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[CEPT Recommendation T/S 43-02 E (1988)]

ETSI

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Foreword

This ETSI Technical Report (ETR) has been produced by the Signalling Protocols and Switching (SPS) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

This work was initiated by the restructuring of CEPT (Conférence Européenne des administrations des Postes et des Télécommunications) and the creation of ETSI. As reported to the 16th Technical Assembly of ETSI, CEPT has proposed to transfer some Recommendations to ETSI which pertain to standardization.

Technical Committee SPS decided to convert these Recommendations into ETRs without any modification. The reader should note that undated references may no longer be relevant.

Endorsement notice

The text of CEPT Recommendation T/S 43-02 E (1988) was approved by ETSI as an ETR without any modification.

NOTE: The endorsed CEPT Recommendation is reproduced on the following pages of this ETR.

Recommendation T/S 43-02 (by correspondence, April 1987, revised in Edinburgh 1988)

SIGNALLING SYSTEM TELEPHONE USER PART "PLUS" (TUP+)

Recommendation proposed by Working Group T/WG 11 "Signalling, Protocols and Switching" (SPS)

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

"The European Conference of Postal and Telecommunications Administrations,

considering

— that CCITT Recommendations Q.721-Q.725 [1] to [5] Red Book define the Telephone User Part,

— that there are a number of options and points requiring further specification in Recommendations Q.721-Q.724 [1] to [4],

— that the interconnection of ISDNs in Europe is an important requirement for European Administrations (see GAP (Analysis and Forecasting Group) report of the EEC),

recommends

that European Administrations who wish to interconnect ISDNs apply the following Recommendations."

INTRODUCTION

This Recommendation called the Telephone User Part "Plus" (TUP+) is a revised version of CCITT Recommendations Q.721-Q.724 (Telephone User Part). In particular, throughout the text, references and figure numbers are maintained as in the CCITT Red Book.

Note. Q.725+ is not included.

The Recommendations are defined for use between international gateways. The interworking between this Recommendation, and National signalling systems is the responsibility of the Administrations concerned.

This Recommendation satisfies the requirements laid down in the GAP report Phase 1 only.

Note 1. References to Q.931 [6] in this Recommendation are intended in a general sense to identify the capability of the signalling system on the access side, and do not refer to any specific document.

Note 2. Recommendation T/S 43-02, revision 1 contains clarifications and corrections of the previous text which are considered very important to prevent divergent interpretations when implementing the TUP+ in international gateways, a situation which could lead to possible troubles for the first international ISDN interconnections in Europe.

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Contents

Recommendation Q.721+

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

1. GENERAL

Use of Signalling System No. 7 for 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 [7]. That Recommendation also defines the division of functions and the requirements of interaction between the Message Transfer Part and the Telephone User Part+ (TUP+).

2. TELEPHONE USER PART+

The Telephone User Part+ specified in these specifications defines the necessary signalling functions for use of Signalling System No. 7 for international call control signalling. It is specified with the aim of providing the same features for telephone signalling as other CCITT telephone signalling systems. The TUP+ provides a set of functions allowing the interconnection of national ISDNs supporting a specified range of services (1st Phase of GAP (Analysis and Forecasting Group)) including PSTNs.

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.

It is designed for the bothway operation of circuits.

When used with homogenous digital 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 circuit when used with analogue circuits.

The standard label structure specified for 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 described in Recommendation Q.708 [8].

3. MESSAGE TRANSFER PART

The Message Transfer Part of Signalling System No. 7 is specified in CCITT Recommendations Q.701 to Q.704 [9] to [12].

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Recommendation Q.722+

GENERAL FUNCTION OF MESSAGES AND SIGNALS

This Recommendation describes the general function of signalling messages and the 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. SIGNALLING MESSAGES

The definition of formats and codes for 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 paragraph 3.3. may be included. Messages so far specified are as follows.

1.1.1. *Initial address message with additional information*

A 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 with additional information 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 paragraph 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 paragraph 3.4. may be included. Message so far specified is 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 paragraph 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. Deleted

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 paragraph 3.4. may be included. Message so far specified are as follows.

1.5.1. *Unsuccessful-call-attempt message*
A message containing a signal, from paragraph 3.4., relating to an unsuccessful call set-up.

1.6. **Call supervision message group**

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

1.7. **Circuit supervision message group**

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

1.8. **Circuit group supervision message group**

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

1.9. Deleted

2. SERVICE INFORMATION

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

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.

3. SIGNALLING INFORMATION

3.1. **Label components**

In the case of the signalling messages the label is used for message routing and, in general, identification of the concerned 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 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 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 number or line identity is an international, or national significant 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. Deleted

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:
— unknown source,
— operator,
— ordinary calling subscriber,
— test call,
— pay phone.

3.3.7A. *Calling Access Signalling Capability Indicator*

Information sent in the forward direction indicating that the call originated from a Q.931 [6] Access or the source is unknown.

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 international 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-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.

3.3.13A. *Screening Indicator*

Information sent in the forward direction to indicate the provider and the verified status of the calling number. The following possibilities are provided:
— user provided, not screened
— user provided, verified and passed
— user provided, verified and failed
— network provided

3.3.14. Deleted

3.3.15. *Continuity signal*

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

3.3.17. Deleted

3.3.17A. *Redirected Call Indicator*

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

3.3.18. Deleted

3.3.19. Deleted

3.3.19A. *Information transfer capability requested indicator*

Information sent in the forward direction indicating the requested information transfer capability of the circuit to be selected.

3.3.20. Deleted

3.3.20A. *TUP+ Signalling path indicator*

Information sent in the forward direction indicating that the capabilities of TUP+ have been used from the originating exchange.

3.3.20B. *Signalling capabilities requested indicator*

Information sent in the forward direction indicating the requested signalling capability of the circuit to be selected.

3.3.21. Deleted

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. Deleted

3.3.23. Deleted

3.3.24. Deleted

3.3.25. Deleted

3.3.26. Deleted

3.3.27. Deleted

3.3.28. Deleted

3.3.29. Deleted

3.3.30. Deleted

3.4. **Backward set-up 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. Deleted

3.4.3. Deleted

3.4.4. Deleted

3.4.4.1. Deleted

3.4.5. Deleted

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 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 will be sent and that the call should not be charged on answer.

3.4.8. *Address-complete signal, pay phone*
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 will be sent, that the call should be charged on answer and that the called number is a pay phone 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. Deleted

3.4.12. Deleted

3.4.12A. *TUP+ signalling path indicator*
Information sent in the backward direction indicating that the capabilities of TUP+ exist to the destination exchange.

3.4.12B. *Called Access Signalling Capabilities Indicator*
Information sent in the backward direction indicating that the call is terminated on a Q.931 [6] Access, or unknown.

3.4.13. Deleted

3.4.14. Deleted

3.4.15. Deleted

3.4.16. *Outgoing echo suppressor request indicator*
Information sent in the backward direction requesting for the insertion of an outgoing suppressor. (For bilateral agreement within GRQ/GSM cycle.)

3.4.17. Deleted

3.4.18. Deleted

3.4.19. Deleted

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. Deleted

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

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 called 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 [16]).

3.4.27. *Access barred signal*

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

3.4.28. Deleted

3.4.28A. *Cause information element indicator*

Information sent in the backward direction indicating the presence of information relating to the failure of a call set up attempt in the remote D channel access signalling system.

3.4.28B. *User to User Information Indicator*

Information indicating the presence or absence of User to User information.

3.4.28C. *Network Resource Unavailable*

Information sent in the backward direction indicating that the Network Resource requested is permanently unavailable.

3.5. **Call supervision signals**

3.5.1. Deleted

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 [13]), and
— to start the measurement of call duration for international accounting purposes (Recommendation E.260 [14]).

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. Deleted

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 [15] apply.

Note. A call to an ISDN subscriber may be released immediately.

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. Deleted

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 the circuit for subsequent calls outgoing from that exchange. An exchange receiving the blocking signal must be capable of accepting incoming calls on the circuit unless it also has sent a blocking signal. Under conditions covered later, 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 the exchange the engaged conditions of the 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 circuit has been blocked.

3.6.6. *Unblocking-acknowledgement signal*

A signal sent in response to an unblocking signal indicating that the 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. Deleted

3.7.6. Deleted

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. Deleted

3.7.13. Deleted

3.7.14. *Circuit group reset-acknowledgement message*

A message 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. Deleted

Recommendation Q.723+

FORMAT AND CODES

0. EXPLANATORY NOTE

The letter "F" is used through this Recommendation to indicate the message/code that it appears against is "Faulty" and depending on the call state, either the call will be failed and the circuit is cleared or the message/code will be discarded and no action will be taken.

1. BASIC FORMAT CHARACTERISTICS

1.1. General

The messages are carried on the signalling data link by means of signal units, the format of which is described in Recommendation Q.703 [11], paragraph 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 paragraph 2.; the heading codes and detailed message formats are described in paragraph 3.

This modified specification is for international use only and not intended for national application.

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], paragraph 12.2.).

The information in the subservice field permits a distinction to be made between national and international signalling messages.

The format of the service information octet is shown in Figure 1/Q.723+.

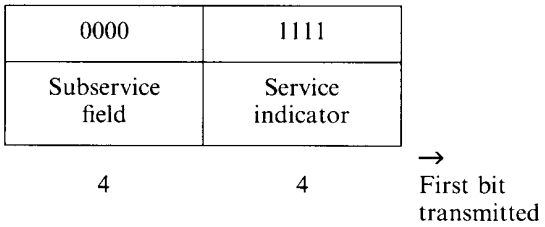


Figure 1/Q.723+. Service information octet.

The following codes are used in the fields of the service information octet:
(a) The service indicator is coded 1111.
(b) Subservice field is coded 0000.

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 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, the transaction is conveniently identified by including the corresponding circuit identity in the label.

One standard label format is specified (paragraph 2.2.) for international use.

2.2. Standard 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+.

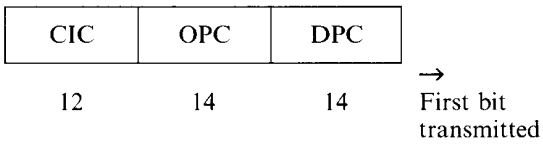


Figure 2/Q.723+. Standard label structure.

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 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 [12], paragraph 2.2.

2.2.2. *Destination and originating point codes*

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

The 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 in accordance with Recommendation Q.708 [8].

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

2.2.3. *Circuit identification code*

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

Allocation rules for certain applications are defined below:

(a) 2,048 kbit/s digital path
For circuits which are derived from a 2,048-kbit/s digital path (Recommendations G.732 [17] and G.734 [18]) 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 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) 8,448 kbit/s digital path
For circuits which are derived from a 8,448-kbit/s digital path (Recommendations G.744 [19] and G.746 [20]) the circuit identification code contains in the 7 least significant bits an identification of the time slot which is assigned to the 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 2,048-kbit/s pulse code modulation standard
For frequency division multiplex systems existing in networks that also use the 2,048-kbit/s pulse code modulation standard, the circuit identification code contains in the 6 least significant bits the identification of a circuit within a group of 60 circuits 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.

0000000	circuit 1
0000001	circuit 2
:	:
:	:
0011111	circuit 32
0100000	circuit 33
:	:
:	:
1111110	circuit 127
1111111	circuit 128

Table 1/Q.723+.

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

Table 2/Q.723+.

3. MESSAGE FORMATS AND CODES

3.1. General

All signal messages contain a heading consisting of two parts, heading code H0 and heading code H1. Code H0 identifies a specific message group (see Part II, Recommendation Q.722+ paragraph 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, F
0001 forward address messages
0010 forward set-up request 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 Reserved, F
1010 to 1111 Spare, F

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 with additional information
— Subsequent address message (with one or more address signals)
— Subsequent address message with one (address) signal

3.3.1. Deleted

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+.

B A	FEDCBA	0010	0001	
Calling access signalling capability	Calling party category	Heading code H1	Heading code H0	Label
2	6	4	4	40

→ First bit transmitted

HGFEDCBA			LKJIHGFEDCBA
First indicator octet	Address signals	Number of address signals	Message indicators
8	n × 8	4	12

Calling line ident.	Addit. routing inform.	Addit. calling party inform.	Closed user group inform.
n × 8	n × 8	n × 8	40

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 paragraph 2.

(b) Heading code H0 is coded 0001

(c) Heading code H1 is coded 0010

(d) Calling party category

bits F E D C B A	
0 0 0 0 0 0	unknown source
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	available to Administrations for selecting
0 0 0 1 1 1	a particular language provided by mutual
0 0 1 0 0 0	agreement
0 0 1 0 0 1	reserved, F
0 0 1 0 1 0	ordinary calling subscriber
0 0 1 0 1 1	reserved, F
0 0 1 1 0 0	reserved, F
0 0 1 1 0 1	test call
0 0 1 1 1 0	spare, F
0 0 1 1 1 1	pay phone
0 1 0 0 0 0 to 1 1 1 1 1 1	spare, F

(e) Calling Access Signalling Capability

bit A: access signalling capabilities indicator
- 0 unknown
- 1 calling access Q.931

bit B: spare & set to 0, other coding F

(f) Message indicators:

bits B A: nature of address indicator
- 0 0 reserved, F
- 0 1 spare, F
- 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, F
- 1 1 spare, F

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, F

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

bit H: reserved, set to 0

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

bit J: reserved, set to 0

bit K: reserved, set to 0

bit L: TUP+ signalling path indicator
- 0 any path
- 1 capabilities of TUP+ used from the originating exchange

(g) Number of address signals

A code expressing in pure binary representation the number of address signals contained in the initial address message, with additional information except for the code 0000 to which the meaning 16 digits including ST is assigned.

(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.

— 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.

(i) First indicator octet

bit A: reserved, set to 0

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
Always set to 1

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

bit F: reserved, set to 0

bit G: reserved, set to 0

bit H: reserved, set to 0

(j) Closed user group information

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

		HGFE	DCBA
Interlock code		Reserved	CUG indicator
Part B	Part A		
32		4	4

Figure 4a/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 reserved, F
- 1 0 outgoing access allowed
- 1 1 outgoing access not allowed

bits C D: spare set to 0, other codings faulty

bits HGFE: Reserved set to 0000, all other codings faulty

— Interlock code

A code identifying the closed user group involved in the call

Part A: 16 bits coded as 4 digits
(Digit 9 followed by Telephone Country Code and filler if appropriate)

Part B: 16 bits coded pure binary
(Interlock Code Value)

(k) Additional calling party information:

The basic format of the additional calling party information field is shown in Figure 4b/Q.723+.

