
RLG	LIG	LGU	Release-guard signal Table 3/Q.723, Figures 2/Q.724, 3/Q.724, 6/Q.724, 7/Q.724
RSC	RZC	RCI	Reseat-circuit signal Table 3/Q.723
RSM	TR	MPR	Signalling-route-set-test message Table 1/Q.704
RSRT	GRTF	CPC	Signalling route set test control Recommendation Q.704, § 14.5, Figures 23/Q.704, 29/Q.704, 43-46/Q.704
RST	TRS	PRS	Signalling-route-set-test signal Table 1/Q.704
RTAC	GRTA	CTA	Transfer allowed control Recommendation Q.704, § 14.5, Figures 29/Q.704, 33/Q.704, 37/Q.704, 43/Q.704, 45/Q.704, 46/Q.704
RTB	TRT	MRT	Retransmission buffer Figures 7/Q.703, 13/Q.703, 15/Q.703
RTPC	GRTI	CTP	Transfer prohibited control Recommendation Q.704, § 14.5, Figures 26/Q.704, 29/Q.704, 43/Q.704, 44/Q.704, 46/Q.704
SAM	MSA	MSD	Subsequent-address message Table 3/Q.723, Figure 3/Q.724, Table 2/Q.725
SAO	MSS	SDU	Subsequent-address message with one signal Table 3/Q.723
SBM	SE	MEC	Successful-backward-set-up information message Table 3/Q.723
SDL	LDS	LED	Functional specification and description language Recommendation Q.704, § 14.1, Recommendation Q.724, § 10.1
SEC	EEC	CEC	Switching-equipment-congestion signal Table 3/Q.723, Figure 3/Q.724
SF	ETC	CE	Status field Figure 3/Q.703
SI	INS	IS	Service indicator Recommendation Q.704, § 13.1.1
SIE	ETAU	IAE	Status indication "emergency terminal status" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703
SIF	INF	CIS	Signal information field Figure 3/Q.703
SIN	ETAN	IAN	Status indication "normal terminal status" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703

English	French	Spanish	Meaning
SIO	SER	OIS	Service information octet Figure 3/Q.703
SIO[2)]	ETAP	IFA	Status indication "out of alignment" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703
SIOS	ETHS	IFS	Status indication "out of service" Recommendation Q.703, §§ 7.2, 7.3 and 10.1.3, Figures 2/Q.703, 4/Q.703, 7-9/Q.703, 13-16/Q.703, A-8/Q.704
SIPO	ETIP	IBP	Status indication "processor outage" Recommendation Q.703, § 10.1.3, Figures 2/Q.703, 7/Q.703, 8/Q.703, 13-16/Q.703, A-8/Q.704
SLC	COC	COE	Signalling link code Recommendation Q.704, §§ 13.2 Figure 14/Q.704
SLM	GCS	GES	Signalling link management Recommendation Q.704, §§ 14.1 and 14.6, Figures 23/Q.704, 25/Q.704, 26/Q.704, 27/Q.704, 29/Q.703
SLS	SCS	SES	Signalling link selection code Recommendation Q.704, § 2.2.4, Figures 3/Q.704, 4/Q.704, 26/Q.704, A-3.1/Q.705
SLTM	ESCO	MPES	Signalling link test message Figure 2/Q.707
SMH	OMS	TMS	Signalling message handling Recommendation Q.704, §§ 14.1 and 14.3, Figures 23/Q.704, 43/Q.704
SP	PS	PS	Signalling point Figures 8/Q.704, 23/Q.703, 24/Q.703, 26/Q.703, 27/Q.703, 30/Q.703, 31/Q.703, 42-44/Q.703
SPRC	CPS	CPS	Signalling procedure control Recommendation Q.724, § 10.1, Figures 1-7/Q.724
SRM	GRS	GRS	Signalling route management Recommendation Q.704, §§ 14.1 and 14.5, Figures 23/Q.704, 25-27/Q.704, 43/Q.704
SSB	OCC	ABO	Subscriber-busy signal (electrical) Table 3/Q.723, Figure 3/Q.724
SSF	DSS	CSS	Sub-service field Recommendation Q.704, § 13.1.1
SST	TSI	TIE	Send-special-information-tone signal Figures 1-7/Q.724
ST	ST	SFN	End-of-pulsing signal Recommendation Q.724, § 1.3
STLC	ESC	CPES	Signalling link test control Figures 25/Q.704, 26/Q.704, 2/Q.707
STM	GTS	GTS	Signalling traffic management Recommendation Q.704, §§ 14.1 and 14.4, Figures 23/Q.704, 25-27/Q.704, 30/Q.704, 35/Q.704, 39/Q.704, 43/Q.704, A-2/Q.704
STP	PTS	PTS	Signalling transfer point Figure 4/Q.701, Recommendation Q.705, § 3, Figures A-1/Q.705, A-2/Q.705, Recommendation Q.706, § 4.3.3, Table 3/Q.706
SU	TS	US	Signal unit Figures 2/Q.703, 7/Q.703

