



ATIS-1000113.2015(R2020)

**Signaling System No. 7 (SS7) –
Integrated Services Digital Network (ISDN) User Part**

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ATIS-1000113.2015(R2020), *Signaling System No. 7 (SS7) – Integrated Services Digital Network (ISDN) User Part*

Is an American National Standard developed by the **PSTN Transition (PSTN) Subcommittee** under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

Published by

Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

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American National Standard for Telecommunications

**Signaling System No. 7 (SS7) --
Integrated Services Digital Network (ISDN) User Part**

Alliance for Telecommunications Industry Solutions

Approved January 8, 2015

American National Standards Institute, Inc.

Abstract

The Integrated Services Digital Network (ISDN) User Part defines the protocol which supports the signaling functions required to provide voice and non-voice services in an Integrated Services Digital Network. This standard is based on the Specification of Signaling System No. 7 for international use issued by ITU-T Study Group 11 in the year 2000 and subsequent amendments. This standard is based on and uses, where applicable, the same signaling procedures, parameters, and message types as the internationally specified ISDN User Part of the ITU-T Signaling System No. 7. The PTSC-PSTN subcommittee has developed this standard to suit anticipated needs and applications within and between U. S. networks.

Foreword

The information contained in this Foreword is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.

This standard is based on the Specification of Signaling System No. 7 for international use issued by ITU-T Study Group 11 in the year 2000 and subsequent amendments. This standard is based on, and uses, where applicable, the same signaling procedures, parameters, and message types as the internationally specified Integrated Services Digital Network (ISDN) User Part of the ITU-T Signaling System No. 7 recommendations. It is suitable for anticipated needs and applications within and between U. S. networks. These specifications are the result of extensive work by the members of the PTSC-PSTN subcommittee.

Since the release of ANSI T1.113-2000 some of the more significant changes to this standard are:

- Automatic re-routing (crankback)
- MLPP user indicator.

Since the release of ATIS-1000113.2005 the following has been added to this standard:

- A new code point in support of Mobile Service Transport (MST) in the Application Transport parameter.

This standard contains the following chapters:

- ATIS-1000113.2015 – Chapter 1, *Functional Description of the Integrated Services Digital Network (ISDN) User Part*;
- ATIS-1000113.2015 – Chapter 2, *General Function of Messages and Signals*;
- ATIS-1000113.2015 – Chapter 3, *Formats and Codes*;
- ATIS-1000113.2015 – Chapter 4, *Signaling Procedures*;
- ATIS-1000113.2015 – Chapter 5, *Performance Objectives in the ISDN Application*;
- ATIS-1000113.2015 – Chapter 6, *State Transition Diagrams*; and
- ATIS-1000113.2015 – Chapter 7, *Application Transport Mechanism*.

The overall and detailed organization of individual chapters of this standard parallels that used in the equivalent ITU-T recommendations. Chapters 1–4 correspond to Q.761–Q.764. Chapter 5 corresponds to Q.766. Chapter 6 contains material previously in Chapter 4. Chapter 7 corresponds to Q.765.

This standard is intended for use in conjunction with ATIS-1000110, *Signaling System No. 7 (SS7)—General Information*.

There are thirteen annexes in this standard. Chapter 1 contains one informative annex. Chapter 3 contains one normative and three informative annexes. Chapter 4 contains five informative annexes. Chapter 7 contains one normative annex and two informative annexes. Information contained in a normative annex forms an integral part of this standard. Information contained in an informative annex is not considered part of this standard, but is rather auxiliary to the standard. Similarly footnotes are not part of this standard.

In case of any conflict between the text and the Specification and Description Language diagrams, the text shall have precedence.

Suggestions for improvement of this standard will be welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC 20005.

This standard was processed and approved for submittal to ANSI by the Accredited Standards Committee Packet Technologies and Systems Committee (PTSC). Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the PTSC had the following members:

At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

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The **PSTN Transition [PSTN]** Subcommittee was responsible for the development of this document.

**Signaling System No. 7 (SS7) –
Integrated Services Digital Network (ISDN) User Part**

Chapter 1

**Functional Description of the
Integrated Services Digital Network (ISDN) User Part**

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Chapter 1: Functional Description of the Integrated Services Digital Network (ISDN) User Part

1 Scope, Purpose, & Application

1.1 General

The Integrated Services Digital Network (ISDN) User Part (UP) defines the protocol which supports the signaling functions required to provide voice and non-voice services in an Integrated Services Digital Network.

The ISDN User Part (ISUP) is also suited for application in dedicated telephone and circuit switched data networks and in analogue and mixed analogue/ digital networks. The ISDN User Part is based on, and uses wherever applicable the same signaling procedures, information elements and message types as the internationally specified ISDN User Part of ITU-T Signaling System No.7 (SS7), as described in:

- Q.730 (2000), *ISDN supplementary services*.¹
- Q.761 (2000), *Functional description of the ISDN user part*.¹
- Q.762 (2000), *General function of messages*.¹
- Q.763 (2000), *Formats and codes*.¹
- Q.764 (2000), *Signaling procedures*.¹
- Q.766 (1992), *Performance objectives in the ISDN applications*.¹

The ISDN User Part is also based on and aligned with:

- Q.850 (1996), *Usage of Cause and Location in the Digital Subscriber Signaling System No. 1 and the Signaling System No. 7 ISDN User Part*.¹
- ATIS-1000607.2014, American National Standard for Telecommunications - *Digital Subscriber Signaling System No. 1 (DSS1) - Layer 3 Signaling Specification for Circuit Switched Bearer Service*.²

In addition, the ISDN User Part is aligned with:

- Q.724 (1988), *Telephone user part signaling procedures*.¹

¹ This document is available from the International Telecommunications Union. < <http://www.itu.int/ITU-T/> >.

² This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=24729> >.

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In addition the ISDN User Part protocol is flexible enough and has sufficient spare capacity to accommodate any foreseeable requirements that may be imposed by the introduction of new supplementary services and network capabilities.

The services of the Signaling System No.7 Message Transfer Part (MTP) and, in some cases, of the Signaling System No.7 Signaling Connection Control Part (SCCP) are used to affect the transfer of signaling information between communicating ISDN User Parts. The MTP is described in:

ATIS-1000111, *American National Standard for Telecommunications - Signaling System Number 7 (SS7) - Message Transfer Part (MTP)*.³

and the SCCP is described in:

ATIS-1000112, *American National Standard for Telecommunications - Signaling System Number 7 (SS7) - Signaling Connection Control Part (SCCP)*.⁴

The ISDN User Part is specified in ATIS-1000113.2015 – Chapter 1 to ATIS-1000113.2015 – Chapter 7 of the American National Standards Specification of Signaling System No.7. A general description of ISDN User Part signals and messages is provided in ATIS-1000113.2015 – Chapter 2. Message formats and message field codings are specified in ATIS-1000113.2015 – Chapter 3, while signaling procedures are described in ATIS-1000113.2015 – Chapter 4 and performance objectives in ATIS-1000113.2015 – Chapter 5. ATIS-1000113.2015 – Chapter 6 contains the state transition diagrams for the ISDN User Part. ATIS-1000113.2015 – Chapter 7 specifies the Application Transport Mechanism (APM).

This chapter may contain requirements that reference other American National Standards. If so, when American National Standards referenced in the requirements are superseded by revisions approved by the American National Standards Institute, Inc, the revisions shall apply.

1.2 Applicability to Other Standards

A number of messages and parameters are described which are part of the ITU-T ISDN User Part Recommendations but for which there are currently no procedures specified in American National Standards. The signaling messages and parameters that fall into this category are marked with the note "no procedure specified for U.S. networks".

2 Services Supported by the ISDN User Part

2.1 Basic Service

The ISDN User Part supports the call control functions in network nodes and the signaling information flows between these functions for circuit mode switched 8kHz structured bearer services⁵, including, but not restricted to:

- speech

³ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=24943> >.

⁴ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < <https://www.atis.org/docstore/product.aspx?id=24942> >.

⁵Based on T1.620-1991 (R2002).

- 3.1 kHz audio
- multi-use
- 64 kbit/s unrestricted
- 64 kbit/s restricted⁶
- 384 kbit/s unrestricted
- 1536 kbit/s unrestricted
- Nx64 kbit/s unrestricted (N=2 to 24)

The 64 kbit/s unrestricted connection may be used to carry any one of the nationally standardized data user classes.

The ISDN User Part procedures, messages, and message contents required to support the basic service are specified in ATIS-1000113.2015 Chapter 2 to ATIS-1000113.2015 – Chapter 4.

2.2 Supplementary Services & Network Capabilities

In addition to the basic service, this issue of the ISDN User Part standard also supports a number of supplementary services and network capabilities. The ISDN User Part procedures required to support these services and network capabilities are defined in other American National Standards. The signaling messages and their content are also described in ATIS-1000113.2015 – Chapter 2 and ATIS-1000113.2015 – Chapter 3.

3 Services Assumed from the MTP

3.1 General

This section describes the functional interface presented by the Message Transfer Part to the ISDN User Part. In accordance with the description techniques defined by the Open System Interconnection (OSI) model, information is transferred to and from the Message Transfer Part in the form of Parameters carried by Primitives.

The general syntax of a primitive is as follows:

X	Generic Name	Specific Name	Parameter

where:

- X designates the function providing the service (the Message Transfer Part in this case);
- The Generic Name describes an action by X;
- The Specific Name indicates the purpose of the primitive, i.e., whether it conveys a request for service, an indication that service-related information has been received, a response to a service request, or a confirmation that the requested service has been performed, and
- The Parameters contain the elements of supporting information transferred by the primitive.

⁶The use of 64 kbit/s restricted is expected to exist during a period of transition to 64 kbit/s unrestricted.

3.2 Description of Primitives

The following paragraphs describe the primitives used across the ISDN User Part - Message Transfer Part interface. The primitives together with the parameters carried by each primitive are also shown in Table 5.1 - ATIS-1000113.2015 – Chapter 1.

3.2.1 Transfer

The MTP-TRANSFER primitive is used either by the ISDN User Part to access the Signaling Message Handling function of the Message Transfer Part or by the latter to deliver signaling message information to the ISDN User Part.