User to user information	High Layer Compatibility	Called party subaddress	Calling party subaddress	Bearer capability	Field length indicator
n × 8	n × 8	n × 8	n × 8	n × 8	8
4≤n≤35	2≤n≤4	4≤n≤7	4≤n≤7	4≤n≤13	

Figure 4b/Q.723+. Additional calling party information.

Field Length indicator

The length indicator is used to indicate the number of octets in the additional calling party information following the length indicator, and is a number in binary code.

Bearer Capability, calling and called party subaddress, High Layer Compatibility and user to user information fields will be carried transparently as received from the access signalling system without re-coding.

If the additional calling party information field is present, it always includes the length indicator and the bearer capability fields. When there is no calling party subaddress, called party subaddress, higher layer compatibility, or user to user information to be transferred, the respective fields are not present.

(l) Additional routing information

The basic format of the additional routing information field is shown in Figure 4c/Q.723+.

	GF	EDCBA
Spare	Signalling Capabilities Requested	Information transfer capability requested
1	2	5

Figure 4c/Q.723+. Additional routing information field.

— Information transfer capability requested
Valid codes are:

bits	E	D	C	B	A:	ITC required
	0	0	0	0	0	speech
	0	1	0	0	0	unrestricted digital information (at 64 kbit/s)
	1	0	0	0	0	3.1kHz audio

All other values are reserved, F

— Signalling Capability requested

bits	G	F:	Signalling Capability requested
	0	0	any signalling system
	0	1	spare, F
	1	0	TUP+ preferred
	1	1	TUP+ mandatory

(m) Calling line identity
The basic format of the calling line identity field is shown in Figure 4d/Q.723+.

	DCBA	DCBA	HGFEDC	BA
Calling number	Number of address signals	Address indicators	Filler	Screening indicator
n × 8	4	4	6	2

Figure 4d/Q.723+. Calling line identity field.

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

— Screening Indicator

bits	B	A:	
	0	0	user provided, not screened
	0	1	user provided, verified and passed
	1	0	user provided, verified and failed
	1	1	network provided

— Filler HGFEDC – spare

— Address indicators:

bits	B	A:	nature of address indicator
	0	0	} reserved, F
	0	1	
	1	0	
	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: incomplete 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	} a code expressing in pure binary representation the number of address signals
			to		
	1	1	1	1	

— Calling number
Each address signal is coded as indicated in paragraph 3.3.2. (h) as applicable.

3.3.3. *Subsequent address message*

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

		0000	0011	0001	
Address signals	No. of address signals	Filler	Heading code H1	Heading code H0	Label
n × 8	4	4	4	4	40

→ First bit transmitted

Figure 5/Q.723+. Subsequent address message.

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

(a) Label: see paragraph 2.
(b) Heading code H0 is coded 0001
(c) Heading code H1 is coded 0011
(d) Address signal is coded as indicated in paragraph 3.3.2. (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+.

0000		0100	0001	
Filler	Address signal	Heading code H1	Heading code H0	Label
4	4	4	4	40

→ First bit transmitted

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 paragraph 2.
(b) Heading code H0 is coded 0001
(c) Heading code H1 is coded 0100
(d) Address signal is coded as indicated in paragraph 3.3.2. (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+.

	HGFEDCBA	0001	0010	
Calling line identity	Response type indicators	Heading code H1	Heading code H0	Label
n × 8	8	4	4	40

→ First bit transmitted

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 paragraph 2.

(b) Heading code H0 is coded 0010

(c) Heading code H1 is coded 0001

(d) Response type indicator

bit A: reserved and set to 0

bit B: calling line identity indicator
0 calling line identity not included
1 calling line identity included
} If requested and allowed then set to 1. An international transit exchange would convey this indicator as received.

bit C: reserved and set to 0

bit D: reserved and set to 0

bit E: to be used on bilateral agreement to indicate the inclusion of an outgoing half echo suppressor

bit F: reserved and set to 0

bit G: reserved and set to 0

bit H: reserved and set to 0

(e) 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 paragraph 3.3.2. (m)).

3.4.2. *Continuity-check message*

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

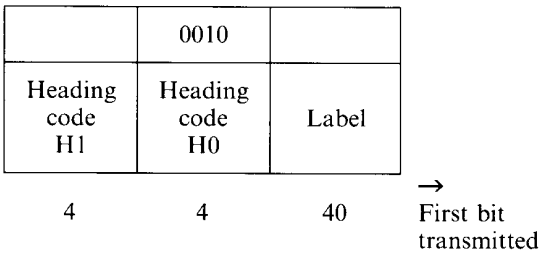


Figure 9/Q.723+. Continuity-check message.

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

(a) Label: see paragraph 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+.

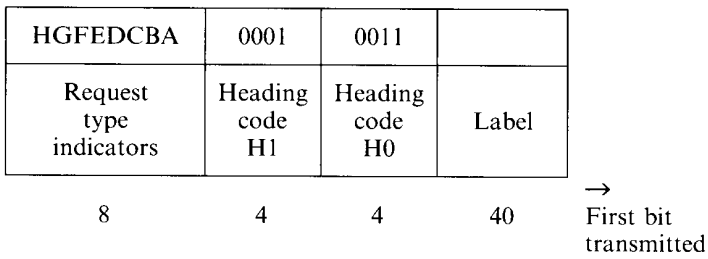


Figure 10/Q.723+. General request message.

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

(a) Label: see paragraph 2.

(b) Heading code H0 is coded 0011

(c) Heading code H1 is coded 0001

(d) Request type indicators

bit A: reserved and set to 0

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

bit C: reserved and set to 0

bit D: reserved and set to 0

bit E: reserved and set to 0

bit F: to be used on bilateral agreement to request an outgoing half echo suppressor

bit G: reserved and set to 0

bit H: spare, F

3.6. Successful backward set-up information message

The following successful backward set-up information message is specified and is identified by a heading code H1:
— address-complete message

3.6.1. *Address-complete message*

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

		HGFEDCBA	0001	0100	
User to user information	Field length indicator	Message indicators	Heading code H1	Heading code H0	Label
n × 8 4≤n≤35	8	8	4	4	40

→ First bit transmitted

Figure 11/Q.723+. Address Complete Message.

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

(a) Label: see paragraph 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 reserved
- 0 1 address-complete signal, charge
- 1 0 address-complete signal, no charge
- 1 1 address-complete signal, pay phone

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: reserved and set to 0

bit F: reserved and set to 0

bit G: TUP+ signalling path indicator
0 any path
1 capabilities of TUP+ exist to the called subscriber
bit H: Called Access Signalling Capabilities indicator
0 unknown
1 Q.931 called access

(e) Field length indicator

The field length indicator is used to indicate the number of octets of user to user information following the length indicator and is a number in binary code. When there is no user to user information to transfer, the field length indicator is coded all zero.

(f) User to User Information

This field will be carried transparently as received from the access signalling system, without re-coding. When there is no user to user information to be transferred, this field is not present.

3.6.2. Deleted

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+.

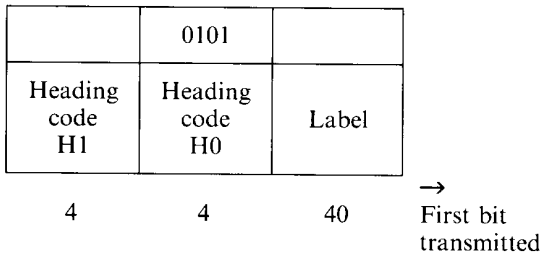


Figure 13/Q.723+. Simple unsuccessful backward set-up information message.

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

(a) Label: see paragraph 2.

(b) Heading code H0 is coded 0101

(c) Heading code H1 contains signal codes as follows:

0000 spare, F
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
0111 unallocated-number signal
1000 line-out-of-service signal
1001 send-special-information-tone signal
1010 access barred signal
1011 reserved, F
1100 reserved, F
1101 network resource unavailable signal
1110 spare, F

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+.

			HGFEDCBA	1111	0101	
User to user info.	Field length indicator	Cause informa. element	Octet indicator	Heading code H1	Heading code H0	Label
n × 8 4≤n≤35	8	8	8	4	4	40

→ First bit transmitted

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 paragraph 2.

(b) Heading code H0 is coded 0101

(c) Heading code H1 contains signal code 1111

(d) Octet indicator is coded as follows:

bits DCBA: spare, always set to 0, otherwise faulty
bit E: reserved (always set to 0, otherwise faulty)
bit F: cause information element indicator (always set to 1)
0 cause information element not included
1 cause information element included
bit G: spare, always set to 0, otherwise faulty
bit H: user to user information indicator
0 user to user information not included
1 user to user information included

(e) Cause information element

The cause information element is as specified by the access protocol. For example:

Value	Meaning
17	User Busy
18	No user responding
21	Call rejected
34	No channel available
63	Service or option not available
88	Incompatible destination
111	Protocol error, unspecified

(f) Field length Indicator

The field length indicator is used to indicate the number of octets of user to user information following the length indicator, and is a number in binary code. When there is not user to user information to transfer, the field is not present.

(g) User to user Information

This field will be carried transparently as received from the access signalling system without re-coding. When there is not user to user information to be transferred, this field is not present.

3.8. **Call supervision message**

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

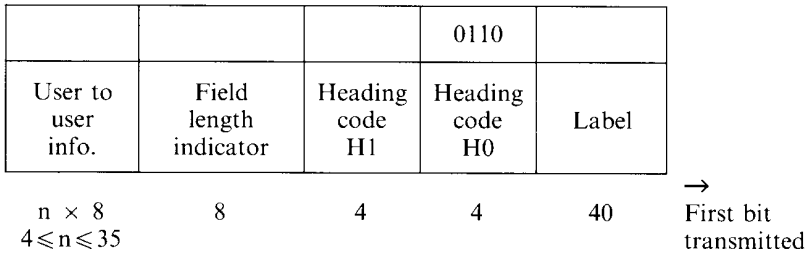


Figure 14/Q.723+. Call supervision message.

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

(a) Label: see paragraph 2.

(b) Heading code H0 is coded 0110

(c) Heading code H1 contains signal codes as follows:

0000 reserved, F
0001 answer signal, charge
0010 answer signal, no charge
0011 clear-back signal
0100 clear-forward signal
0101 re-answer signal (see *Note*)
0110 reserved, F
0111 reserved, F
1000 to 1110 spare, F
1111 reserved, F

Note. This signal does not include user to user information or field length indicator.

(d) Field Length Indicator

The field length indicator is used to indicate the number of octets of user to user information following the length indicator and is a number in binary code. When there is no user to user information to transfer, the field is coded all zero.

(e) User to User Information

This field will be carried transparently as received from the access signalling system without re-coding. When there is no user to user information to be transferred, this field is not present.

3.9. **Circuit supervision message**

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

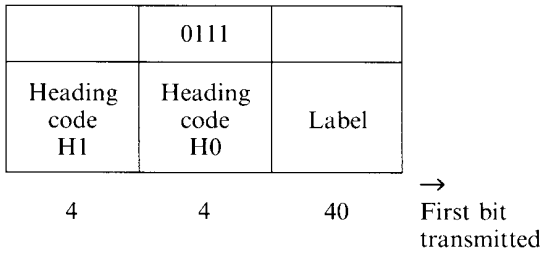


Figure 15/Q.723+. Circuit supervision message.

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

(a) Label: see paragraph 2.

(b) Heading code H0 is coded 0111

(c) Heading code H1 contains signal codes as follows:

0000 spare, F
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, F

3.10. **Circuit group supervision message**

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

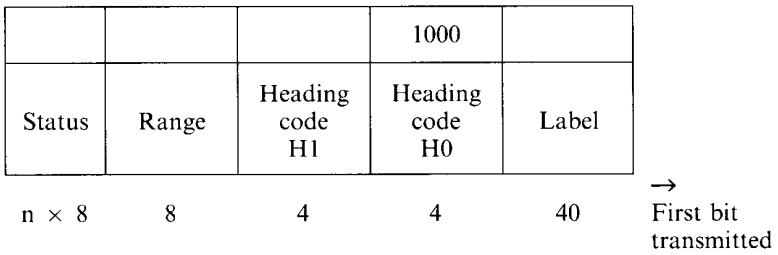


Figure 16/Q.723+. Circuit group supervision message.

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

(a) Label: see paragraph 2.
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.

(b) Heading code H0 is coded 1000

(c) Heading code H1 contains message codes as follows:

0000 spare, F
0001 Maintenance oriented group blocking message
0010 Maintenance oriented group blocking-acknowledgement 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-acknowledgement message
0111 Hardware failure oriented group unblocking message
1000 Hardware failure oriented group unblocking-acknowledgement message
1001 Circuit group reset message
1010 Circuit group reset-acknowledgement message
1011 1100 1101 1110 reserved, F
1111 spare, F

(d) Range

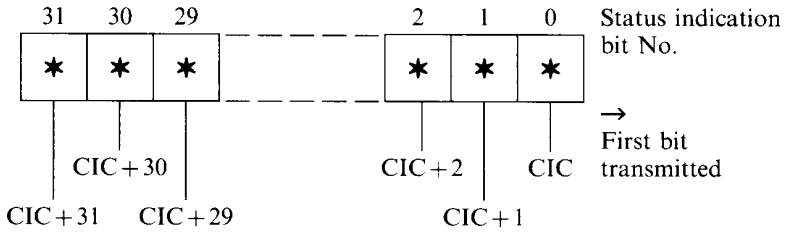
A non zero value in this field indicates that the message is related to a whole circuit group or a part thereof, and includes a status field unless the message is the circuit group reset message. The number of consecutive circuits to be handled is indicated by the value contained in the range field increased 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 32 (range value 31).

Note. If a zero value for the range field is received then the message should be ignored and no action should be taken.

(e) Status field

All circuit group supervision messages except the circuit group reset message include a status field containing status indicator bits. 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 32 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.