2) In English, another abbreviation will have to be found for *status indication "out of alignment"*, since the abbreviation SIO is already used for *service information octet*

English	French	Spanish	Meaning
SUERM	STTS	MUS	Signal unit error rate monitor Figures 7/Q.703, 8/Q.703, 11/Q.703, 18/Q.703, A-8/Q.704
TAA	TAA	ATA	Transfer-allowed acknowledgement signal Table 1/Q.704, Figure 45/Q.704
TB	TEM	MT	Transmission buffer Figures 7/Q.703, 13/Q.703, 15/Q.703
TCBC	GTCN	TCRS	Changeback control Recommendation Q.704, § 14.4, Figures 27-29/Q.704, 31/Q.704, A-7/Q.704
TCOC	GTCS	TCER	Changeover control Recommendation Q.704, § 14.4, Figures 27-30/Q.704, 37/Q.704, A-6/Q.704, A-7/Q.704
TCRC	GTRN	TCRC	Controlled rerouting control Recommendation Q.704, § 14.4, Figures 27/Q.704, 29/Q.704, 33/Q.704, 45/Q.704
TFA	TAO	TRA	Transfer-allowed signal Table 1/Q.704
TFM	TF	MTR	Transfer-prohibited and transfer-allowed messages Table 1/Q.704
TFP	TIO	PTR	Transfer-prohibited signal Table 1/Q.704
TFRC	GTRS	TCRF	Forced rerouting control Recommendation Q.704, §§ 14.4, Figures 27/Q.704, 29/Q.704, 32/Q.704
TLAC	GTSD	TCDE	Link availability control Recommendation Q.704, § 14.4, Figures 27-31/Q.704, 37/Q.704, A-5/Q.704, A-6/Q.704, A-7/Q.704
TPA	TIA	APT	Transfer-prohibited acknowledgement signal Table 1/Q.704, Figure 44/Q.704
TSFC	GTFX	CFTS	Signalling traffic flow control Figures 27/Q.704, 29/Q.704, 34/Q.704
TSRC	GTAC	CEN	Signalling routing control Recommendation Q.704, § 14.4, Figures 27-34/Q.704, 36/Q.704, 37/Q.704, 44-46/Q.704, A-6/Q.704, A-7/Q.704
TUP	SSUT	PUT	Telephone user part Recommendation Q.701, § 2.1, Figure 2/Q.701, Recommendation Q.721, § 1
TXC	EMI	CT	Transmission control Figures 8/Q.703, 9/Q.703, 12-16/Q.703, A-8/Q.704
UBA	DBA	ARD	Unblocking-acknowledgement signal Table 3/Q.723
UBL	DBO	DBL	Unblocking signal Table 3/Q.723
UBM	EE	MEI	Unsuccessful-backward-set-up-information message Table 3/Q.723
UNN	NNU	NNA	Unallocated-national-number signal Table 3/Q.723, Figure 3/Q.724
UP	SSU	PU	User part Figure 2/Q.704

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