3.2.2 Pause

The MTP-PAUSE primitive is sent by the Message Transfer Part to indicate its inability to transfer messages to the destination specified as a parameter. The ISDN User Part should stop sending signaling traffic while it waits for the MTP-RESUME primitive.

3.2.3 Resume

The MTP-RESUME primitive is sent by the Message Transfer Part to indicate its ability to resume unrestricted transfer of messages to the destination specified as a parameter.

3.2.4 Status

The MTP-STATUS primitive is sent by the Message Transfer Part to indicate the signaling route to a specific destination is congested or the ISDN User Part at the destination is unavailable. Unavailability causes can be unequipped, inaccessible, or unknown. The affected destination and the congestion indication are carried as parameters (see Table 5.1 – ATIS-1000113.2015 – Chapter 1) in the primitive.

4 End-to-End Signaling

4.1 General

End-to-end signaling is defined as the capability to transfer signaling information directly between the end points of a built up circuit switched connection or between signaling points that are not interconnected by a circuit switched connection.

End-to-end signaling is used typically between call originating and terminating local exchanges, to request or to respond to requests for additional call related information, to invoke a supplementary service or to transfer user-to-user information transparently through the network.

End-to-end signaling procedures are described in ATIS-1000113.2015 – Chapter 4. Two methods are available (see Figure 5.1 – ATIS-1000113.2015 – Chapter 1) as described in Clause 4.2 and Clause 4.3.

4.2 SCCP Method of End-to-End Signaling

The means for connection-oriented or connectionless transport of end-to-end signaling information is provided by the services of the SCCP and the MTP of Signaling System No.7 as defined in ATIS-1000112 and ATIS-1000111, respectively. (The use of connection-oriented SCCP transport of end-to-end signaling information is for further study.)

4.3 Pass-along Method of End-to-End Signaling

An alternative method for transporting end-to-end signaling information, called pass-along, is provided within the ISDN User Part, and does not require the services of the SCCP. This method may be used between two exchanges when the information to be transferred relates to an existing call for which a physical connection between the same two exchanges has been established. The information transfer in this case occurs over the same signaling path as that used to set up the call and establish the physical connection.

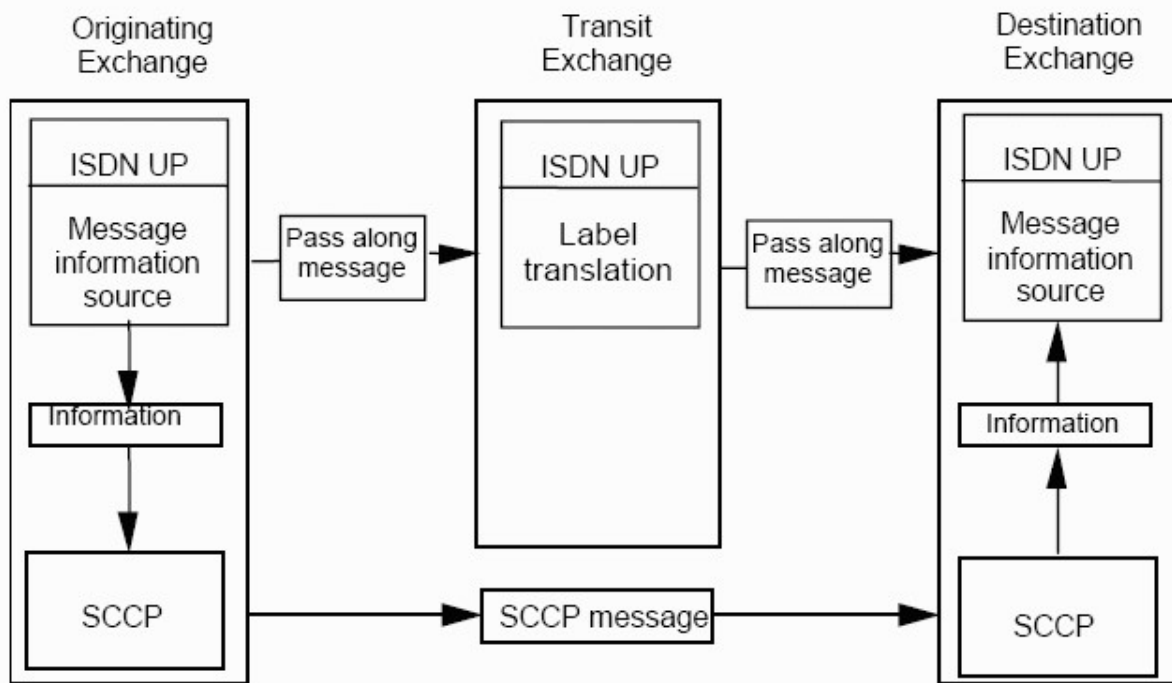
5 Future Enhancements

Requirements for additional protocol capabilities, such as the ability to support new supplementary services and network capabilities, will result from time to time in the need to add to or modify existing protocol elements and thus to create a new protocol version.

In order to ensure adequate service continuity, the insertion of a new protocol version into one part of a network should be transparent to the remainder of the network. Compatible interworking between protocol versions is optimized by adhering to the following guidelines when specifying a new version:

- (a) Existing protocol elements (i.e., procedures, messages, parameters, and codes) should not be changed unless a protocol error needs to be corrected or it becomes necessary to change the operation of the service or network capability that is being supported by the protocol.
- (b) The semantics of a message, a parameter, or of a field within a parameter should not be changed.
- (c) Established rules for the formatting and encoding of messages should not be modified.
- (d) The addition of parameters to the mandatory part of an existing message should not be allowed. If needed, a new message should be defined containing the desired set of existing and new mandatory parameters.
- (e) A parameter may be added to an existing message as long as it is allocated to the optional part of the message.
- (f) The addition of new octets to an existing mandatory fixed length parameter should be avoided. If needed, a new optional parameter should be defined containing the desired set of existing and new information fields.
- (g) The sequence of fields in an existing variable length parameter should remain unchanged. New fields may be added at the end of the existing sequence of parameter fields. If a change in the sequence of parameter fields is required, a new parameter should be defined.
- (h) The all zeros code point should be used exclusively to indicate an unallocated (spare) or insignificant value of a parameter field. This avoids an all zeros code, sent by one protocol version as a spare value, to be interpreted as a significant value in another version.
- (i) The compatibility mechanism described in 5.1 applies to post-1995 versions of ATIS-1000113.2015 (formerly T1.113).

Rules (a) to (h) also apply, and additional principles, which allow this and future versions of the ANSI ISDN-UP to directly interwork with each other, maintaining protocol and service compatibility and including end-to-end transparency, are described in clause 5.2 below.



NOTE - The Message Transfer Part is not shown.

Figure 5.1 - End-to-End Signaling Methods – Chapter 1

Table 5.1 - Description of Primitives – Chapter 1

Primitives		Parameters
Generic Name	Specific Name	
MTP-TRANSFER	Request Indication	OPC DPC SLS SIO Signaling Info.
MTP-PAUSE	Indication	Affected DPC
MTP-RESUME	Indication	Affected DPC
MTP-STATUS	Indication	Affected DPC Cause (Note)

NOTE - The cause parameter can assume four values:

- (1) Signaling network congestion level;
- (2) User part unavailability - unequipped remote user;
- (3) User part unavailability - inaccessible remote user; and
- (4) User part unavailability - unknown.

5.1 Version Compatibility

From T1.113-2000 onwards, compatibility between the 2000 and future versions will be guaranteed, in the sense that any two versions can be interconnected directly with each other, and the following requirements are fulfilled:

(1) Protocol compatibility

Calls between any two ISDN-UPs do not fail for the reason of "not satisfying" protocol requirements.

(2) Service and functional compatibility

This requirement may be considered as compatibility typically between originating and destination exchanges. Services and functions available at these exchanges, but possibly not yet supported in the intermediate exchanges, are supported, provided they require only transparency of the intermediate exchanges. If this is not the case, a controlled call rejection or service rejection is required.

Signaling for a facility completely provided between the originating and destination exchanges could utilize one of the end-to-end methods (see Clause 3 in ATIS-1000113.2015 – Chapter 4), i.e., such facilities do not have to be supported by transit exchanges.

(3) Resource control and management compatibility

For these functions occurring only link-by-link (e.g., maintenance messages), at least a backward notification (such as an acknowledge message) is needed, if correct handling is not possible.

The compatibility mechanism is common for all ISDN-UPs from the T1.113-2000 version onwards. It is based on forward compatibility information associated with new signaling information.

The compatibility method eases the network operation, e.g., for the typical case of an ISDN-UP mismatch during network upgrading, to interconnect two networks on a different functional levels, for networks using a different subset of the same ISDN-UP.

All messages and parameters contained in the T1.113-2000 version shall be recognized by all exchanges. This does not impose a requirement that the related functions are implemented, but the function shall be rejected correctly (where applicable). All future new messages and parameters are subject to the rules of the compatibility mechanism (see clauses 5.2.1 and 5.2.2).

5.2 Additional Coding Guidelines for Compatibility of ISDN User Parts

The following clauses detail guidelines that are mandatory.

5.2.1 Messages

All new messages use only parameters coded according to coding rules for the parameters of the optional part of ISDN-UP messages, since an exchange that does not recognize a message cannot know the length of mandatory parameters it does not recognize. The new messages always contain a Message Compatibility Information parameter.

5.2.2 Parameters

As a general principle, mixing information for different application associations (requiring different functional entity actions) in a new ISUP parameter should be avoided so that the behavior of cooperating nodes can be defined using the compatibility mechanism.

All new parameters introduced from T1.113-2000 (now ATIS-1000113.2015) onwards shall have associated compatibility information contained in the Parameter Compatibility Information parameter. Unrecognized parameter handling procedures can be found in clause 2.9.5 of ATIS-1000113.2015 – Chapter 4.

Annex A: Guidelines for Use of Instruction Indicators

(informative)

A.1 Introduction

Instruction indicators are used to indicate to an exchange receiving unrecognized information what action the exchange should take due to this information being unrecognized. Unrecognized information may be a message or one or more parameters within a message, unrecognized values within a parameter which cause the parameter itself to be treated as unrecognized. Instruction indicators are only examined once the message or parameter has been detected as unrecognized.