✱ Value 1 or 0

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)
  1 blocking
  0 no blocking

— in all group blocking-acknowledgement messages (MBA, HBA)
  1 blocking acknowledgement
  0 no blocking acknowledgement

— in all group unblocking messages (MGU, HGU)
  1 unblocking
  0 no unblocking

— in all group unblocking-acknowledgement messages (MUA, HUA)
  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. Deleted

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		*	IAI	SAM	SAO											
FSM	0010		GSM		COT	CCF											
BSM	0011		GRQ														
SBM	0100		ACM	*													
UBM	0101		SEC	CGC	NNC	ADI	CFL	SSB	UNN	LOS	SST	ACB	*	*	NRU		EUM
CSM	0110	*	ANC	ANN	CBK	CLF	RAN	*	*								*
CCM	0111		RLG	BLO	BLA	UBL	UBA	CCR	RSC								
GRM	1000		MGB	MBA	MGU	MUA	HGB	HBA	HGU	HUA	GRS	GRA	*	*	*	*	
*	1001		*	*	*	*	*	*	*								
	1010 1011	Spare, reserved for international and basic national use															
	1100 1101 1110 1111	Spare, reserved for national use															

* Reserved

Table 3/Q.723+. Heading code allocation.

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
BLA Blocking-acknowledgement signal
BLO Blocking signal
BSM Backward set-up message
CBK Clear-back signal
CCF Continuity-failure signal
CCM Circuit supervision message
CCR Continuity-check-request signal
CFL Call-failure signal
CGC Circuit-group-congestion signal
CLF Clear-forward signal
COT Continuity signal
CSM Call Supervision message
EUM Extended unsuccessful backward set-up information message
FAM Forward address message
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
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
MUA Maintenance oriented group unblocking-acknowledgement message
NNC National-network-congestion signal
NRU Network resource unavailable signal
RAN Reanswer signal
RLG Release-guard signal
RSC Reset-circuit signal
SAM Subsequent address message
SAO Subsequent address message with one signal
SBM Successful backward set-up information message
SEC Switching-equipment-congestion signal
SSB Subscriber-busy signal
SST Send-special-information tone signal
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, pay phone
AFC Address-complete, charge subscriber free
AFN Address-complete, no charge, subscriber free
AFX Address-complete, pay phone, subscriber free

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Recommendation Q.724+

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 Part II (Recommendation Q.722+) and the format and content are given in Part III (Recommendation Q.723+).

1.1. Initial address message with additional information

An initial address message with additional information is sent as the first message for a call between two TUP+ exchanges. The initial address message with additional information 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 with additional information.

An initial address message with the additional information contains mandatory additional routing information field (see 1.16A.). The additional calling party information (optional) would contain, if available, information relating to the access signalling system (Recommendation Q.931 [6]).

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 [21].

All digits required for routing the call through the international network will be sent in the initial address message with additional information. On calls with a country code in the number (except in the case of calls to special operators), the initial address message with additional information will contain a minimum of 4 digits and should contain as many digits as are available. All digits of the number may be included.

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

The through-connection of a circuit is initiated as soon as the outgoing circuit has been seized and, if applicable, the continuity, check has been completed successfully on the previous circuit.

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 number may be sent individually in one-digit messages or in groups in multidigit messages, as soon as they are available.

However, 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 [22], 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 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 circuits

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. However, per-call continuity-check may be needed on fully digital circuits when circuits or bundles of circuits in primary multiplex groups are dropped and inserted en route between switches, and alarm indications carried on bits of the primary multiplex frame structure are lost in passing through an intermediate transmission facility that does not relay them transparently. Typically, per-call continuity-checks may be needed when the transmission link between switches contains a TDMA satellite system, a digital circuit multiplication system or a digital access and cross-connection system, where fault indications are lost.

When an Initial Address Message with additional information is received with a request for a continuity-check relating to a digital circuit having inherent fault indication, one of the following actions is taken:
either (a) the continuity-check request is disregarded;
or (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.

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.

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 or when no inherent fault indication is available, a continuity-check loop should always be connected in the following case:
i) when the exchange has the capability to process Initial Address Message with additional information with check requests and such messages are received;
ii) when Continuity-check Request messages are received.

For analogue circuits with pilot supervision it is sufficient to perform the continuity-check on a statistical basis or by test calls (see paragraph 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 composed of circuits and 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 of the 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 paragraph 7.

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

1.5. Cross-office check

For digital exchanges the requirements mentioned in Recommendation Q.504 [23] shall be met.

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 (and a possible General request message/general forward set-up information message cycle has been completed):

(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.

The time-out condition for the address complete is described in paragraph 6.4.1.

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 signals; or
(e) extended unsuccessful backward set-up information message.

Note. Cases (c) and (d) can only occur after an address-complete signal without subscriber free has been sent. However, in the case of incoming international traffic, the national network will send only a national network congestion signal. On the other hand (b) and (e) can occur up to the receipt of answer signal.

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

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 Part II (Recommendation Q.722+), paragraph 3.4.) is sent without waiting for the completion of a possible continuity-check sequence.

The circuit group congestion signal is also applicable in the case where the requested network resource is congested (see 1.16A.). In the case of permanent unavailability of the requested network resource the network resource unavailable signal is sent (see 1.9A.).

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.

1.8A. **Extended unsuccessful backward set-up information message**

The extended unsuccessful backward set-up information message is returned only in the case of a call offered to a Q.931 [6] user and a clearing message is received in response, e.g. user busy, call rejected, etc. The call failure reason is returned as the cause value.

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

The called-party's-line-condition signals (see Part II (Recommendation Q.722+), paragraph 3.4.) will be sent when the appropriate 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.

1.9A. **Network resource unavailable signal**

In the case of permanent unavailability of the requested network resource (see also 1.16A.) the network resource unavailable signal is sent.

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 circuit 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 [24].

In the case that the called party is an ISDN subscriber the reanswer, clear-back sequence may not apply and the first clear-back signal could initiate the call release in the originating network.

1.12. **Reanswer and clear-back signal sequences**

Subsequent off-hook, on-hook signals from a non ISDN 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.

In the case that the called party is an ISDN subscriber the reanswer, clear-back sequence may not apply and the first clear-back signal could initiate the call release in the originating network.

1.13. Deleted

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 paragraph 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 paragraphs 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 in paragraph 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. The group is limited to 32 circuits.

On receipt of circuit group reset message 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 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 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:
   When this is received, the message is ignored and no action should be taken.

In addition the unaffected exchange should perform the following actions:

(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 blocking 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. 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* [25].)

1.16A. **Analysis of "Network Resource requested" information for routing**

The additional routing information field of the initial address message with additional information contains Network Resource required information. The routing functions of an international exchange have to examine both components—Information Transfer Capability required and Signalling System Capability required—of the information which is received in the initial address message with additional information.

1.16A.1. *Information Transfer Capability requested*

The Information Transfer Capability is the capability of a circuit to transfer the information. The network must provide a circuit which satisfies the Information Transfer Capability requirement and if this is not possible, the call must be rejected. In the case of temporary unavailability circuit group congestion signal is returned and in the case of permanent unavailability network resource unavailable signal is returned.

1.16A.2. *Signalling Capability requested*

The required signalling capability is identified in this information field. It could be set to indicate:

i) TUP+ Mandatory; or
ii) TUP+ Preferred; or
iii) any signalling system.

When set to:

i) The TUP+ signalling capability is requested and interworking with signalling system having lower capability is not allowed. The network must provide a circuit controlled by a signalling system with capabilities of TUP+. If this is not possible the call is failed and the circuit congestion signal is returned in the case of temporary unavailability and network resource unavailable signal is returned on permanent unavailability.

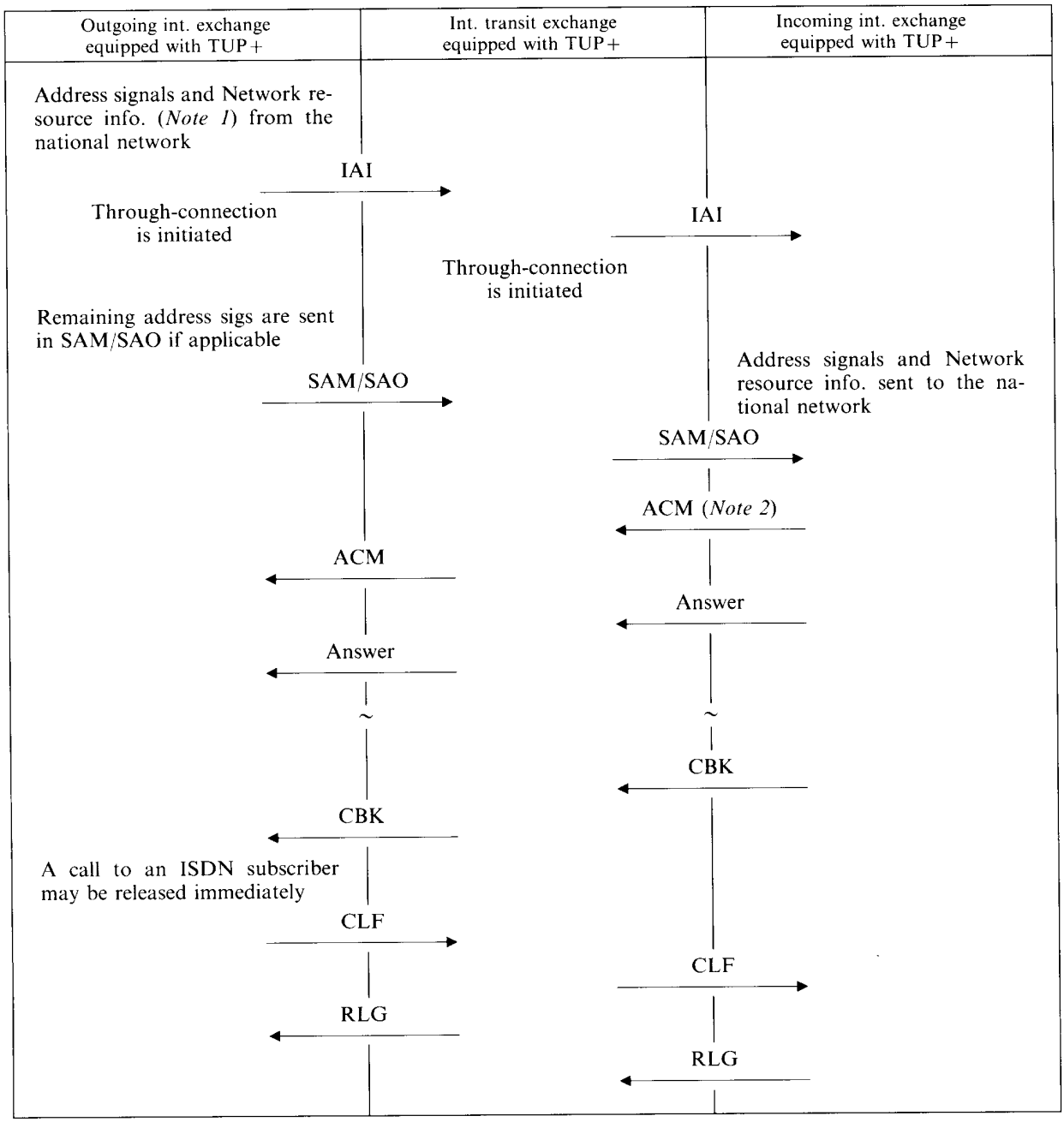
ii) Indicates that the "signalling capability requested" is TUP+; when no route with TUP+ capabilities exists on a permanent basis, i.e. interworking with PSTN/IDN, a signalling system with lower signalling capabilities (e.g. R2) should be used and the call continued (in this condition and if the "ITC requested" information contained in the initial address message with additional information is "64kbit/s unrestricted" signalling system with lower signalling capabilities can be used under the condition that the 64kbit/s connectivity can be ensured up to the called user network interface, otherwise the call is rejected and the network resource unavailable signal is returned).
When a route with TUP+ capabilities exists but all circuits are congested or failure has occurred, the call should be rejected unless the requested information transfer capability is speech. In this case the call may be routed to resources supported by a signalling system with lower signalling capabilities.

iii) — If the "ITC requested" information contained in the initial address message with additional information is "speech" or "3.1 kHz audio", the call is set up regardless of the signalling capability available on the outgoing circuit.
— If the "ITC requested" information contained in the initial address message with additional information is "64kbit/s unrestricted", the call is set up regardless of the signalling capability available on the outgoing circuit under the condition that the 64kbit/s connectivity can be ensured up to the called user network interface, otherwise the call is rejected and the network resource unavailable signal is returned.

1.17. Diagrams showing signal sequence

In the following some examples of call set-up sequences as specified for the TUP+ interface are shown diagrammatically.

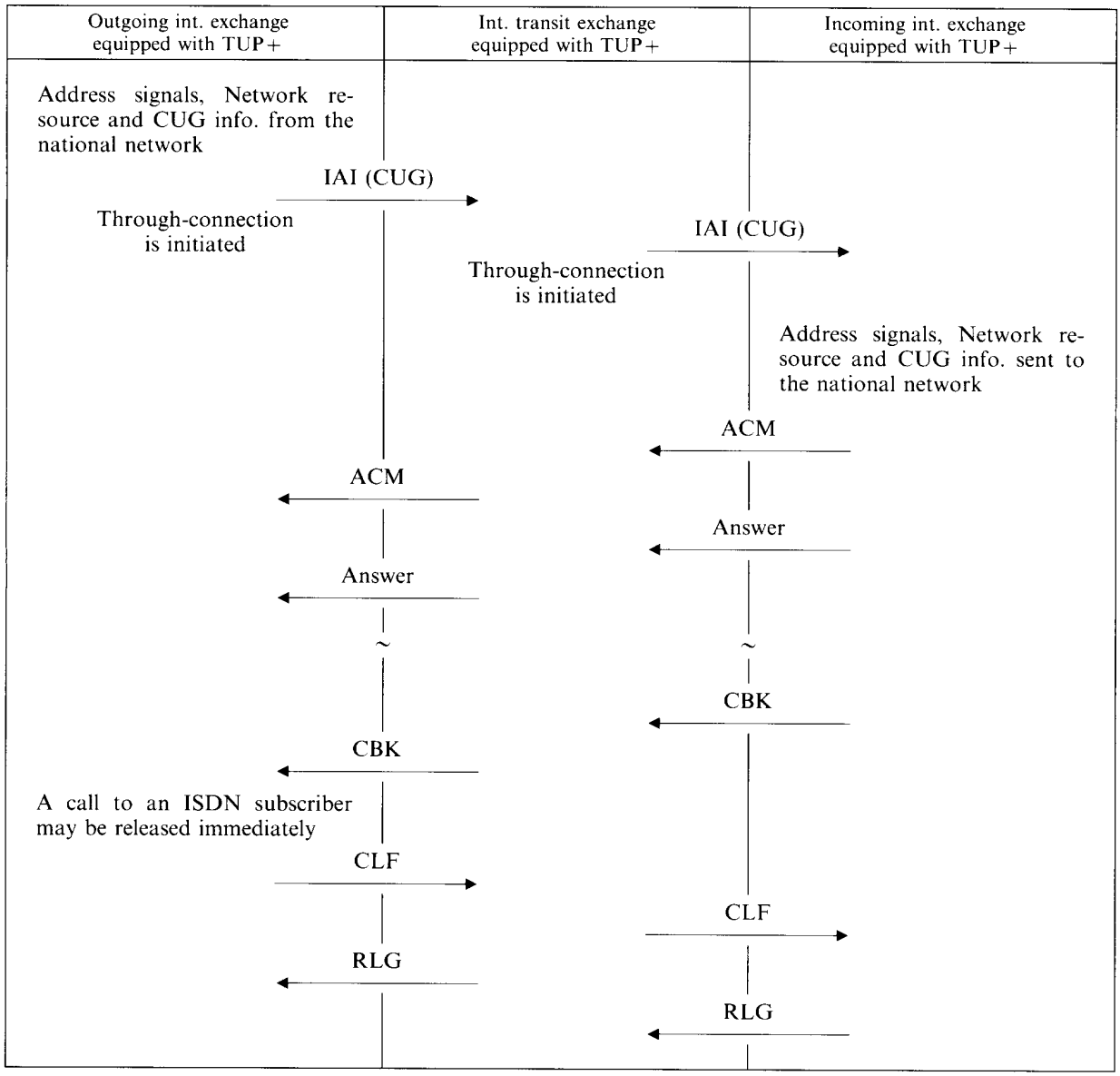
In the case of ambiguity, the text should be regarded as definitive.



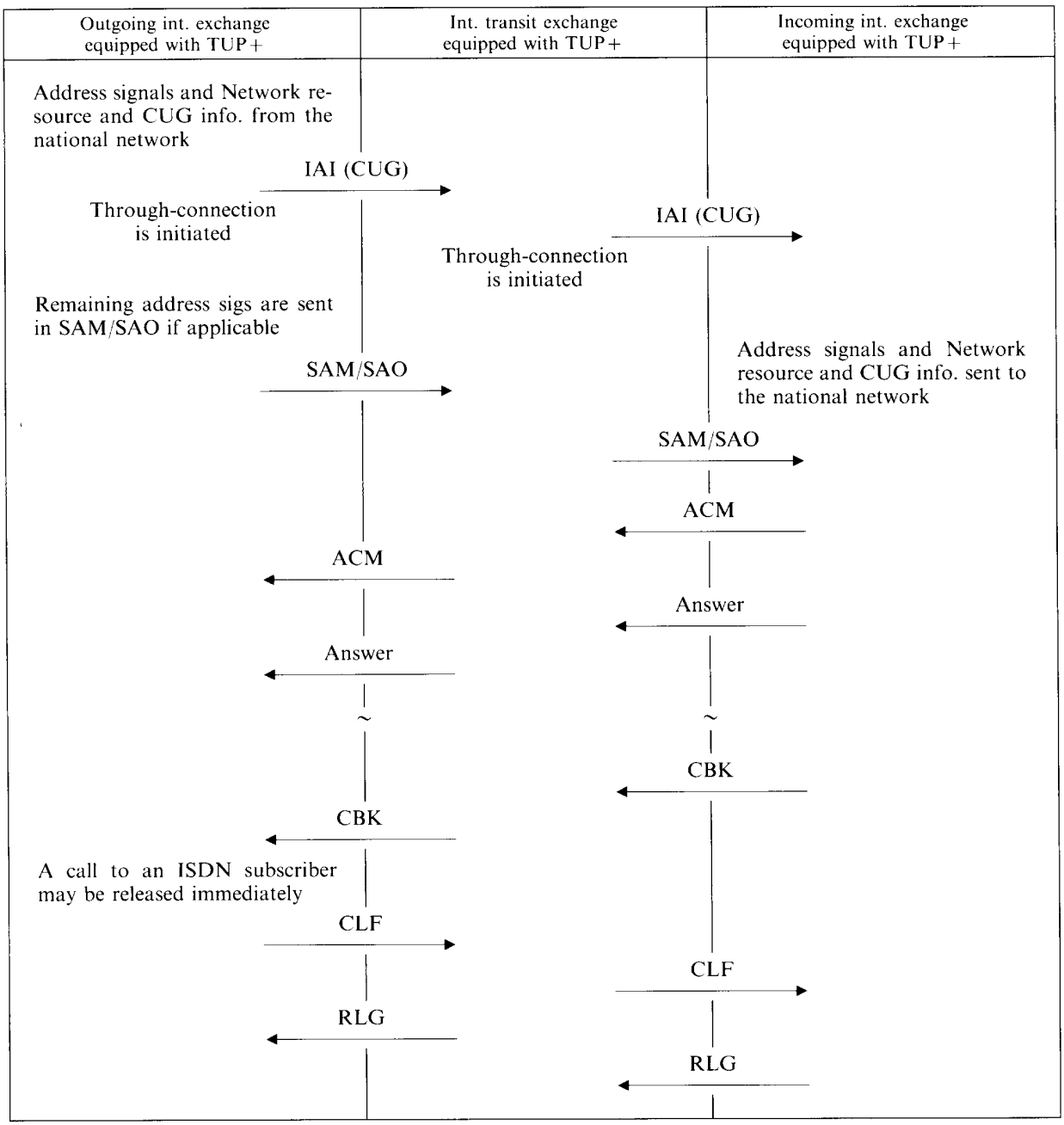
SUCCESSFUL BASIC CALL TO A TUP+ EXCHANGE

Note 1. Network resource info. contains both Information transfer capability and signalling system capabilities required.

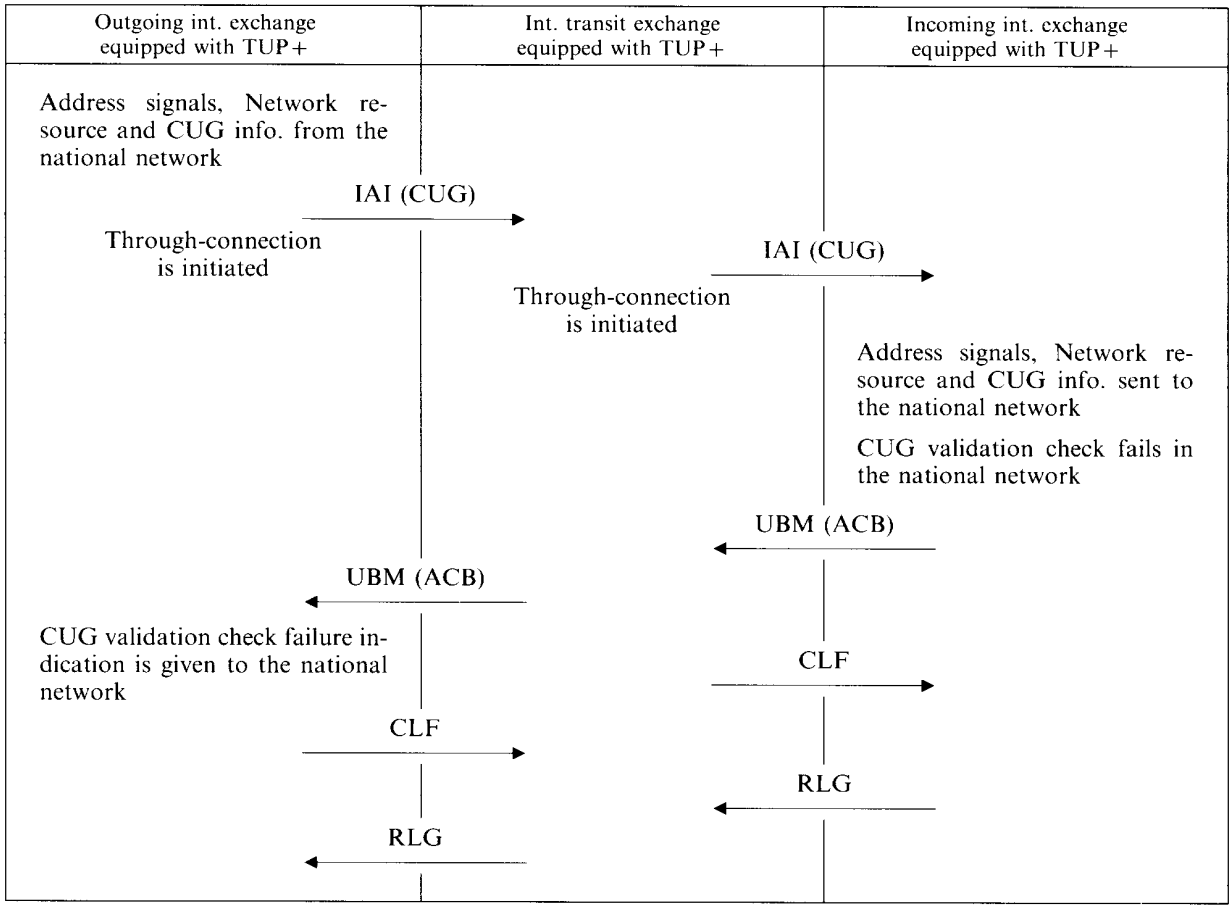
Note 2. If the terminating subscriber is an ISDN (Q.931 [6]), user then the ACM will have the called Access Signalling capabilities indicator (bit H) set.



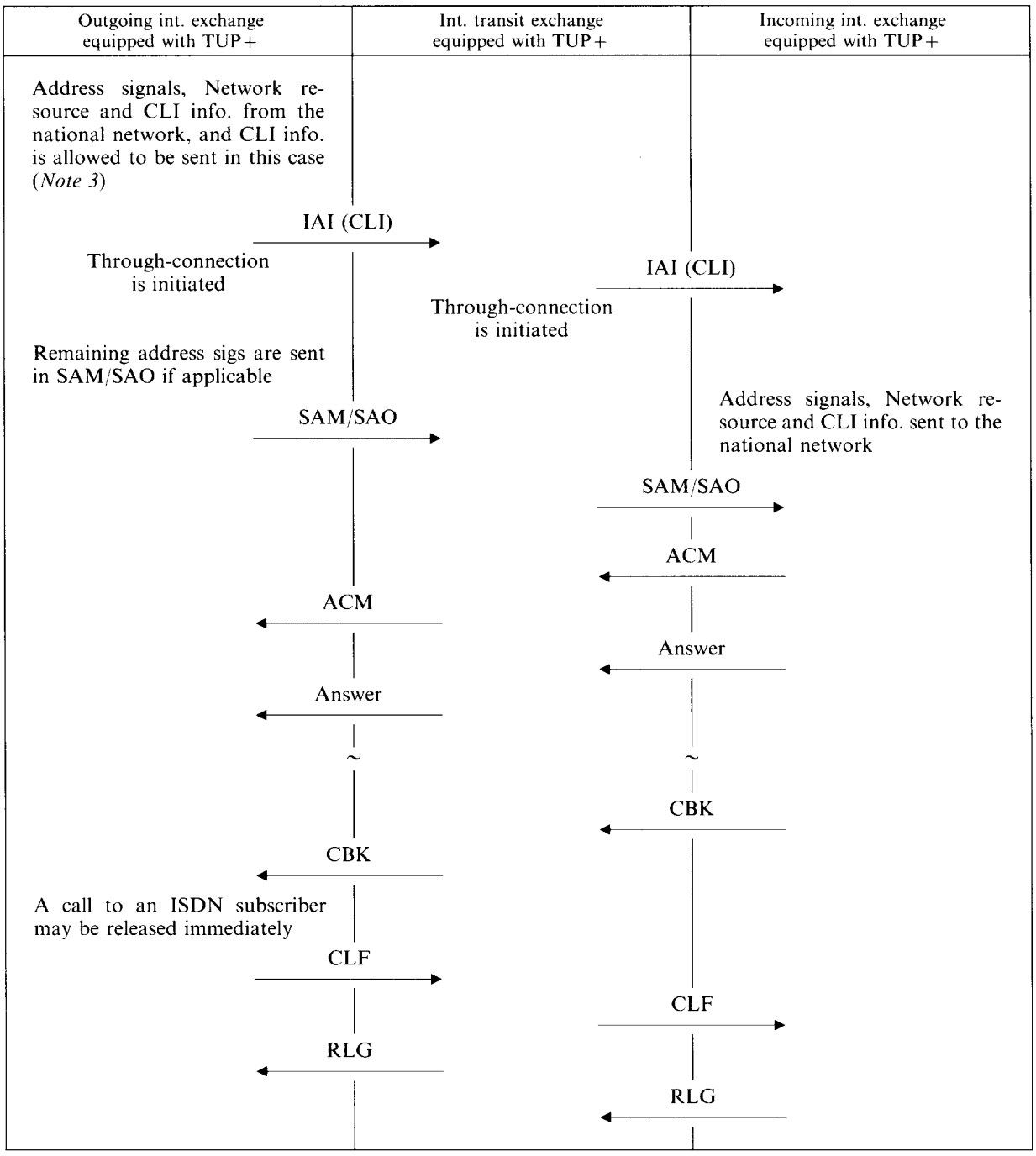
SUCCESSFUL CUG CALL TO A TUP+ EXCHANGE
(en bloc signalling)



SUCCESSFUL CUG CALL TO A TUP+ EXCHANGE
(overlap signalling)