A.2 Priority of Execution

When processing instruction indicators a certain order is implied by the type of actions which can be specified, the following list indicates a decreasing order of processing priority.

- Transit at intermediate exchange indicator.
- Broadband / Narrowband interworking indicator.
- Release call indicator.
- Discard message, with or without notification, based on the notification indicator.
- Discard parameter, with or without notification, based on the notification indicator.
- Pass on not possible indicator.

NOTE - Only Broadband / Narrowband interworking exchanges examine the Broadband / Narrowband interworking indicator, in place of the Release call, Discard message, or Discard parameter indicators.

A.3 Notification

The Notification indicator is not strictly tied to the order of processing of the other indicators. It is recommended that notification is only required when information is discarded. This minimizes the amount of Confusion messages which may be generated along the call path for a particular piece of unrecognized information (this would not be the case if each exchange passing information on, also generated Confusion messages). The notification (Confusion message) contains a Cause indicators parameter with a Cause value indicating if the unrecognized information was a message or parameter(s), the diagnostic field contains the message or parameter code(s).

A.4 Considerations

A.4.1 Discarding Unrecognized Messages

Message compatibility information may indicate 'discard message', for those messages which do not affect the basic state of the protocol; otherwise there would be a misalignment between the states of the two protocol machines. This would normally result in the release of the call due to timer expiry. This would also be the case if an exchange generates parameter compatibility information indicating 'discard message'. Particular care must be taken in this case because it becomes possible that messages such as Answer may be discarded.

A.4.2 Essential Services

If a service is essential to a call and the information related to that service is unrecognized, then the call should be released.

A.4.3 Non-Essential Services

If a service is not essential to a call and the information related to that service is unrecognized, then the information should be discarded. A notification should be requested if an explicit indication needs to be generated when the service is not provided. This notification can then result in the explicit service rejection or notification being generated by the exchange that recognizes the contents of the diagnostic field of the Cause indicators parameter contained in the Confusion message (this is an exchange that was capable of generating the information which is notified as being unrecognized).

A.4.4 Broadband/Narrowband Interworking

Services such as many of the supplementary services are developed to operate in both the Broadband and the Narrowband networks. These services should have the Broadband / Narrowband interworking indicator set to 'pass on'. However, some information which may relate more to the nature of the networks such as the Broadband bearer capability should not be passed from the broadband to the narrowband network, hence the Broadband/Narrowband interworking indicator should be set to 'Release call' if bearer service is one which cannot be supported in the narrowband. In other cases, it may be set to 'discard' or 'pass on' dependent on whether the ability of broadband services transiting the narrowband is supported.

A.4.5 Pass On

Pass on allows unrecognized information to be passed through an exchange which is acting as an end node. The pass on not possible indicator must be examined when pass on has been requested but it is not possible to pass on the information. Pass on is not possible when the protocol on the other side of the exchange has a different syntax (message and parameter structure) to the ISUP, or policing actions performed in the exchange prohibit the passing of unrecognized information. When it has been determined that pass on is not possible, another action must be performed, such as release of the call or discarding of the information.

A.5 General Principles for Coding of Instructions Indicator for the Sending Exchanges

- Transit at intermediate exchange indicator
 - The coding of this indicator depends on whether a type B exchange should interpret the corresponding signaling information or not.
- Send notification indicator
 - The coding of this indicator can only be decided on a service basis by the exchange initiating the procedure, which can judge if some kind of notification can help the correct handling of the service if a message or parameter has been discarded.
- Discard message indicator, Discard parameter indicator, Release call indicator, Pass on not possible indicator
 - If not only type B exchanges but also most type A exchanges need not interpret the contents of a parameter, the Parameter Compatibility Information parameter is set to 'pass on'.
 - If some exchanges (type A exchanges or type A and type B exchanges, which depends on the value of Transit at intermediate exchange indicator) have to interpret the contents of a parameter, and even

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if without the parameter, the exchanges can continue processing the message with possibly affecting service, the Parameter Compatibility Information parameter is set to 'discard parameter'.

- If some exchanges (type A exchanges or type A and type B exchanges, which depends on the value of Transit at intermediate exchange indicator) cannot continue processing the message completely without a parameter, the Parameter Compatibility Information parameter is set to 'release call'.

**Signaling System No. 7 (SS7) –
Integrated Services Digital Network (ISDN) User Part**

Chapter 2

General Function of Messages and Signals

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American National Standard on –

Signaling System No.7 (SS7) – Integrated Services Digital Network (ISDN) User Part

Chapter 2: General Function of Messages and Signals

Scope, Purpose, & Application

This chapter describes the elements of signaling information used by the ISDN User Part protocol and their function. The encoding of these elements, the format of the messages in which they are conveyed and their application in the ISDN User Part signaling procedures are described in Chapters ATIS-1000113.2015 – Chapter 3 and ATIS-1000113.2015 – Chapter 4.

A number of messages and parameters are described which are part of the ITU-T ISDN User Part Recommendations but for which there are currently no procedures specified in ANSI standards. The signaling messages and parameters that fall into this category are marked with the note "No procedures specified for U.S. networks".

This chapter may contain requirements that reference other American National Standards. If so, when American National Standards referenced in the requirements are superseded by revisions approved by the American National Standards Institute, Inc., the revision shall apply.

1 Signaling Messages

1.1 Address Complete Message (ACM). A message sent in the backward direction indicating that all the address signals required for routing the call to the called party have been received.

1.2 Answer Message (ANM). A message is sent in the backward direction indicating that the call has been answered. In semi-automatic working this signal has a supervisory function. In automatic working this signal is used in conjunction with charging information in order to:

1. Start metering the charge to the calling subscriber (ITU-T Recommendation Q.28).⁷
2. Start measurement of call duration for international accounting purposes (ITU-T Recommendation E.260)⁶

1.2A Application Transport Message (APM). A message sent in either direction containing the Application Transport parameter.

1.3 Blocking Message (BLO). A message sent for maintenance purposes to the exchange at the other end of a circuit, to cause an engaged condition of that circuit for subsequent calls outgoing from that exchange.

1.4 Blocking Acknowledgement Message (BLA). A message sent in response to a Blocking Message indicating that the circuit has been blocked.

1.5 Call Modification Completed Message (CMC). (No procedures specified for U.S. networks).

⁷ This document is available from the International Telecommunications Union. < <http://www.itu.int/ITU-T/> >

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1.5A Call Modification Reject Message (CMRJ). (No procedures specified for U.S. networks).

1.6 Call Modification Request Message (CMR). (No procedures specified for U.S. networks).

1.7 Call Progress Message (CPG). A message sent in the forward or backward direction indicating that an event has occurred in the progress of a call.

1.8 Circuit Group Blocking Message (CGB). A message sent for maintenance purposes to the exchange at the other end of an identified group of circuits to cause an engaged condition of this group of circuits for subsequent calls outgoing from that exchange.

1.9 Circuit Group Blocking Acknowledgement Message (CGBA). A message sent in response to a Circuit Group Blocking Message to indicate that the requested group of circuits has been blocked.

1.9A Circuit Group Reset Message (GRS). A message sent by an exchange when, due to memory mutilation or for other reasons, it does not know the particular state of a group of circuits and wants to release any calls currently in progress, remove any blocked condition from that group of circuits, and align their state with the state of those circuits as perceived by the far-end exchange.

1.9B Circuit Group Reset Acknowledgement Message (GRA). A message sent in response to a Circuit Group Reset Message to indicate that the circuit group reset has been performed.

1.10 Circuit Group Unblocking Message (CGU). A message sent to the exchange at the other end of an identified group of circuits to cause cancellation in that group of circuits of an engaged condition invoked earlier by a Circuit Group Blocking Message.

1.11 Circuit Group Unblocking Acknowledgement Message (CGUA). A message sent in response to a Circuit Group Unblocking Message to indicate that the requested group of circuits has been unblocked.

1.11A Circuit Query Message (CQM). A message sent on a routine or demand basis to request the exchange at the other end of a group of circuits to give the state of circuits in a particular range.

1.11B Circuit Query Response Message (CQR). A message sent in response to a Circuit Query Message to indicate the state of all circuits in a particular range.

1.11C Circuit Reservation Message (CRM). A message sent in the forward direction only when interworking with Exchange Access MF signaling to reserve a circuit and initiate any required continuity check.

1.11D Circuit Reservation Acknowledgement Message (CRA). A message sent in the backward direction in response to a circuit reservation message indicating that a circuit has been reserved for an incoming call.

1.11E Circuit Validation Response Message (CVR). A message sent in response to a Circuit Validation Test Message to convey translation information for the indicated circuit.

1.11F Circuit Validation Test Message (CVT). A message sent on a routine or demand basis to request circuit translation information from the exchange at the other end of a circuit.

1.12 Closed User Group Selection and Validation Request Message (CSVR). (No procedure specified for U.S. networks).

1.13 Closed User Group Selection and Validation Response Message (CSVS). (No procedure specified for U.S. networks).

1.13A Confusion Message (CFN). A message sent in response to any message (other than a confusion message) if the exchange does not recognize the message or detects part of a message as being unrecognized.

1.13B Connect Message (CON). (No procedures specified for U.S. networks).

1.14 Continuity Message (COT). A message sent in the forward direction indicating continuity status of the preceding circuit(s) as well as of the selected circuit to the following exchange, including verification of the communication path across the exchange with the specified degree of reliability.

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1.15 Continuity Check Request Message (CCR). A message sent by an exchange for a circuit on which a continuity check is to be performed, to the exchange at the other end of the circuit, requesting continuity checking equipment to be attached.

1.16 Delayed Release Message (DRS). (No procedures specified for U.S. networks).

1.16A Exit Message (EXM). A message sent in the backward direction from an outgoing gateway exchange to indicate that call set-up information has successfully progressed to the adjacent network. This message is for intra-network use only.

1.17 Facility Accepted Message (FAA). (No procedures specified for U.S. networks).

1.18 Facility Deactivated Message (FAD). (No procedure specified for U.S. networks).

1.19 Facility Information Message (FAI). (No procedure specified for U.S. networks).

1.19A Facility Message (FAC). A message sent by an exchange in either direction and in any phase of the call to request an action at another exchange. The message may also be used by the exchange in which the action is being performed to notify the requesting exchange of the success or failure to complete the action.