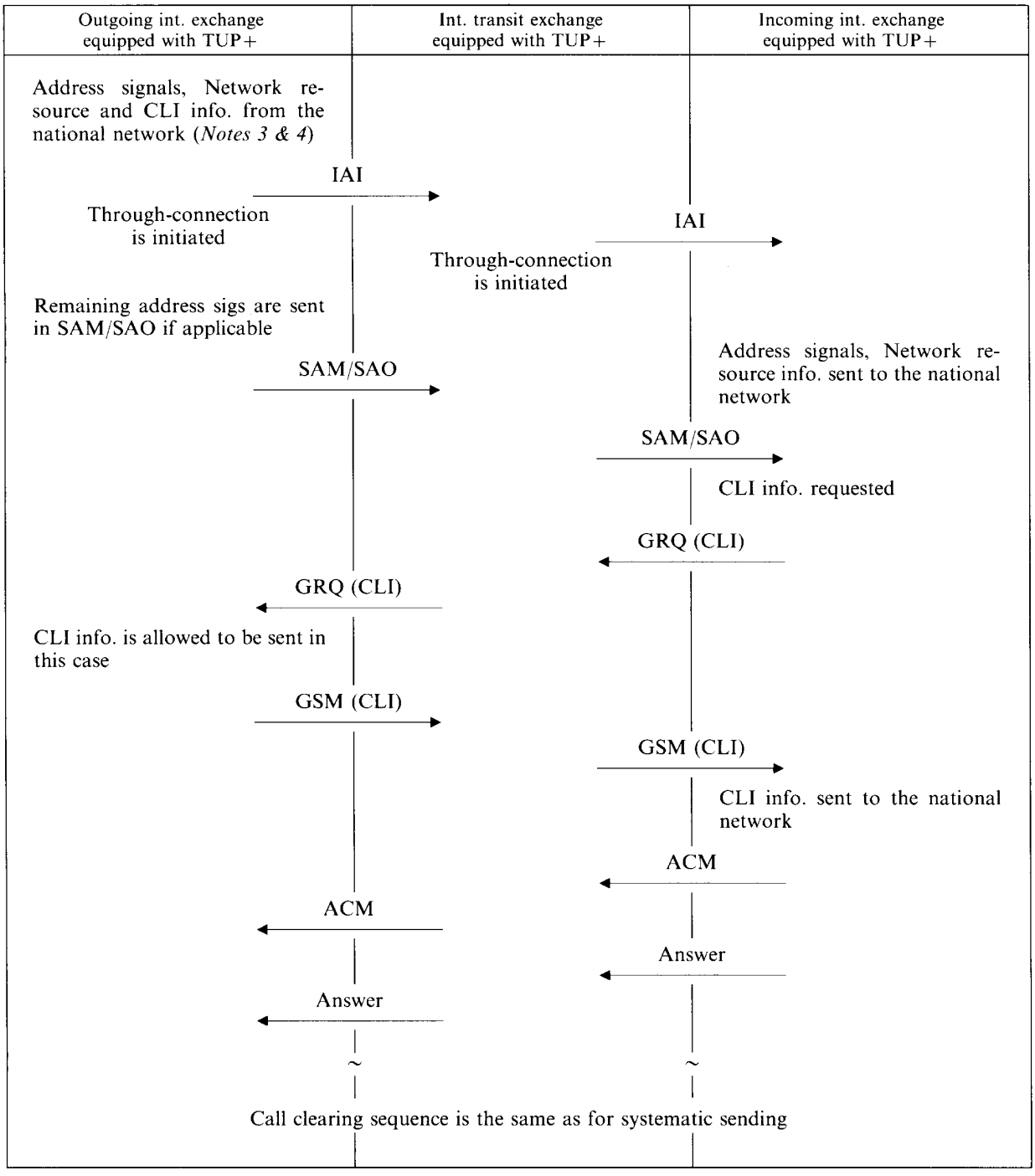


UNSUCCESSFUL CUG CALL TO A TUP+ EXCHANGE
(only en bloc sending shown in this diagram)



SUCCESSFUL CLI CALL TO A TUP+ EXCHANGE (systematic sending)

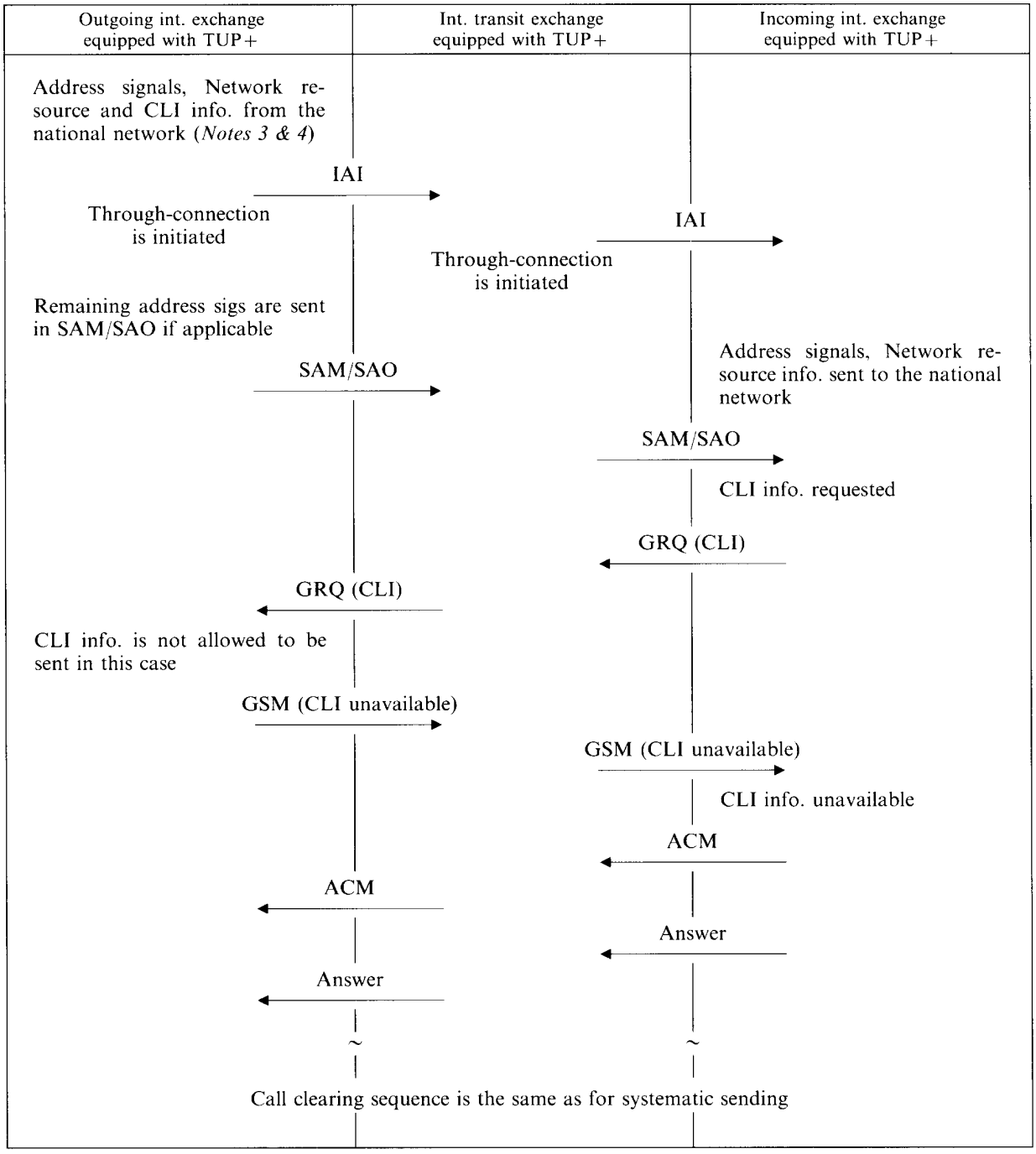
Note 3. An outgoing exchange can use either systematic or req/res technique for sending CLI even though the systematic technique is the preferred technique (see section 10.2.2. for the use of the optional CLI field).



SUCCESSFUL CLI CALL TO A TUP+ EXCHANGE (req/res sending)

Note 3. An outgoing exchange can use either systematic or req/res technique for sending CLI even though the systematic technique is the preferred technique (see section 10.2.2. for the use of the optional CLI field).

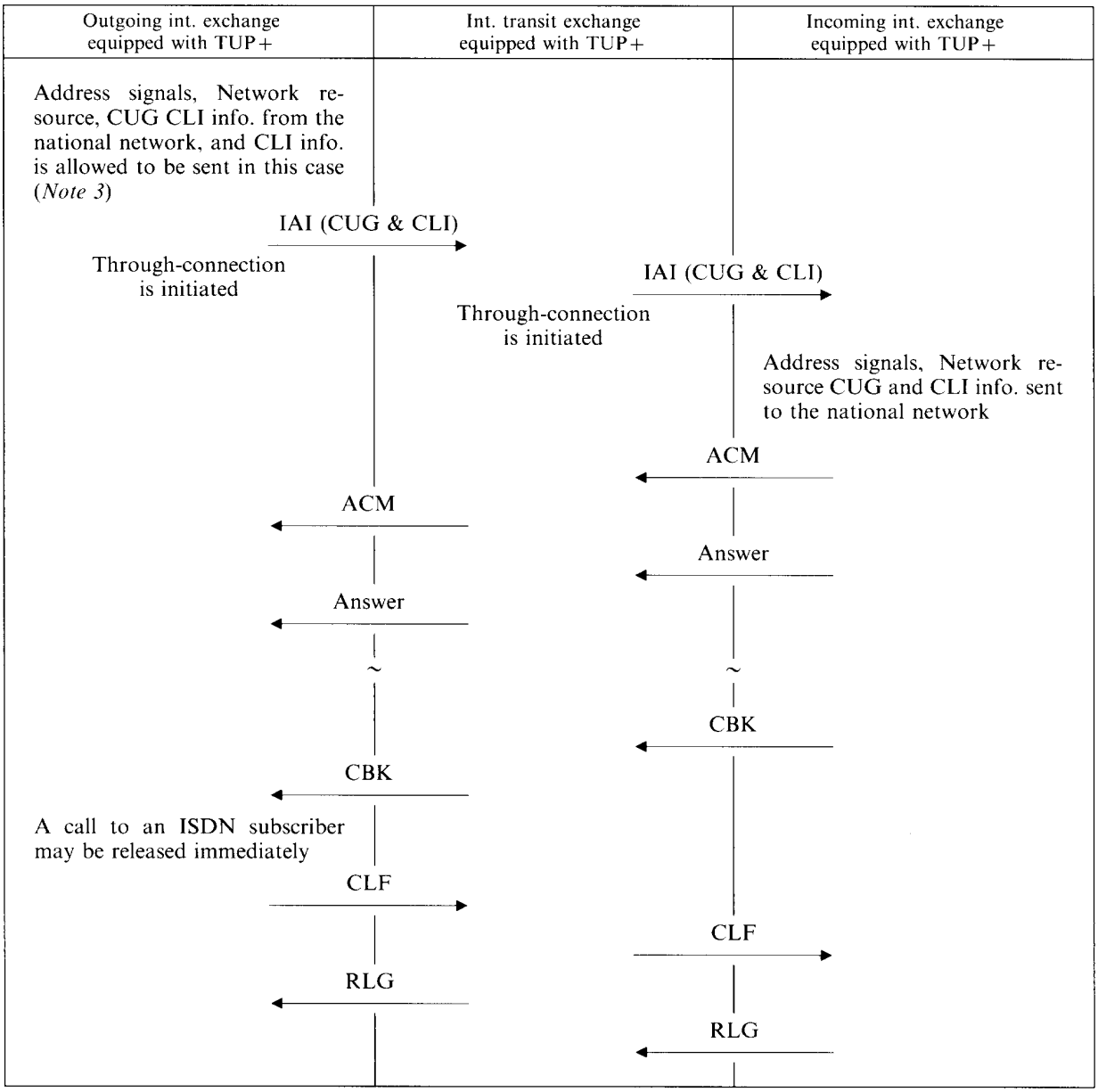
Note 4. When req/res technique is used then the CLI need not be available at the outgoing int. exchange before the IAI is sent.



SUCCESSFUL CALL TO A TUP+ EXCHANGE (CLI request denied)

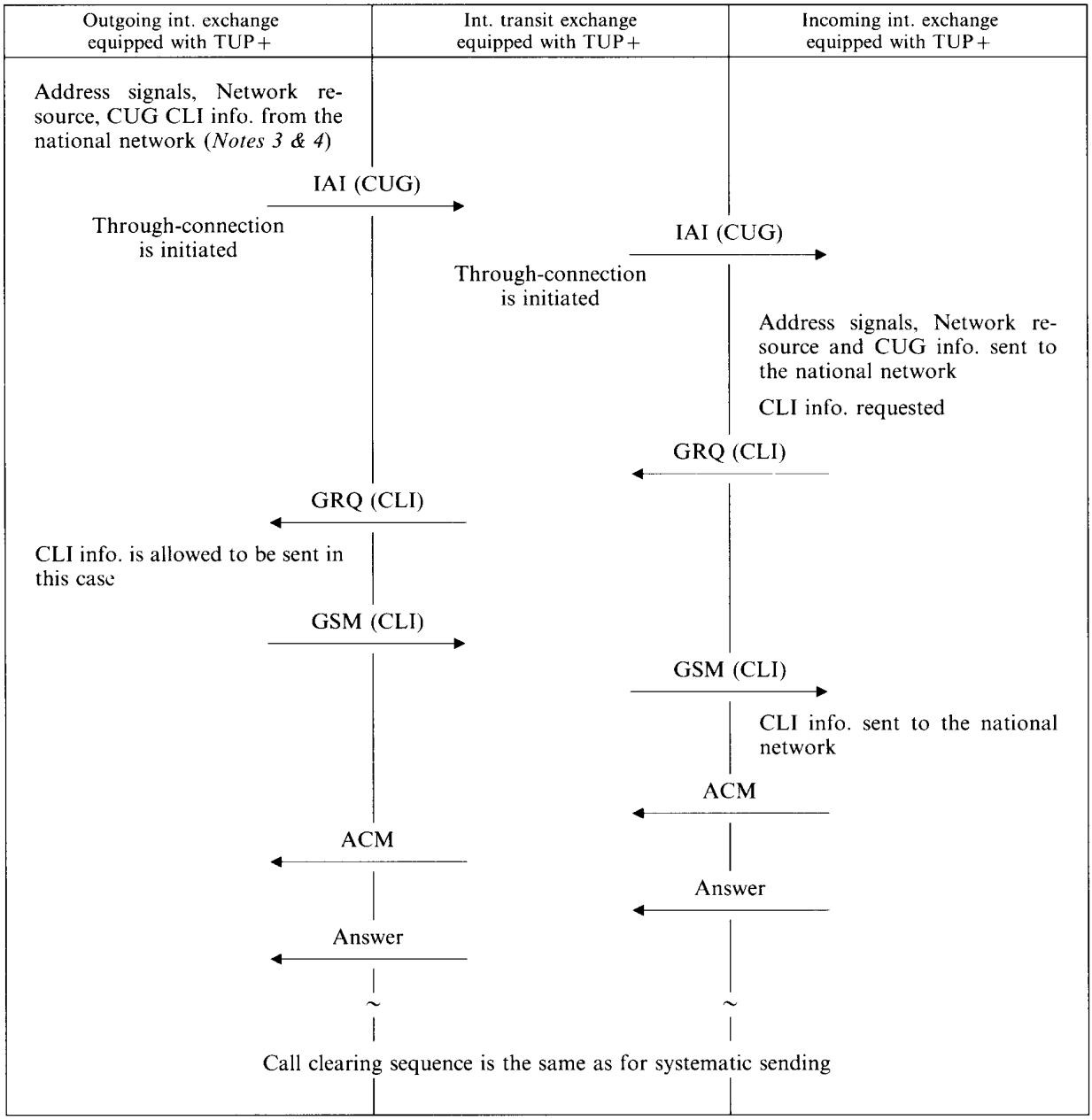
Note 3. An outgoing exchange can use either systematic or req/res technique for sending CLI even though the systematic technique is the preferred technique (see section 10.2.2. for the use of the optional CLI field).