1.20 Facility Reject Message (FRJ). (No procedures specified for U.S. networks).

1.21 Facility Request Message (FAR). (No procedures specified for U.S. networks).

1.22 Forward Transfer Message (FOT). A message sent in the forward direction on semi-automatic calls when the operator wants the help of an operator at a distant exchange. The message will normally serve to bring an assistance operator (see ITU-T Recommendation Q.101) into the circuit if the call is automatically set up at the exchange. When the call is completed via an operator (incoming or delay operator), the message should preferably cause this operator to be recalled.

1.23 Information Message (INF). A message sent to convey additional call related information, which may have been requested in an Information Request Message.

1.24 Information Request Message (INR). A message sent by an exchange to request additional call related information.

1.25 Initial Address Message (IAM). A message sent in the forward direction to initiate seizure of an outgoing circuit and to transmit number and other information relating to the routing and handling of a call.

1.25A Loop Back Acknowledgement Message (LPA). A message sent in the backward direction in response to a Continuity Check Request Message indicating that a loop (or transceiver in the case of a 2-wire circuit) has been connected.

1.25B Overload Message. (No procedure specified for U.S. networks).

1.26 Pass Along Message (PAM). A message that may be sent in either direction to transfer information between two signaling points along the same signaling path as that used to establish a physical connection between those two points.

1.27 Pause Message. Replaced by 1.36A, *Suspend Message*.

1.27A Pre-Release Information Message (PRI). A message to be used with the Release message for the transport of information where sending of that information in the Release message itself would cause compatibility problems with ISUP 2000 and subsequent version of the ISUP protocol.

1.28 Reject Connect Modify Message. Replaced by 1.5A, *Call Modification Reject Message*

1.29 Release Message (REL). A message sent in either direction indicating that the circuit identified in the message is being released due to the reason (cause) supplied and is ready to be put in the idle state on receipt of the Release Complete Message.

1.30 Release Complete Message (RLC). A message sent in either direction in response to the receipt of a Release Message, or if appropriate, to a Reset Circuit Message, when the circuit concerned has been brought into the idle condition.

1.31 Released Message. Message no longer required. See instead 1.29, *Release Message*.

1.32 Reset Circuit Message (RSC). A message that is sent by an exchange when, due to memory mutilation or for other reasons, it does not know the particular state of a circuit and wants to release any calls currently in progress, remove any remotely blocked condition from that circuit and align its state with the state of that circuit as perceived by the far-end exchange.

1.33 Reset Circuit Group Message. Replaced by 1.9A, *Circuit Group Reset Message*.

1.34 Reset Circuit Group Acknowledgement Message. Replaced by 1.9B, *Circuit Group Reset Acknowledgement Message*.

1.35 Resume Message (RES). A message sent in the backward direction to indicate reanswer from an interworking node, or that a non-ISDN called party has gone off-hook within a certain time after going on-hook during the active phase of a call.

1.35A Segmentation Message (SGM). A message sent in either direction to convey an additional segment of an overlength message.

1.36 Subsequent Address Message (SAM). (No procedures specified for U.S. networks).

1.36A Suspend Message (SUS). A message sent in the backward direction to indicate clear-back from an interworking node or that a non-ISDN called party has gone on-hook during the active state of a call.

1.37 Unblocking Message (UBL). A message sent to the exchange at the other end of a circuit to cancel, in that exchange, the engaged condition of the circuit caused by a previously sent Blocking Message.

1.38 Unblocking Acknowledgement Message (UBA). A message sent in response to an Unblocking Message indicating that the circuit has been unblocked.

1.38A Unequipped Circuit Identification Code Message (UCIC). A message sent from one exchange to another when it receives a message that contains an unequipped circuit identification code.

1.39 Unsuccessful Backward Set-up Information Message. Message no longer required. See instead 1.29, *Release Message*.

1.40 User-to-User Information Message (USR). (No procedures specified for U.S. networks).

2 Signaling Information

2.1 Access Barred. (No procedure specified for U.S. networks).

2.1A Access Transport. Information generated on the access side of a call and transferred transparently in either direction between the originating and terminating local exchanges. The information is of significance to both users and local exchanges.

2.2 Address Incomplete. Replaced by 2.23A, *Cause Value*.

2.3 Address Presentation Restricted Indicator. Information sent in either direction to indicate that the address information is not to be presented to a public network user, but can be passed to another public network.

2.3A Application Transport. Information sent in either direction to allow the peer-to-peer communication of application transport mechanism user applications, consisting of the following:

- **Application context identifier.** A value that uniquely identifies the application using the application transport mechanism.
- **Application Transport Instruction Indicators (ATII).** Information sent in either direction indicating how an exchange should react in case the indicated application using the application transport mechanism is not supported.
- **APM segmentation indicator.** Information sent in either direction to indicate the number of remaining segments carrying information using the APM mechanism that will be forwarded.
- **APM-user information.** Information supplied by the Application Transport Mechanism user application required to be transported by the application transport mechanism.
- **Sequence indicator.** Used to indicate the beginning (first segment) of an APM segmentation procedure sequence.
- **Segmentation Local Reference (SLR).** A unique value to a call used to associate segments in an APM segmentation procedure.
- **Destination Address.** In the Application Transport Mechanism, the address of the node where the Application Transport Mechanism user application information shall be delivered.
- **Destination Address length.** In the Application Transport Mechanism, the binary coded information indicating the number of octets in the Destination Address field.
- **Originating Address.** In the Application Transport Mechanism, the address of the node which has initiated the relationship with the remote Application Transport Mechanism user application.
- **Originating Address length.** In the Application Transport Mechanism, the binary coded information indicating the number of octets in the Originating Address field.

2.4 Address Signal. An element of information in a network address. The address signal may indicate digit values 0 to 9, code 11 or code 12. One address signal value is reserved to indicate end of pulsing of the called party number (ST) and is not used.

2.4A Alarm Carrier Indicator. Information sent in either direction indicating the type of carrier alarm handling.

2.4B Attendant Status. An indication sent within the business group parameter signifying whether or not the business group information pertains to an attendant line.

2.4C Automatic Congestion Level. Information optionally included in a Release Message and sent to the exchange at the other end of a circuit to indicate that a particular level of congestion exists at the sending exchange.

2.4CA Automatic Re-Routing. Information sent in either direction giving information about automatic re-routing of a call.

2.4D Backward Call Indicators. Information sent in the backward direction consisting of the charge indicator, called party's status indicator, called party's category indicator, end-to-end method indicator, interworking indicator, end-to-end information indicator, ISDN User Part indicator, holding indicator, ISDN access indicator, echo control device indicator, and SCCP method indicator.

2.4E Business Group. Information sent in either direction to indicate the identity of the Multi-Location Business Group associated with a number (e.g., the Calling Party Number), the identity of a Subgroup within that Multilocation Business Group and the Line Privileges allocated to the number.

2.4F Business Group Identifier. Information sent within the business group parameter to indicate the identity of the corresponding Multilocation Business Group.

2.4G Business Group Identifier Type. Information sent within the business group parameter to indicate the type of business group identification used, e.g., multi-location business group identifier or interworking with private networks identifier.

2.5 Call Failure Indicator. Replaced by 2.23, *Cause Value*.

2.6 Call Forwarding Indicator. Replaced by 2.63, *Redirection Information*.

2.6A Call Forwarding May Occur Indicator. (No procedure specified for U.S. networks).

2.7 Call Identity. Information sent in the call reference parameter indicating the identity of a call in a signaling point.

2.7A Call Modification Indicators. (No procedure specified for U.S. networks).

2.8 Call Reference. Circuit independent information identifying a particular call.

2.9 Call Rerouting Indicator. (No procedure specified for U.S. networks).

2.10 Called Party Number. Information sent in the forward direction to identify the called party and consisting of the odd/even indicator, nature of address indicator, numbering plan indicator, and address signals.

2.11 Called Party Address Request Indicator. (No procedure specified for U.S. networks).

2.12 Called Party Address Response Indicator. (No procedure specified for U.S. networks).

2.13 Called Party Free Indicator. (No procedure specified for U.S. networks).

2.14 Called Party's Category Indicator. Information sent in the backward direction indicating the category of the called party, e.g., ordinary subscriber or payphone.

2.15 Called Party's Status Indicator. Information sent in the backward direction indicating the status of the called party, e.g., subscriber free.

2.15A Calling Geodetic Location. Information that indicates the geodetic location of the calling party. The reference system for the coding is the World Geodetic System 1984 (WGS-84). The origin of the WGS-84 coordinate system is the geometric center of the WGS-84 ellipsoid. The ellipsoid is constructed by the rotation of an ellipse around the minor axis that is oriented in the North-South direction. The rotation axis is the polar axis of the ellipsoid, and the plane orthogonal to it and including the center of symmetry is the equatorial plane.

The relevant dimensions are as follows:

- Major Axis (a) = 6378137m
- Minor Axis (b) = 6356752.314m

Co-ordinates are then expressed in terms of longitude and latitude relevant to this ellipsoid. The range of longitude is -180° to $+180^{\circ}$, and the range of latitude is -90° to $+90^{\circ}$. 0° longitude corresponds to the Greenwich Meridian, and positive angles are to the East, while negative angles are to the West. 0° latitude corresponds to the equator, and positive angles are to the North, while negative angles are to the South. Altitudes are defined as the distance between the ellipsoid and the point, along a line orthogonal to the ellipsoid.

2.15AA Location presentation restricted indicator. Information that indicates that the geodetic location information is not to be presented to a public network user, but can be passed to another public network. It may also be used to indicate that the geodetic location cannot be ascertained.

2.15AB Type of shape. Information that indicates the format of the geodetic location information held in the associated shape description.

2.15AC Shape description. Information that describes the geodetic location of the calling party.

2.15AD Ellipsoid point shape description. Information that describes a point on the surface of the WGS-84 ellipsoid that consists of latitude and longitude. In practice, such a description can be used to refer to a point on Earth's surface, or close to Earth's surface, with the same longitude and latitude. Figure 2.1 of ATIS-1000113.2015 – Chapter 2 illustrates a point on the surface of the ellipsoid and its co-ordinates.