Note 4. When req/res technique is used then the CLI need not be available at the outgoing int. exchange before the IAI is sent.



SUCCESSFUL CUG & CLI CALL TO A TUP+ EXCHANGE (systematic sending)
(only en bloc sending shown in this diagram)

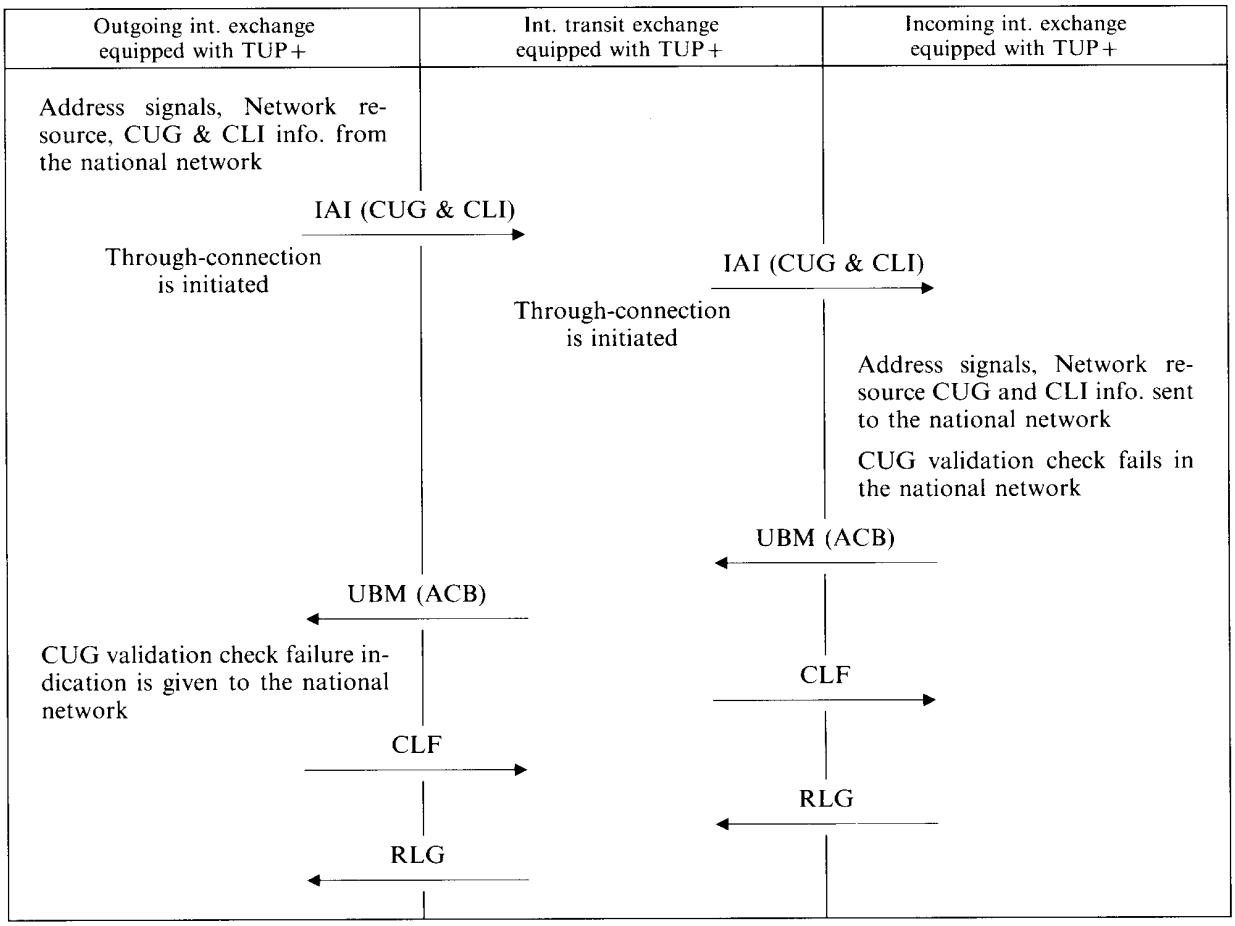
Note 3. An outgoing exchange can use either systematic or req/res technique for sending CLI even though the systematic technique is the preferred technique (see section 10.2.2. for the use of the optional CLI field).



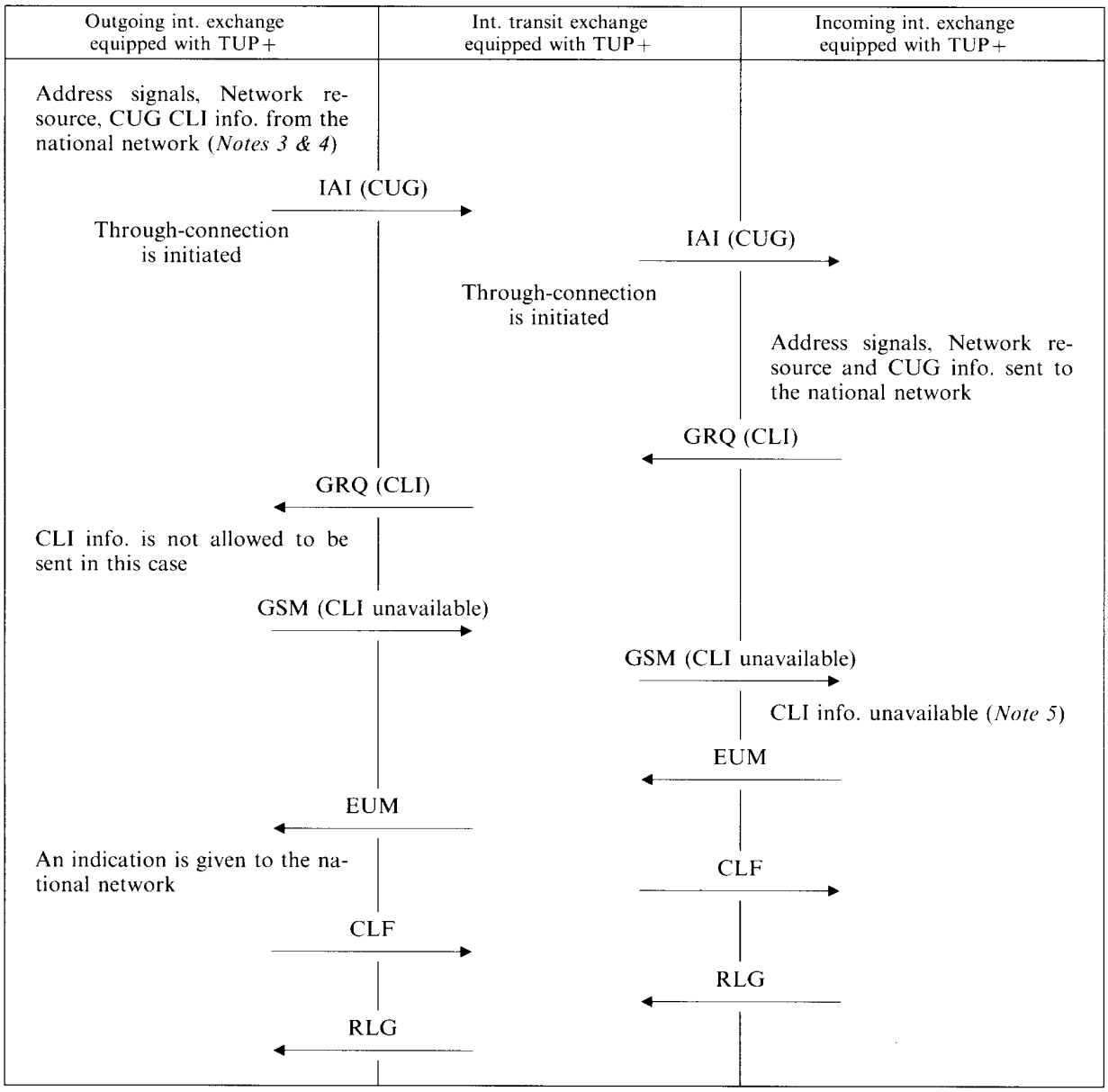
SUCCESSFUL CUG & CLI CALL TO A TUP+ EXCHANGE (req/res sending)
(only en bloc sending shown in this diagram)

Note 3. An outgoing exchange can use either systematic or req/res technique for sending CLI even though the systematic technique is the preferred technique (see section 10.2.2. for the use of the optional CLI field).

Note 4. When req/res technique is used then the CLI need not be available at the outgoing int. exchange before the IAI is sent.



UNSUCCESSFUL CUG & CLI CALL TO A TUP+ EXCHANGE
(only en bloc sending shown in this diagram)

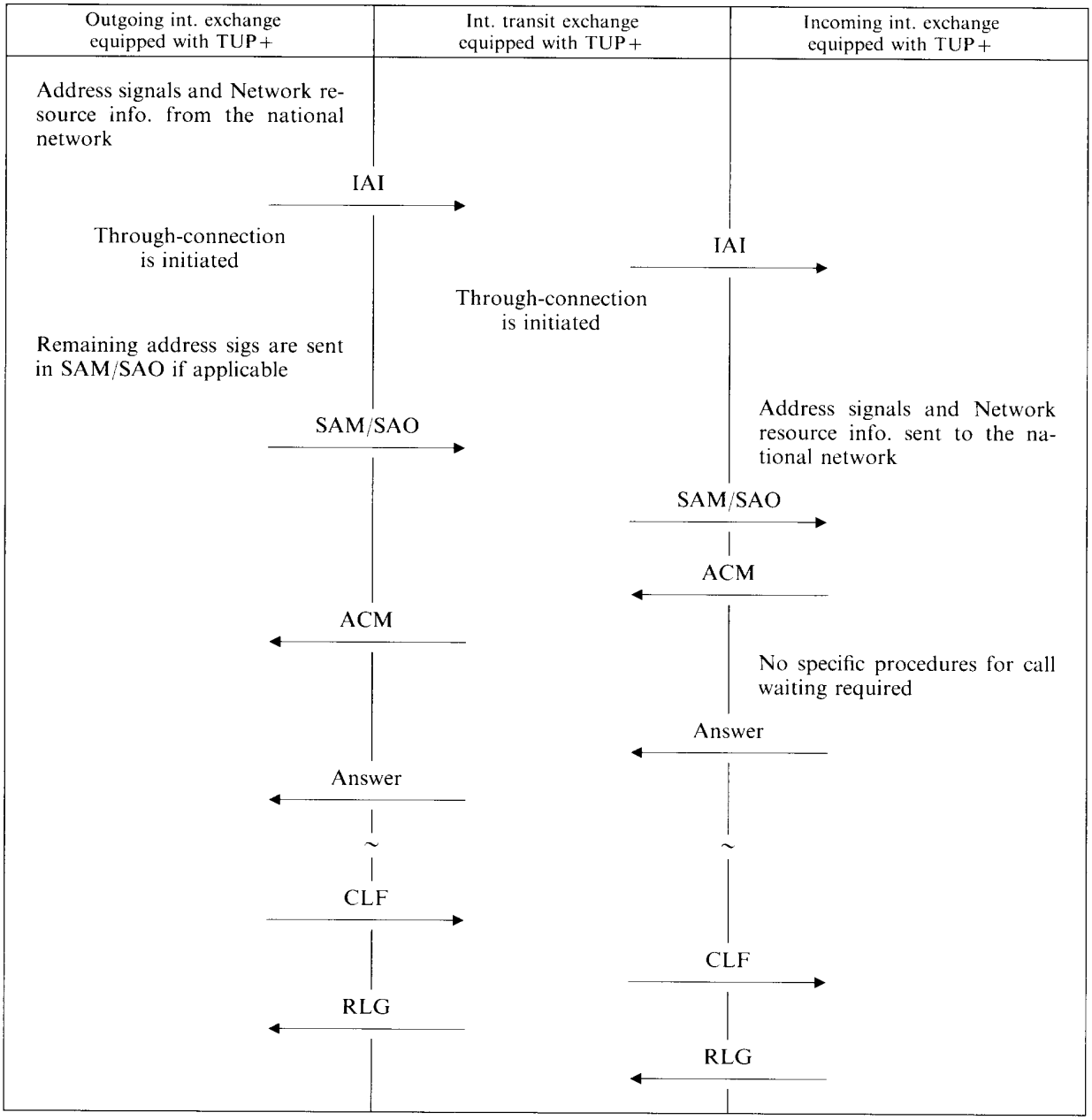


CUSTOMER CALL REJECTION DUE TO CLI UNAVAILABILITY
(only en bloc sending shown in this diagram)

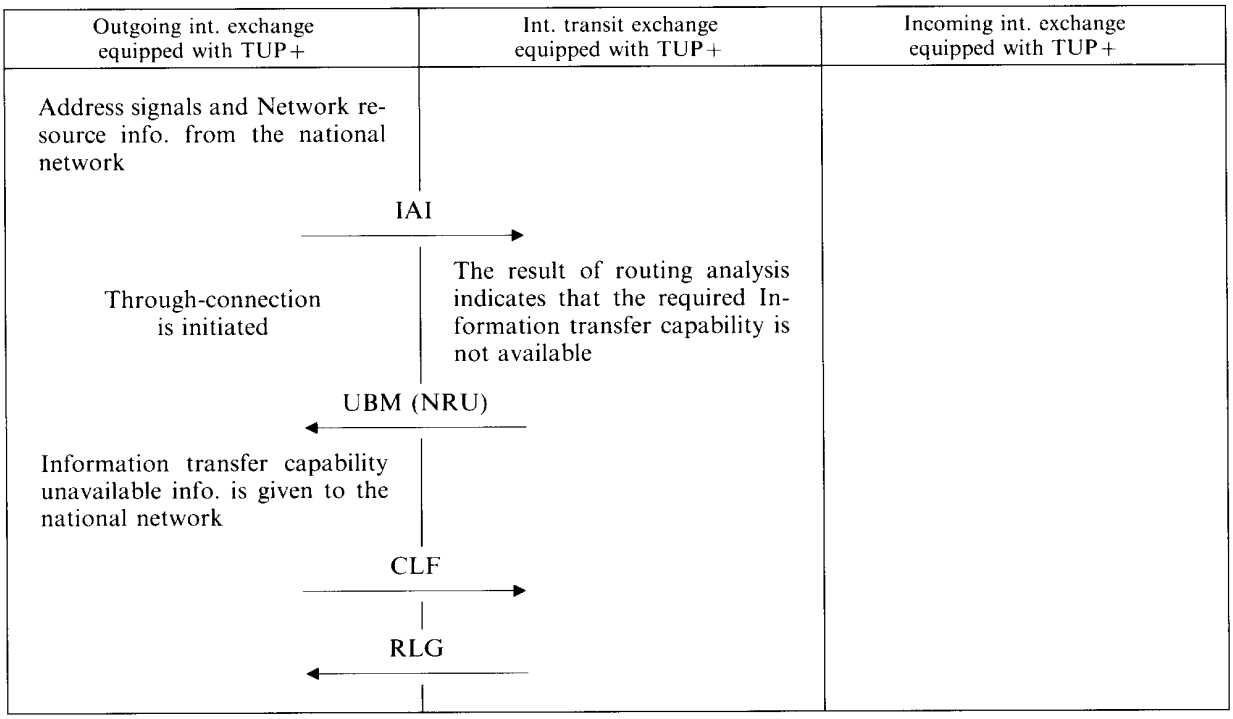
Note 3. An outgoing exchange can use either systematic or req/res technique for sending CLI even though the systematic technique is the preferred technique (see section 10.2.2. for the use of the optional CLI field).