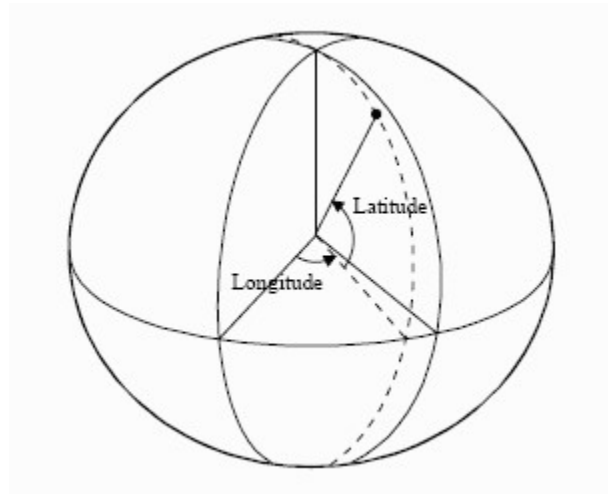


Figure 2.1 – Description of ellipsoid point as two co-ordinates – ATIS-1000113.2015 – Chapter 2

The latitude is the angle between the equatorial plane and the perpendicular to the plane tangent to the ellipsoid surface at the point. Positive latitudes correspond to the North hemisphere. The longitude is the angle between the half-plane determined by the Greenwich meridian and the half-plane defined by the point and the polar axis, measured Eastward.

2.15AE Ellipsoid point with uncertainty shape description. Information that describes a point that is characterized by the co-ordinates of an ellipsoid point (the origin) and a distance r . It describes the set of points on the ellipsoid which are at a distance from the origin less than or equal to r , the distance being the geodesic distance over the ellipsoid, i.e., the minimum length of a path staying on the ellipsoid and joining the two points, as shown Figure 2.2 - ATIS-1000113.2015 – Chapter 2. Similar to the ellipsoid point, this can be used to indicate points on the Earth surface, or near the Earth surface, of same latitude and longitude. The typical use of this shape is to indicate a point when its position is known only with a limited accuracy.

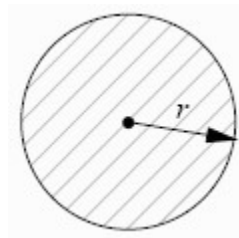


Figure 2.2 - Description of uncertainty – ATIS-1000113.2015 – Chapter 2

2.15AF Point with altitude and uncertainty shape description. Information that describes a point that is characterized by the co-ordinates of an ellipsoid point, an uncertainty distance r , an altitude a and an altitude uncertainty h . It describes the set of points which are at a vertical distance h or less from the origin. The origin is a point at altitude a above an ellipsoid point with uncertainty (see 2.15AE) as shown in Figure 2.3 - ATIS-1000113.2015 – Chapter 2.

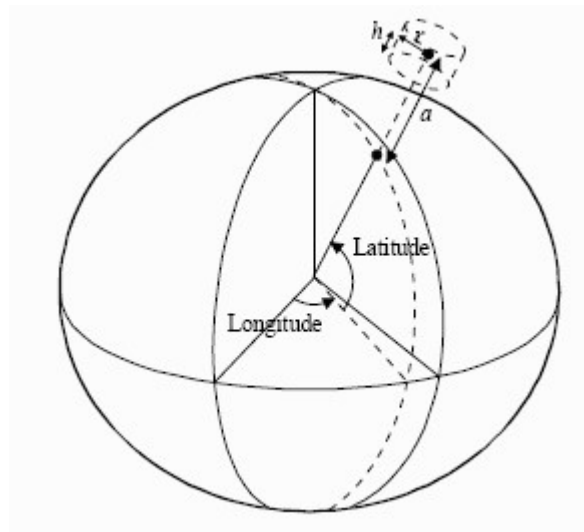


Figure 2.3 –Description of a point with altitude and uncertainty – ATIS-1000113.2015 – Chapter 2

- A connecting line shall not cross another connecting line;
- Two successive points must not be diametrically opposed on the ellipsoid.

The described area is situated to the right of the lines with the downward direction being toward the Earth's center and the forward direction being from a point to the next.

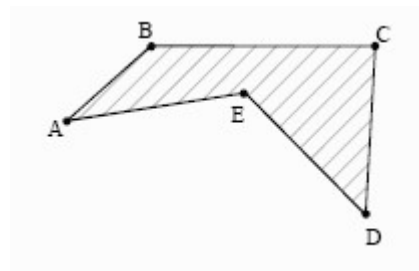


Figure 2.4 –Description of a polygon – ATIS-1000113.2015 – Chapter 2

2.15AH Latitude sign. Information that indicates the geodetic location of the calling party in terms of Northern or Southern Hemisphere.

2.15AI Degrees of latitude. Information that indicates the geodetic location of the calling party in terms of degrees of latitude north or south of the equator.

2.15AJ Degrees of longitude. Information that indicates the geodetic location of the calling party in terms of degrees of longitude east or west of the Greenwich Meridian.

2.15AK Uncertainty code. Information that indicates the level of uncertainty inherent to the associated longitude/latitude information.

2.15AL Altitude sign. Information that indicates the geodetic location of the calling party in terms of above or below the WGS-84 ellipsoid surface.

2.15AM Altitude. Information that indicates the geodetic location of the calling party in terms of distance above or below the WGS-84 ellipsoid surface.

2.15AN Altitude uncertainty code. Information indicating the level of uncertainty inherent to the associated altitude information.

2.15AO Ellipse on the ellipsoid shape description. Information that describes the set of points on the ellipsoid that lie within the defining ellipse. The ellipse is characterized by the coordinates of an ellipsoid point (the origin), the major and minor radii of the ellipse r_{major} and r_{minor} , and the orientation of the ellipse θ which describes the angle between the major radius of the ellipse and North, as shown in Figure 2.5 - ATIS-1000113 – Chapter 2.

Similar to the ellipsoid point, this shape description can be used to indicate points on the Earth's surface, or near the surface.

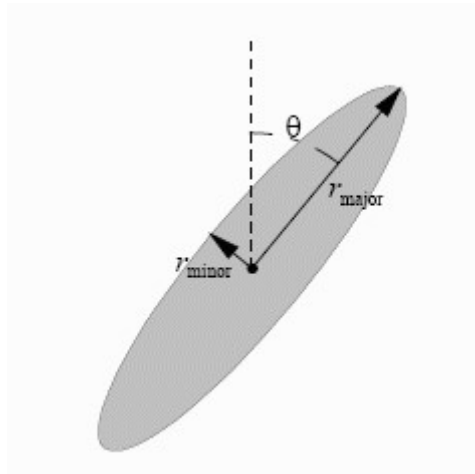


Figure 2.5 –Description of an ellipse on the ellipsoid – ATIS-1000113.2015 – Chapter 2

2.15AP Ellipsoid circle sector shape description. Information that describes the set of points on the ellipsoid that lie within the defining circle sector. The circle sector is characterized by the coordinates of an ellipsoid point (the origin), the radius of the circle sector r , being the geodesic distance over the surface of the ellipsoid, the offset angle (θ) between the first defining radius of the sector and North, and the included angle (β) being the angle between the first and second defining radius, as shown in Figure 2.6 - ATIS-1000113.2015 – Chapter 2.

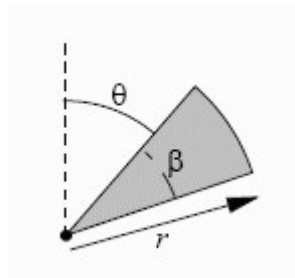


Figure 2.6 – Description of a circle sector – ATIS-1000113.2015 – Chapter 2

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2.15AQ Major radius. Information identifying the size of the major axis of an ellipse on the ellipsoid shape description.

2.15AR Minor radius. Information identifying the size of the minor axis of an ellipse on the ellipsoid shape description.

2.15AS Orientation. Information identifying the orientation of an ellipse on the ellipsoid.

2.15AT Confidence. Information identifying the confidence by which it is known that the calling party lies within the associated shape description.

2.15AU Radius. Information identifying the size of the radius of the associates circle sector shape description.

2.15AV Offset. Information identifying the offset of a circle sector from North.

2.15AW Included angle. Information identifying the included angle of a circle sector.

2.16 Calling Party Number. Information sent in the forward direction to identify the calling party and consisting of the odd/even indicator, nature of address indicator, numbering plan indicator, address presentation restriction indicator, screening indicator, and address signals. The Calling Party Number provides numbering information related to the calling party.

2.17 Calling Party Address Request Indicator. (No procedures specified for U.S. networks).

2.18 Calling Party Address Response Indicator. (No procedures specified for U.S. networks).

2.19 Calling Party Answer Indicator. (No procedure specified for U.S. networks).

2.19A Calling Party Number Incomplete Indicator. (No procedures specified for U.S. networks).

2.20 Calling Party's Category. Information sent in the forward direction indicating the category of the calling party, e.g., ordinary subscriber, test call.

2.21 Calling Party's Category Request Indicator. (No procedures specified for U.S. networks).

2.22 Calling Party's Category Response Indicator. (No procedures specified for U.S. networks).

2.22A Carrier Identification Code. Information sent in the forward direction to the transit network indicating the transit network selected by the originating subscriber.

2.22B Carrier Selection Information. Information sent in the forward direction to indicate whether the calling user selected the transit network by presubscription or dialed input and if presubscribed whether or not the carrier identification code was also dialed.

2.22C Carrier Service Provider Identification. Information sent in the forward direction indicating the potential carriers associated with the call and the carrier selected for the call as dialed if other than the local service provider.

2.23 Cause Indicators. Information sent in either direction consisting of the coding standard, location, cause value and diagnostics. It indicates the reason for sending the message in which it is contained, e.g., the Release, Address complete or Confusion messages, and identifies the network in which the message originated, e.g., local network, transit network, remote local network.

2.23A Cause Value.

a) ITU-T standard causes

The following cause values, names, and definitions are those identified in Q.850 as pertaining to ISUP.

Normal Class

Cause 1 Unallocated (*unassigned*) number. This cause indicates that the called party cannot be reached because, although the called party number is in a valid format, it is not currently allocated (assigned).

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Cause 2 No route to specified transit network. This cause indicates that the equipment sending this cause has received a request to route the call through a particular transit network which it does not recognize. The equipment sending this cause does not recognize the transit network either because the transit network does not exist or because that particular transit network, while it does exist, does not serve the equipment which is sending this cause. This cause is supported on a network-dependent basis.

Cause 3 No route to destination. This cause indicates that the called party cannot be reached because the network through which the call has been routed does not serve the destination desired. This cause is supported on a network-dependent basis.

Cause 4 Send special information tone. This cause indicates that the called party cannot be reached for reasons that are of long term nature and that the special information tone should be returned to the calling party.

Cause 5 Misdialled trunk prefix. (No procedures specified for U.S. networks)

Cause 8 Preemption. This cause indicates that the call is being preempted.

Cause 9 Preemption - circuit reserved for reuse. This cause indicates that the call is being preempted and the circuit is reserved for reuse by the preempting exchange.

Cause 16 Normal call clearing. This cause indicates that the call is being cleared because one of the users involved in the call has requested that the call be cleared. Under normal situations, the source of this cause is not the network.

Cause 17 User busy. This cause is used to indicate that the called party is unable to accept another call because the user busy condition has been encountered. This cause value may be generated by the called user or by the network. In the case of user determined user busy, it is noted that the user equipment is compatible with the call.

Cause 18 No user responding. This cause is used when a called party does not respond to a call establishment message with either an alerting or connect indication within the prescribed period of time allocated.

Cause 19 No answer from user (user alerted). This value is used when the called party has been alerted but does not respond with a connect indication within a prescribed period of time. Note - This cause is not necessarily generated by Q.931 procedures but may be generated by internal network timers.

Cause 20 Subscriber absent. This cause value is used when a mobile station has logged off, radio contact is not obtained with a mobile station or if a personal telecommunication user is temporarily not addressable at any user-network interface.

Cause 21 Call rejected. This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible. This cause may also be generated by the network, indicating that the call was cleared due to a supplementary service constraint. The diagnostic field may contain additional information about the supplementary service and reason for rejection.

Cause 22 Number changed. This cause is returned to a calling party when the called party number indicated by the calling party is no longer assigned. The new called party number may optionally be included in the diagnostic field. If a network does not support this cause value, cause number 1, unallocated (unassigned) number shall be used.

Cause 23 Redirect to new destination. This cause is used by a general ISUP protocol mechanism that can be invoked by an exchange that decides that the call should be set up to a different called number.

Cause 27 Destination out of order. This cause indicates that the destination indicated by the user can not be reached because the interface to the destination is not functioning correctly. The term "not functioning correctly" indicates that a signaling message was unable to be delivered to the remote party; e.g., a physical layer or data link layer failure at the remote party, or user equipment off-line.

Cause 28 Invalid number format (address incomplete). This cause indicates that the called party cannot be reached because the called party number is not in a valid format or is not complete.

NOTE - This condition may be determined:

- immediately after reception of an ST signal, or

- on time-out after the last received digit.

Cause 29 Facility *rejected*. This cause is returned when a supplementary service requested by the user cannot be provided by the network.

Cause 31 Normal, *unspecified*. This cause is used to report a normal event only when no other cause in the normal class applies.

Resource Unavailable Class

Cause 34 No *circuit/channel available*. This cause indicates that there is no appropriate circuit/channel presently available to handle the call.

Cause 38 Network *out of order*. This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time, e.g., immediately re-attempting the call is not likely to be successful.

Cause 41 Temporary *failure*. This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time, e.g., the user may wish to try another call attempt almost immediately.

Cause 42 Switching *equipment congestion*. This cause indicates that the switching equipment generating this cause is experiencing a period of high traffic.

Cause 43 Access *information discarded*. This cause indicates that the network could not deliver access information to the remote user as requested, i.e., user-to-user information, low layer compatibility, high layer compatibility, or sub-address, as indicated in the diagnostic.

It is noted that the particular type of access information discarded is optionally included in the diagnostic.

Cause 44 Requested *circuit/channel not available*. This cause is returned when the circuit or channel indicated by the requesting entity cannot be provided by the other side of the interface.

Cause 46 Precedence *call blocked*. This cause indicates that there are no preemptable circuits or that the called user is busy with a call of equal or higher preemptable level.

Cause 47 Resource *unavailable, unspecified*. This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.

Service or Option Unavailable Class

Cause 50 Requested *facility not subscribed*. This cause indicates that the user has requested a supplementary service which is implemented by the equipment which generated this cause, but the user is not authorized to use.

Cause 53 Outgoing *calls barred within CUG*. (No procedures specified for U.S. networks).

Cause 55 Incoming *calls barred within CUG*. (No procedures specified for U.S. networks)

Cause 57 Bearer *capability not authorized*. This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but the user is not authorized to use.

Cause 58 Bearer *capability not presently available*. This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but which is not available at this time.

Cause 62 Inconsistency *in designated outgoing access information and subscriber class*. This cause indicates that there is an inconsistency in the designated outgoing access information and subscriber class.

Cause 63 Service *or option not available, unspecified*. This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.

Service or Option Not Implemented Class

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Cause 65 Bearer *capability not implemented*. This cause indicates that the equipment sending this cause does not support the bearer capability requested.

Cause 69 Requested *facility not implemented*. This cause indicates that the equipment sending this cause does not support the requested supplementary service.

Cause 70 Only *restricted digital information bearer capability is available*. This cause indicates that the calling party has requested an unrestricted bearer service but that the equipment sending this cause only supports the restricted version of the requested bearer capability.

Cause 79 Service or option *not implemented, unspecified*. This cause is used to report a service or option not implemented event only when no other cause in the service or option not implemented class applies.

Invalid Message (e.g., Parameter out of Range) Class

Cause 87 User *not member of CUG*. (No procedures specified for U.S. networks).

Cause 88 Incompatible *destination*. This cause indicates that the equipment sending this cause has received a request to establish a call which has low layer compatibility, high layer compatibility, or other attributes (e.g., data rate) which cannot be accommodated.

Cause 90 Non-existent *CUG*. (No procedures specified for U.S. networks).

Cause 91 Invalid *transit network selection*. This cause indicates that a transit network identification was received which is of an incorrect format as defined in Annex C of T1.607.

Cause 95 Invalid *message, unspecified*. This cause is used to report an invalid message event only when no other cause in the invalid message class applies.

Protocol Error (e.g., Unknown Message) Class

Cause 97 Message *type non-existent or not implemented*. This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

Cause 99 Information *element/Parameter non-existent or not implemented*. This cause indicates that the equipment sending this cause has received a message which includes information element(s)/parameter(s) not recognized because the information element identifier(s)/parameter name(s) are not defined or are defined but not implemented by the equipment sending the cause. This cause indicates that the information element(s)/parameter(s) were discarded. However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.

Cause 102 Recovery *on timer expiry*. This cause indicates that a procedure has been initiated by the expiry of a timer in association with error handling procedures.

Cause 103 Parameter *non-existent or not implemented - passed on*. This cause indicates that the equipment sending this cause has received a message which included parameters not recognized because the parameters are not defined or are defined but not implemented by the equipment sending the cause. The cause indicates that the parameter(s) were ignored. In addition, if the equipment sending this cause is an intermediate point, then this cause indicates that the parameter(s) were passed on unchanged.

Cause 110 Message *with unrecognized parameter discarded*. This cause indicates that the equipment sending this cause has discarded a received message which includes a parameter that is not recognized.

Cause 111 Protocol *error, unspecified*. This cause is used to report a protocol error event only when no other cause in the protocol error class applies.

Interworking Class

Cause 127 Interworking, *unspecified*. This cause indicates that there has been interworking with a network which does not provide causes for actions it takes. Thus, the precise cause for a message which is being sent cannot be ascertained.

b) ANSI standard causes

Normal Class

Cause 23 Unallocated *destination number*. This cause indicates failure of a business group call because the destination number is unallocated in the business group numbering plan.

Cause 24 Unknown *business group*. This cause indicates failure of a business group call because the business group identifier is unknown.

Cause 25 Exchange *routing error*. This cause indicates that the called party cannot be reached because of an error in exchange number translation tables used to route the call (results when the hop counter parameter value is decremented to 0).

Cause 26 Misrouted *call to a ported number*. This cause indicates that the called party cannot be reached because the “ported number” in the generic address parameter identifies a called party that is not served by the exchange.

Cause 27 Number portability Query on Release (QoR) number not found. (No procedure specified for U.S. networks).

Resource Unavailable Class

Cause 45 Preemption. [Used by T1.113-1988 and ATIS-1000619.1992(R2015)..] This cause indicates that the equipment sending this cause has preempted the circuit for a new call and the existing call should be cleared.

Cause 46 Precedence *call blocked*. [Used by T1.113-1988 and ATIS-1000619.1992(R2015).] In case of a call with a precedence level higher than the lowest level (ROUTINE), this cause indicates that all circuits are busy on calls of equal or higher priority.

Service or Option Not Available Class

Cause 51 Call *type incompatible with service request*. This cause indicates that an action was rejected because it was not compatible with the bearer capability of the call.

Cause 54 Call *blocked due to group restrictions*. This cause indicates failure of a business group call because it did not pass line privileges and/or subgroup screening.

2.24 CCBS Call Indicator. (No procedure specified for U.S. networks).

2.25 Charge Indicator. Information sent in the backward direction indicating whether or not the call is chargeable.

2.25A Charge Number. Information sent in either direction indicating the chargeable number for the call and consisting of the odd/even indicator, nature of address indicator, numbering plan indicator, and address signals.

2.26 Charge Information Request Indicator. (No procedure specified for U.S. networks).

2.27 Charge Information Response Indicator. (No procedure specified for U.S. networks).

2.27A Circuit Group Blocking Type Indicator. Information sent in a Circuit Group Blocking (Unblocking) (Acknowledgement) Message indicating the blocking procedure used.

2.27B Circuit Group Carrier Indicator. Information sent in either direction indicating if the circuit group carrier is analog, digital, or analog and digital.