Note 4. When req/res technique is used then the CLI need not be available at the outgoing int. exchange before the IAI is sent.

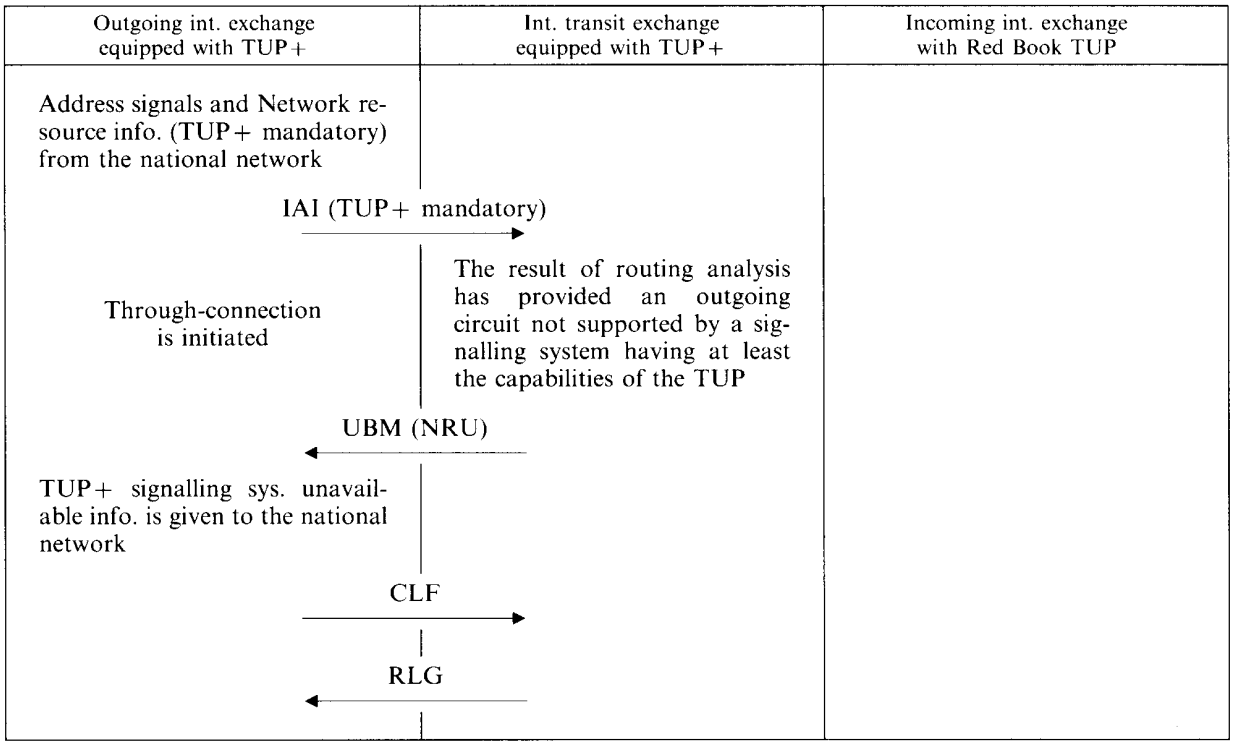
Note 5. ACM may be received depending on the interaction of the network with the Access protocol.



SUCCESSFUL CALL WAITING TO A TUP+ EXCHANGE



UNSUCCESSFUL CALL DUE TO UNAVAILABLE INFORMATION TRANSFER CAPABILITY



UNSUCCESSFUL CALL DUE TO UNAVAILABLE SIGNALLING SYSTEM CAPABILITY

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 paragraph 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 with additional information for a circuit for which it has sent an initial address message with additional information (see also paragraph 7.5.1.).

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.

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. Of this group the circuit which has been released for the longest time 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 with additional information 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 [26], is provided in Signalling System No. 7.

An automatic repeat attempt will be made:

— upon failure of the continuity-check (see paragraph 7.3.);
— on detection of dual seizure (at the noncontrol exchange) (see paragraph 2.5.);
— on receipt of the blocking signal after sending an initial address message with additional information and before any backward signal has been received (see paragraph 6.);
— on receipt of a reset-circuit signal after sending an initial address message with additional information and before a backward signal has been received;
— on receipt of unreasonable signalling information after sending an initial address message with additional information 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 with additional information shall take place as soon as sufficient digits are received and analysed to permit the selection of an outgoing circuit;
— if "en bloc" operation is used, the initial address message with additional information should be sent as soon as all the digits of the number 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 analysed.

4.3. Incoming international exchange

At the incoming international exchange:

— if overlap 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 number 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 paragraph 9.

Since circuits served by Signalling System No. 7 have bothway 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 with additional information 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 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 with additional information 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 the maintenance systems at each end of the circuit should be informed. Should a call be in progress on the circuit involved, the five minutes time will commence when that call is cleared.

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.

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, the message is ignored and no action should be taken.

The same rule applies to the acknowledgements.

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

For the circuits blocked for reasons of hardware failure 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 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 paragraph 7.3.);
— on receipt of an address-incomplete signal (see paragraph 1.7.);
— on receipt of one of the congestion signals (see paragraph 1.8.);
— on receipt of extended unsuccessful backward set up information message (see paragraph 1.8A.);
— on receipt of one of the called-party's-line-condition signals (see paragraph 1.9.);
— on receipt of Network resource unavailable signal (see paragraph 1.9A.);
— on receipt of the blocking signal or the maintenance oriented group blocking message after sending an initial address message with additional information and before a backward signal relating to that call has been received (see paragraph 5.);
— on receipt of unreasonable signalling information after sending an initial address message with additional information and before one of the backward signals required for call set-up has been received (see paragraph 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 paragraph 6.4.);
— on receipt of a call-failure signal (see paragraph 6.3.);
— on failure to receive a clear-forward signal after sending a clear-back signal (see paragraph 6.4.);
— on failure to receive an answer signal (see paragraph 6.4.);
— on receipt of a reset-circuit signal or circuit group reset message (see paragraph 1.15.).

Information contained within the initial address message with additional 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*

Information contained within the initial address message with additional information is stored at the outgoing international exchanges and must be retained until receipt of one of the following 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,
(f) the extended unsuccessful backward set-up information message,
(g) the network resource unavailable signal,
or when the connection is cleared earlier and no automatic repeat attempt has to be made.

6.1.2. *Incoming international exchange*

Information contained within the initial address message with additional information is stored at the incoming international exchange and must be retained until receipt of one of the backward signals indicated in paragraph 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 the congestion signals,
(d) the call-failure signal,
(e) the reset-circuit signal, or circuit group reset message,
(f) the extended unsuccessful backward set-up information message,
(g) the network resource unavailable signal,
or on receipt of a clear-forward signal.

6.1.3. *International transit exchange*

Information contained within the initial address message with additional information is stored at an international transit exchange and must be retained until receipt of one of the backward signals indicated in paragraph 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 entity 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 paragraph 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 Extended unsuccessful backward set up information message,
— the called-party's-line-condition signals,
— the access barred signal,
— the network resource unavailable signal.

Reception of the call-failure 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 entity is alerted and circuit reset initiated.

6.4. **Abnormal release condition—other sequences**

If the conditions for normal release as covered in paragraph 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 paragraph 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 [24];

(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 [24].

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 Part III, Recommendation Q.723+, paragraph 3.3.2) before 10-15 seconds after receipt of the initial address messsage with additional information, or
— on failure to receive one of the backward signals indicated in paragraph 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 paragraph 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 signal, extended unsuccessful backward set-up information message, network resource unavailable signal 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 [24].

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 if applicable (see Part III, Recommendation Q.723+, paragraph 3.3.2) before 10-15 seconds after receipt of the initial address message with additional information; or
— on failure to meet the conditions for normal release as covered in paragraph 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 signal, extended unsuccessful backward set-up information message, network resource unavailable signal, 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 paragraph 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 [27], paragraph 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

7.1. General

This specification relates only to that part of a connection served by a Signalling System No. 7. The part of the circuit 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 path 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 path 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 $2{,}000 \pm 20$ Hz. For international application the sending level of the check-tone will be -12 ± 1 dBmO.

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: $2{,}000 \pm 30$ 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 tolerances allow for variations at the sending end and for variations in line transmissions that are considered acceptable.

(b) Non-operating requirements

Signal frequency: outside the frequency band $2{,}000 \pm 200$ 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 paragraph 7.3.)

— after recognition of tone, interruptions of up to 15 ms shall be ignored; this will prevent switching through the 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 paragraph 1.4. The outgoing exchange will indicate whether continuity-check is required or not by the continuity-check indicator in the initial address message with additional information (Part III, Recommendation Q.723+, paragraph 3.3.2). If it is required, the outgoing exchange will connect a transceiver to the circuit when it sends an initial address message with additional information. If continuity-check is not required either on the incoming circuit or on the outgoing circuit, the outgoing exchange can switch-through the circuit immediately after having sent the initial address message with additional information.

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 path across the exchange has been checked and found correct (see paragraph 1.4.), and
— if the continuity check indicator in the received initial address message with additional information indicates that continuity-check is being (has been) performed on previous circuit(s), receipt of a continuity signal from the proceeding exchange.

The 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 path should be delayed until the residual check-tone has propagated through the return path of the 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.

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 paragraph 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 circuit 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 circuit will be returned to idle with a clear-forward/release-guard sequence. If the second check fails, the maintenance entity 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 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 with additional information.

If retransmissions of an initial address message with additional information 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 with additional information 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 with additional information 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 with additional information is available 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 with additional information 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 continuty-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 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 paragraph 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 paragraph 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 with additional information 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 an initial address message with additional information, will ignore it and continue the call set-up procedure.

8. Deleted

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. paragraph 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 circuits or a considerable reduction of level. Therefore a switching equipment monitoring this indication (see paragraph 1.4.) should inhibit local seizure of the concerned 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 paragraph 9.2.2. below.

When interruption control is implemented, possible use of the specifications contained in Recommendation Q.416 [28] could be applied.

9.2.2. *Blocking and unblocking of circuits*

Blocking signals are sent to the other end, with regard to the relevant 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 Part II, Recommendation Q.722+ and the format and the content given in Part III, Recommendation Q.723+.

10.1. **Closed User Group**

10.1.1. Deleted

10.1.2. *Call set-up procedure with decentralized administration CUG data*

10.1.2.1. Deleted

10.1.2.2. Deleted

10.1.2.2A. CUG calls in the international networks

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

10.1.2.2B. Action at the outgoing international exchange

In the case of international CUG call no special functions are required at the international outgoing exchange provided that the international interlock code assigned to the international CUG concerned is used in the national network. If this is not the case a conversion to the international code is required. (National matter.) Furthermore a check may be performed to see that CUG call is allowed to the concerned country.

Note. Depending on CUG call options the following signalling capability is requested:
— in the case of a CUG call with outgoing access the signalling capability requested indicator is set to TUP+ preferred;
— for a CUG call without outgoing access the indicator is set to TUP+ mandatory.

10.1.2.2C. Action at an international transit exchange

No additional action than described in paragraph 10.1.2.2A. is performed.

10.1.2.2D. Action at the incoming international exchange

No additional action other than that described in paragraph 10.1.2.2A. is performed provided that the international interlock code is used in the incoming national network. If this is not the case a conversion function is required. (National matter.)

10.1.2.2E. Examples

The examples of successful and unsuccessful calls with the CUG facilities are illustrated in signal sequence diagrams in paragraph 1.17.

10.1.2.3. Deleted

10.1.3. Deleted

10.1.4. Deleted

10.2. **Calling Line Identification**

10.2.1. *General*

Call set-up is as for a normal call. The information related to the calling line identification received from the preceding exchange is forwarded to the succeeding exchange.

In the case where the calling party has indicated the calling line identity presentation restricted facility, the initial address message with additional information includes the calling line identity presentation restricted indicator.

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 with additional information.

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

From TUP+ specification view point, the preferred method of transporting the calling line identification is the systematic sending of CLI in the initial address message with additional information. An option shall exist for the CLI information not to be included in the initial address message with additional information, in this case the information may be transported, if available and allowed to be transported, in the general forward set up information message in response to the request by a general request message.

If a request for the calling line identity is received in a general request message, even though the CLI had been sent systematically in the initial address message with additional information, a general forward set up information message is sent with either CLI information (if available) or without the CLI information. The request and response cycle is only possible up to the receipt of an address-complete signal.

10.2.2A. *Actions at an outgoing international exchange*

The outgoing international exchange can either send the CLI information in the initial address message with additional information or withhold the information and, if allowed, send it in response to a GRQ message.

If a request for the calling line identity is received in a GRQ message, a response as above will be given in the GSM message even though the CLI had been sent systematically in the initial address message with additional information.

If the calling line identity is available and is allowed to be sent, the optional field "calling line identity" is present in the IAI and it contains the calling number digits.

If the calling line identity cannot be provided in the initial address message (for any reason) but could be provided on request, the optional field "calling line identity" *should not be included* in the IAI.

If the calling line identity is not available or is not allowed to be sent, the optional field "calling line identity" *should be included* in the IAI and should contain the calling line identity not available indicator (coded in the number of address signals field).

10.2.2B. *Actions at an incoming international exchange*

The incoming international exchange must be able to accept the initial address message with additional information with the CLI information included.

If the optional field "calling line identity" *is present* in the IAI but with the calling line identity not available indicator coded in the number of address signals field, then the incoming international exchange *should not send* a GRQ message requesting for the calling line identity.

If the optional field "calling line identity" *is not present* in the IAI the incoming exchange can request the CLI information with a GRQ message, and accept the GSM with the CLI information included.

10.2.2.1. Deleted

10.2.2.2. Deleted

10.3. **Sub-addressing**

Calling and called sub-addresses can only be transported in the Initial Address message with additional Information (IAI). When present, the information is transferred (forward) as received i.e. transparently.

A call with sub-address(es) is set-up as a normal call. No specific indication is sent backward in case of non-delivery.

10.4. **User to User signalling**

User to user information can be transported in some call control messages, namely:
— Initial Address message with additional information (IAI)
— Address Complete Message (ACM)
— Answer signal, Charge (ANC)
— Answer signal, No charge (ANN)
— Clear forward signal (CLF)
— Clear back signal (CBK)
— Extended Unsuccessful backward set-up information Message (EUM)

When present, the information is transferred as received i.e. transparently.

A call with user to user information is set up as a normal call. No specific indication is sent in the opposite direction in case of non-delivery.

11. ECHO SUPPRESSOR CONTROL

The echo suppressor control could be applied in the international network upon bilateral agreement. (See CCITT Red Book Recommendation Q.724 [4] section 11.)

12. Deleted

Annex

COMPATIBILITY BETWEEN A SWITCH EQUIPPED WITH BOTH TUP+ AND TUP AND ONE WITH THE CCITT RED BOOK TUP

In order to achieve compatibility between exchanges equipped with both TUP+ and TUP (TUP+/TUP) and those with the Red Book TUP the following set of rules should be applied at a TUP+/TUP node:

i) At a switch supporting the TUP+/TUP, the decision of whether to use TUP+ or TUP protocols should be made on the basis of route data. For all incoming and outgoing calls, on a specific circuit, or circuit-group, the decision has to be the same at both ends of the circuit or the circuit group.

ii) The message and procedures to be used for call set up to a TUP+ exchange are defined in Part III Q.723+ and Part IV Q.724+ of this Recommendation.

iii) The message and procedures to be used for call set up to a Red Book TUP exchange are defined in the Red Book Q.723 [3], and Q.724 [4].

CONSEQUENCES OF APPLICATION OF THE ABOVE RULES

If various interworking combinations are considered then the application of the above rules will result in the following:

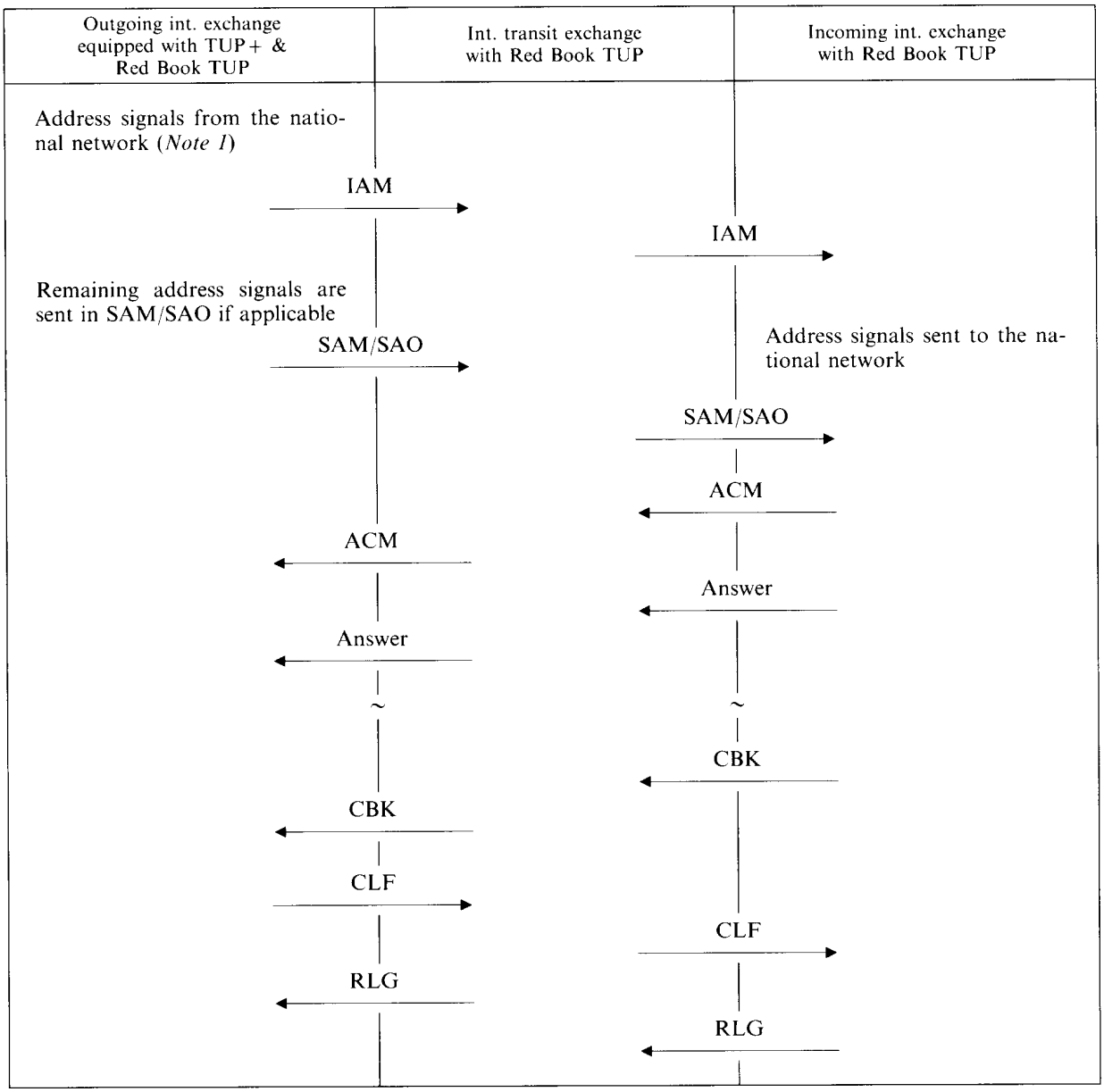
Case 1: TUP/TUP+ ——————————— TUP

In this situation the TUP+ node has the other exchanges marked in route data as a non TUP+ node and hence it does not apply the TUP+. The services available on this type of connection will be only those supported by the TUP. If that is not sufficient then the call must be failed.

Case 2: TUP ——————————— TUP+/TUP

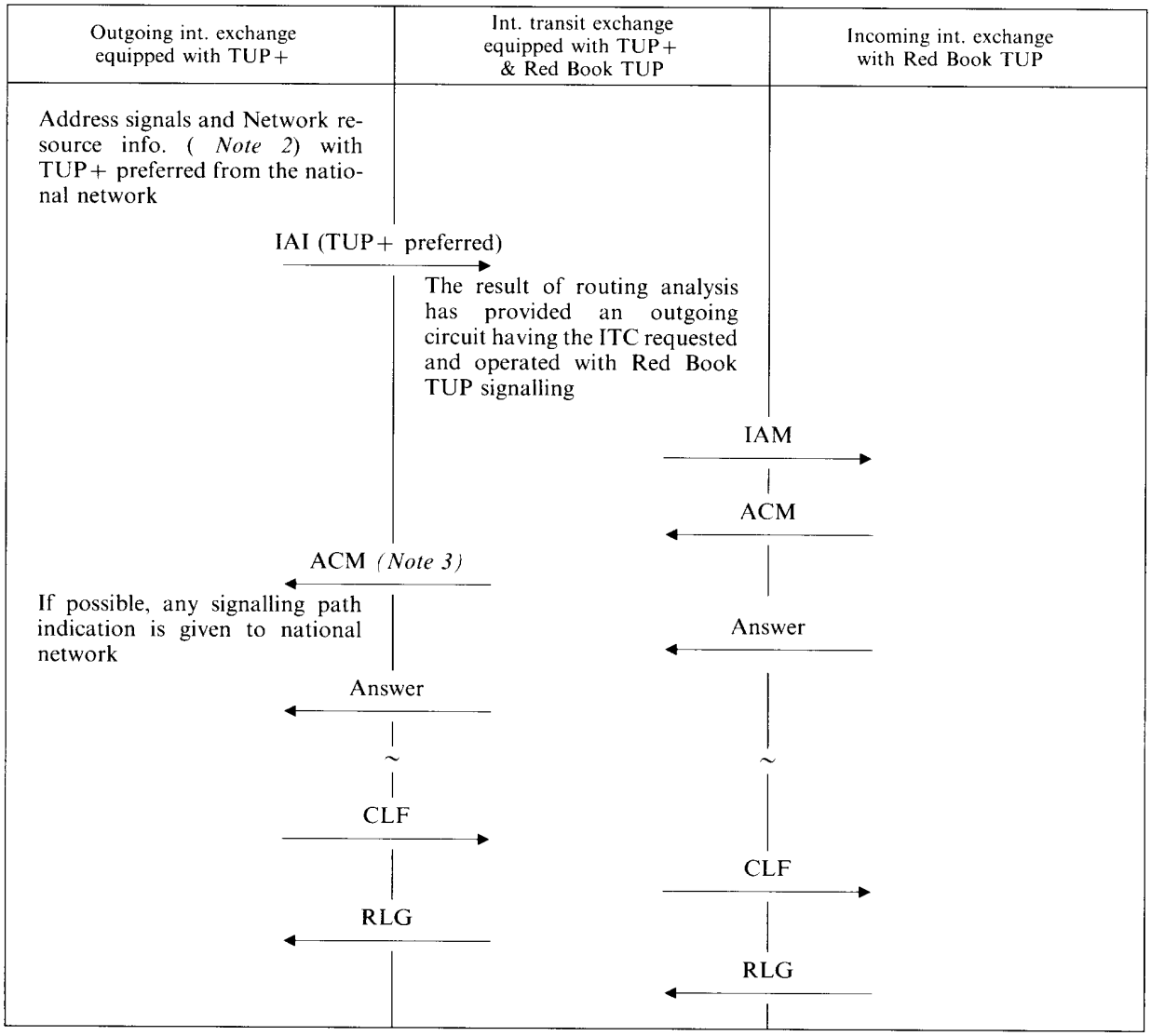
In this situation the originating non TUP+ node will not use the TUP+ and hence the enhanced features of the TUP+ will not be available. The TUP+/TUP node will however be able to correctly respond to the TUP messages and procedures.

The following sequence diagrams are given as examples to illustrate the above rules.



SUCCESSFUL BASIC CALL TO A RED BOOK TUP EXCHANGE

Note 1. The messages and procedures used between the outgoing int. exchange and the int. transit exchange are the standard CCITT Red Book Q.723 [3] messages and Q.724 [4] procedures.



SUCCESSFUL BASIC CALL TO A RED BOOK TUP EXCHANGE
(via a TUP+ transit exchange)

Note 2. Network resource info. contains both Information transfer capability and signalling system capabilities required.
Note 3. The TUP+ signalling path indicator in the ACM will indicate any signalling path.

REFERENCES

[1] CCITT Recommendation Q.721. *Functional description of the signalling system Telephone User Part (TUP).*
[2] CCITT Recommendation Q.722. *General function of telephone messages and signals.*
[3] CCITT Recommendation Q.723. *Formats and codes.*
[4] CCITT Recommendation Q.724. *Signalling procedures.*
[5] CCITT Recommendation Q.725. *Signalling performance in the telephone application.*
[6] CCITT Recommendation Q.931. *ISDN user-network interface layer 3 specification.*
[7] CCITT Recommendation Q.701. *Functional description of the signalling system (Message Transfer Part).*
[8] CCITT Recommendation Q.708. *Numbering of International Signalling Point Codes.*
[9] CCITT Recommendation Q.701. *Functional description of the signalling system (Message Transfer Part).*
[10] CCITT Recommendation Q.702. *Signalling data link.*
[11] CCITT Recommendation Q.703. *Signalling link.*
[12] CCITT Recommendation Q.704. *Signalling network functions and messages.*
[13] CCITT Recommendation Q.28. *Determination of the moment of the called subscriber's answer in the automatic service.*
[14] CCITT Recommendation E.260. *Basic technical problems concerning the measurement and recording of call durations.*
[15] CCITT Recommendation Q.118. *Special release arrangements.*
[16] CCITT Recommendation Q.35. *Technical characteristics of tones for the telephone service.*
[17] CCITT Recommendation G.732. *Characteristics of primary PCM multiplex equipment operating at 2,048 kbit/s.*
1[18] CCITT Recommendation G.734. *Characteristics of synchronous digital multiplex equipment operating at 1,544 kbit/s.*
[19] CCITT Recommendation G.744. *Second order PCM multiplex equipment operating at 8,448 kbit/s.*
[20] CCITT Recommendation G.746. *Characteristics of second order PCM multiplex equipment operating at 6,312 kbit/s.*
[21] CCITT Recommendation Q.107. *Standard sending sequence of forward address information.*
[22] CCITT Recommendation Q.608. *Miscellaneous interworking aspects.*
[23] CCITT Recommendation Q.504. *Performance and availability design objectives.*
[24] CCITT Recommendation Q.118. *Special release arrangements.*
[25] CCITT Recommendation Q.107*bis*.*Analysis of forward address information for routing.*
[26] CCITT Recommendation Q.12. *Overflow-alternative routing-rerouting-automatic repeat attempt.*
[27] CCITT Recommendation Q.706. *Message Transfer Part signalling performance.*
[28] CCITT Recommendation Q.416. *Interruption control.*

History

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