2.27C Circuit Group Characteristics Indicator. Information sent in response to a request for circuit validation, indicating the characteristics of the concerned circuit group in terms of carrier type, double seizing control, alarm handling and continuity check requirements.

2.27D Circuit Assignment Map. Information identifying the map format and the circuits in a multi-rate connection. For the DS1 map format it identifies the DS0 circuits constituting an NxDS0 connection. The circuit assignment map is used only for NxDS0 calls when non-contiguous time slot allocation is used.

2.28 Circuit Group Congestion. Replaced by 2.23, *Cause Value*

2.29 Circuit Group Supervision Message Type Indicator. Information sent in either direction in a circuit group supervision message and consisting of the circuit group blocking type indicator.

2.30 Circuit Identification Code. Information identifying the physical path between a pair of exchanges.

2.30A Circuit Identification Name. Information identifying the exchanges on which a circuit group terminates and the number of each trunk within that group.

2.30B Circuit State Indicator. Information indicating the state of a circuit according to the sending exchange.

2.30C Circuit Validation Response Indicator. Information indicating the far-end results of a circuit validation test.

2.31 Closed User Group Call Indicator. (No procedure specified for U.S. networks).

2.32 Closed User Group Check Successful Indicator. (No procedure specified for U.S. networks).

2.33 Closed User Group Interlock Code. (No procedures specified for U.S. networks).

2.33A Coding Standard. Information sent in association with a parameter (e.g., cause indicators) identifying the standard in which the parameter format is defined.

2.33B COMMON LANGUAGE Location Identification (CLLI) Code™.⁸ COMMON LANGUAGE Location Identification (CLLI) information used for circuit validation to identify a switching office by town, state, and building subdivision.

2.33C Connected Address Request Indicator. (No procedure specified for U.S. networks).

2.33D Connected Address Response Indicator. (No procedure specified for U.S. networks).

2.33E Connected Number. (No procedures specified for U.S. networks).

2.34 Connection Request. Information sent in the forward direction on behalf of the Signaling Connection Control Part requesting the establishment of an end-to-end connection and consisting of the local reference, point code, protocol class, and credit.

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

2.35A Continuity Check Requirement Indicator. Information sent in either direction indicating if and how often a continuity check is required for the circuit group.

2.36 Continuity Indicator. Information sent in the forward direction indicating whether or not the continuity check on the outgoing circuit was successful. A continuity check successful indication also implies continuity of the preceding circuits and successful verification of the path across the exchange with the specified degree of reliability.

2.36A Continuity Indicators. Information sent in the forward direction consisting of the continuity indicator.

2.37 Credit. Information sent in a connection request, indicating the window size requested by the signaling connection control part for an end-to-end connection.

2.37B Diagnostic. Information which is sent in association with a cause value and which provides supplementary information about the reason for sending the message.

2.38 Divergence Indicator. (No procedure specified for U.S. networks).

⁸ COMMON LANGUAGE is a registered trademark and CLLI is a trademark of Telcordia Technologies, Inc.

2.38A Double Seizing Control Indicator. Information sent in either direction indicating the type of double seizing control applied to the circuit group.

2.39 Echo Control Device Indicator. Information sent in the forward direction indicating whether or not an outgoing half echo control device is included in the connection.

2.39A Egress Service. Information sent in the forward direction by the first incoming exchange in the terminating exchange area, to indicate network specific attributes associated with the terminating exchange (e.g., the interexchange carrier, the point of interconnection, and type of terminating access service).

2.40 End-to-End Information Indicator. Information sent in either direction indicating whether or not the sending exchange has further call information available for end-to-end transmission.

2.41 End-to-End Method Indicator. Information sent in either direction indicating the available methods, if any, for end-to-end transfer of information.

2.41A Event Indicator. Information sent in either direction to indicate the type of event which caused a Call Progress message to be sent.

2.41B Event Information. Information sent in either direction consisting of the event indicator and event presentation restricted indicator.

2.41C Event Presentation Restricted Indicator. Information sent in either direction to indicate that the occurrence of the concerned event should not be reported to the user.

2.41D Extension Indicator. Information indicating whether or not the associated octet has been extended.

2.42 Facility Indicator. (No procedures specified for U.S. networks).

2.42A Facility Information Indicator. (No procedure specified for U.S. networks).

2.42B Facility Information Indicators. (No procedure specified for U.S. networks).

2.42C Facility Request Active Indicator. (No procedure specified for U.S. networks).

2.42D Facility Request Enquiry Indicator. (No procedure specified for U.S. networks).

2.42E Feature Code Indicator. Information sent in either direction to invoke a specific feature operation at the terminating or originating switch.

2.42F Forward Call Indicators. Information sent in the forward direction consisting of the incoming international call indicator, end-to-end method indicator, interworking indicator, end-to-end information indicator, ISDN User Part indicator, ISDN User Part preference indicator, ISDN access indicator, and SCCP method indicator.

2.43 In Call Modification Indicator. (No procedure specified for U.S. networks).

2.43A Generic Address. Information in the form of an address pertaining to a supplementary service (e.g., dialed number, destination number) and including type of address, nature of address, and numbering plan indications.

2.43B Generic Digits. Information in the form of digits pertaining to a supplementary service , (e.g., account code, authorization code, private network class mark) and including type of digits and encoding method indicators.

2.43C Generic Name. Information sent in the forward direction containing specific name related information.

2.43D Holding Indicator. (No procedures specified for U.S. networks).

2.43E Hop Counter. Information sent in the forward direction to minimize the impact of IAM looping. The initial count determines the maximum number of contiguous SS7 interexchange circuits that are allowed to complete the call, assuming all subsequent intermediate exchanges decrement the hop counter.

2.43F Inband Information Indicator. Information sent in the backward direction to indicate that inband information, e.g., a tone or announcement, is present on the circuit path.

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2.43G Incoming International Call Indicator. Information sent in the forward direction indicating whether the call is an incoming international or an incoming national call.

2.44 Index. (No procedure specified for U.S. networks).

2.45 Index Request Indicator. (No procedure specified for U.S. networks).

2.45A Index Response Indicator. (No procedure specified for U.S. networks).

2.45B Information Indicators. Information sent in either direction consisting of the calling party address response indicator, connected address response indicator, calling party's category response indicator, charge information response indicator, and solicited information indicator.

2.45C Information Request Indicators. Information sent in either direction consisting of the calling party address request indicator, connected address request indicator, calling party's category request indicator, charge information request indicator, malicious call identification request indicator, and holding indicator.

2.45D Information Transfer Capability. Information sent in the forward direction indicating the type of transmission medium required for the connection.

2.45E Information Transfer Rate. Information sent in the forward direction indicating the information transfer rate.

2.46 Interworking Indicator. Information sent in either direction indicating whether or not Signaling System No.7 is used in all parts of the network connection.

2.46A ISDN Access Indicator. Information sent in either direction indicating whether or not the access signaling protocol is ISDN.

2.47 ISDN User Part Indicator. Information sent in either direction to indicate that the ISDN User Part is used in all parts of the network connection.

2.47A ISDN User Part Preference Indicator. Information sent in the forward direction indicating whether or not the ISDN User Part is required or preferred in all parts of the network connection.

2.47B Jurisdiction Information. Information sent in the forward direction indicating the geographic origination of the call.

2.48 Line Out of Service. Replaced by 2.23, *Cause Value*.

2.48A Line Privileges Information Indicator. Information sent within the business group parameter signifying whether the indicated line privileges are standard or customer defined.

2.48B Line Privileges. Information sent within the business group parameter to indicate the privileges of the user identified by the corresponding number.

2.48C Local Service Provider Identification. Information sent in the forward and backward directions identifying the local service providers of the calling and called parties, respectively.

2.49 Local Reference. Information sent in the connection request, indicating the local reference allocated by the signaling connection control part to an end-to-end connection.

2.49A Look-ahead For Busy. Information sent within the precedence parameter indicating whether the look-ahead for busy option is allowed or whether the path has been reserved.

2.50 Malicious Call Identification Request Indicator. (No procedures specified for U.S. networks).

2.50A Message Compatibility Information. Information sent in either direction indicating how an exchange should react in case a message is unrecognized.

2.51 Misdialed Trunk Prefix. Replaced by 2.23, *Cause Value*.

2.51A Modification Indicator. (No procedures specified for U.S. networks).

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- 2.51B MLPP Service Domain.** Information sent in the precedence parameter identifying the network resources to which the Multi-Level Precedence and Preemption supplementary service is applicable for the call.
- 2.52 National Network Congestion.** Replaced by 2.23, *Cause Value*.
- 2.53 National/International Call Indicator.** Replaced by 2.43E, *Incoming International Call Indicator*.
- 2.54 Nature of Address Indicator.** Information sent in association with an address indicating the nature of that address (e.g., ISDN international number, ISDN national significant number, or ISDN subscriber number).
- 2.54A Nature of Connection Indicators.** Information sent in the forward direction consisting of the satellite indicator, continuity check indicator, and echo control device indicator.
- 2.54B Network Identification.** Information sent in the forward direction indicating the identity of the transit network.
- 2.54C Network Identification Plan.** Information sent in association with the transit network selection information to identify the type of network identification used.
- 2.54D Network Transport.** A parameter sent in either direction for the purpose of transporting other ISDN User Part parameters transparently across transit exchanges.
- 2.54E Network Management Controls.** Information sent in the forward direction concerning network management related action for a call.
- 2.54F Network Specific Facility.** Service related information transparently in either direction between the local exchange and the identified network which provides the service. The information is significant to both user and the identified network.
- 2.55 Normal Call Indicator.** (No procedure specified for U.S. networks).
- 2.55A Notification Indicator.** Information sent in either direction intended to provide supplementary service related notification to a user.
- 2.55B Numbering Plan Indicator.** Information sent in association with an address indicating the numbering plan used for that address (e.g., ISDN numbering plan).
- 2.56 Odd/even Indicator.** Information sent in association with an address, indicating whether the number of address signals contained in the address is even or odd.
- 2.56A Optional Backward Call Indicator.** Information sent in the backward direction consisting of the inband information indicator, the call forwarding may occur indicator and the user-network interaction indicator.
- 2.56B Optional Forward Call Indicators.** Information related to the characteristics of the connection, signaling path, and called party sent in the forward direction.
- 2.56C Operator Services Information.** Information sent in the forward direction between operator services entities primarily identifying charging and service type options.
- 2.57 Original Called Number.** Information sent in the forward direction to indicate, in the case of call redirection (e.g., call forwarding), the number of the user who initiated the initial redirection.
- 2.58 Original Address Request Indicator.** (No procedure specified for U.S. networks).
- 2.58A Original Redirecting Reason.** Information sent in the forward direction indicating the forwarding condition for the original redirection.
- 2.58B Originating Line Information.** Information sent in the forward direction, indicating a toll class of service for the call.
- 2.58C Outgoing Trunk Group Number.** Information sent in the backward direction indicating the trunk group selected at an outgoing gateway. This parameter is for intra-network use only.

2.58D Party Selector. Information sent within a business group parameter to indicate the type of number to which the business group information applies.

2.58E Parameter Compatibility Information. Information sent in either direction indicating how an exchange should react in case a parameter is unrecognized.

2.58F Pivot Capability. Information sent in the Initial Address Message (IAM) indicating the call state until which the Pivot routing can be requested using a Facility message.

2.58G Pivot Routing Indicators. Information sent in Facility message identifying the pivot routing request, failure, and cancel capability with which the message is concerned.

2.59 Point Code. Information sent in the call reference parameter indicating the code of the signaling point in which the call identity allocated to the call reference is relevant.

2.59A Precedence. Information sent in the forward direction in association with the invocation of the Multi-Level Precedence and Preemption (MLPP) supplementary service, consisting of the look-ahead for busy indication, the precedence level, network identity, and the MLPP service domain.

2.59B Precedence Level. Information sent in the precedence parameter indicating the precedence level of the call.

2.59C Ported Number Translation Indicator. Information sent in the forward direction to indicate that the Call Completion to a Portable Number query has been done.

2.60 Protocol Class. Information sent in the connection request parameter indicating the protocol class requested by the signaling connection control part for the end-to-end connection.

2.61 Protocol Control Indicator. Information consisting of the end-to-end method indicator, the interworking indicator, the end-to-end information indicator and the ISDN User Part indicator. The protocol control indicator is contained in both the forward and backward call indicators parameter fields and describes the signaling capabilities within the network connection.

2.61A Query on Release (QoR) Attempt Indicator. (No procedure specified for U.S. networks).

2.62 Range. Information sent in a circuit group supervision message (e.g., Circuit Group Blocking) to indicate the range of circuits affected by the action in the message.

2.62A Range and Status. Information sent in either direction in circuit group supervision messages consisting of the range and status.

2.62B Redirecting Address Request Indicator. (No procedure specified for U.S. networks).

2.62C Redirecting Address Response Indicator. (No procedure specified for U.S. networks).

2.62D Redirecting Indicator. (No procedure specified for U.S. networks).

2.62E Redirecting Number. Information sent in the forward direction indicating the number from which the call was last redirected and consisting of the nature of address indicator, numbering plan indicator, address presentation restriction indicator, and address information (signals).

2.62F Redirecting Reason. Information sent in the forward direction indicating the forwarding condition for the last redirection.

2.62G Redirection Counter. Information sent in the forward direction indicating the number of forwardings undergone.

2.62H Redirect Backward Information. Information sent in the backward direction in support of redirection.

2.62I Redirect Capability. Information sent in the forward direction to indicate that a succeeding exchange is allowed to initiate the redirection procedure by releasing the circuit, and the call states in which the procedure is possible.

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2.62J Redirect Counter. Information sent in the forward direction indicating the number of redirections that a call has undergone.

NOTE - The maximum possible value may be used by a service application to meet a specific service requirement.

2.62K Redirect Forward Information. Information sent in the forward direction in support of redirection.

2.62L Redirect Status. Information used to inform exchanges regarding the possibility that an offer to redirect will be accepted later.

2.63 Redirection Information. Information sent in the forward direction consisting of the original redirecting reason, redirection counter, and redirecting reason.

2.63A Redirection Number. Information sent in the backward direction indicating the number towards which the call must be redirected or has been forwarded.

2.64 Redirection Indicator. Replaced by 2.63, *Redirection Information*.

2.64A Redirection Reason. (No procedure specified for U.S. networks).

2.64B Remote Operations. The remote operations parameter is used to indicate the invocation of a supplementary service identified by an operation value and also carry the result or error indications depending on the outcome of the operation.

2.64C Re-Routing Counter. Information indicating the number of invocations of re-routing that a call has undergone.

2.64D Re-Routing Inhibit Indicator. Information indicating whether the call is allowed to be re-routed.

2.64E Re-Routing Reason Information indicating the reason why automatic re-routing has been invoked.

2.65 Reverse Holding Indicator. Replaced by 2.43C, *Holding Indicator*.

2.66 Routing Label. Information provided to the message transfer part for the purpose of message routing (see 2.2 of ATIS-1000111.4).

2.67 Satellite Indicator. Information sent in the forward direction indicating the number of satellite circuits in the connection.

2.67A SCCP Method Indicator. Information sent in the forward direction indicating the available SCCP methods, if any, for end-to-end transfer of information.

2.68 Send Special Information Tone. Replaced by 2.23, *Cause Value*.

2.68A Screening Indicator. Information sent in association with a number indicating whether the number was network or user provided, and if user provided, whether the network views the number as correctly identifying the user.

2.68B Service Activation. Information sent in either direction to indicate the invocation of one or more supplementary services.

2.68C Service Code. Information sent in the forward direction indicating a service code provided by the calling party (for further study).

2.69 Signaling Point Code. (No procedure specified for U.S. networks).

2.69A Solicited Information Indicator. Information sent in an information message to indicate whether or not the message is a response to an information request message.

2.69B Special Processing Request. Information sent in the forward direction from a private network access node to service node in the public switched network to indicate that the call requires special processing at that node (e.g., private network number translation or verification of authorization codes).

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2.70 Status. Information sent in a circuit group supervision message (e.g., Circuit Group Blocking) to indicate the specific circuits, within the range of circuits stated in the message, that are affected by the action specified in the message.

2.70A Sub-Group Identifier. Information sent within a business group parameter to indicate the identity of the sub-group of which the user identified by the corresponding number is a member.

2.70B Subsequent Number. (No procedure specified for U.S. networks).

2.71 Subscriber Busy. Replaced by 2.23, *Cause Value*.

2.71A Suspend/Resume Indicator. Information sent in the Suspend and Resume Messages to indicate whether suspend/resume was initiated by an ISDN subscriber or by the network.

2.71B Suspend/Resume Indicators. Information sent in either direction consisting of the suspend/resume indicator.

2.72 Switching Equipment Congestion. Replaced by 2.23, *Cause Value*.

2.72A Transaction Request. Information sent in the Initial Address Message (IAM) to help continue call processing, using Transaction Capabilities (TC), associated with a given call during an assist or hand-off procedure.

2.72B Transfer Mode. Information sent in the forward direction indicating circuit or packet transfer mode.

2.72C Transit Network Selection. Information sent in the forward direction indicating the transit network(s) requested for the routing of the call and consisting of the type of network identification, network identification plan, and network identification.

2.72D Transmission Medium Used. Information sent in the backward direction indicating the resulting fallback connection type used for a call after the fallback has occurred.

2.72E Temporary Alternative Routing (TAR) Indicator. Information sent in the forward direction indicating that a call is TAR controlled call.

2.73 Transmission Medium Requirements. (No procedures specified for U.S. networks).

2.73A Trunk Number. Information used for circuit validation to identify the trunk number of the COMMON LANGUAGE circuit identification.

2.73B Type of Address. Information which specifies the type of address digits contained in a Generic Address parameter.

2.73C Type of Digits. Information which specifies the type of digits contained in a Generic Digits parameter.

2.73D Type of Network Identification. Information sent in the forward direction indicating the format of the transit network identification.

2.74 Unallocated Number. Replaced by 2.23, *Cause Value*.

2.75 User Class Indicator. (No procedure specified for U.S. networks).

2.75A User-Network Interaction Indicator. Information sent in the backward direction to indicate that the sending exchange is collecting additional information from the calling party before routing the call further.

2.75B User Service Information. Information sent in the forward direction indicating the bearer capability requested by the calling party and including as a minimum the coding standard, information transfer capability, transfer mode, and information transfer rate.

2.75C User Service Information Prime. Information sent in the forward direction indicating the preferred bearer capability requested by the calling party.

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2.76 User-to-User Indicators. Information sent in association with the response to a request for user-to-user signaling supplementary service.

2.76A User-to-User Information. Information generated by a user and transferred transparently through the intermediate exchanges between the originating and terminating local exchanges.

2.77 Voice/Data Indicator. (No procedure specified for U.S. networks).

Table 2.1 - Mandatory or Optional Parameters in ISDN User Part Messages (Sheet 1 of 6) – ATIS-1000113.2015 – Chapter 2

PARAMETER FIELD	SUB-FIELD	Type (Ref ATIS- 1000 113.3)	IAM	INR	INF	CRA	CRM	COT	ACM	EXM	ANM	CPG	FOT	REL	CFN	CVR	CVT RLC	CCR RSC	BLO UBL	BLA UBA	SUS RES	CGB CGU	CGBA CGUA	GRS GRA	CQR	2.1.	FAC	2.1.	SGM
MESSAGE TYPE		2.1	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
ACCESS TRANSPORT		3.1A	O		O				O		O	O		O															O
APPLICATION TRANSPORT		3.2	O						O		O	O														O		O	
AUTOMATIC CONGESTION LEVEL		3.2A												O															
AUTOMATIC RE-ROUTING	Re-routing counter Re-routing inhibit indicator Re-routing reason	3.2B	O											O															
BACKWARD CALL INDICATORS	Charge indicator Called party's status indicator Called party's category ind. Echo control device indicator IAM segmentation indicator End-to-end method indicator Interworking indicator Holding indicator ISDN User Part indicator ISDN access indicator SCCP method indicator	3.3							M		O	O																	
BUSINESS GROUP	Attendant status Line privileges information ind. Party selector Business group identifier Sub-group identifier Line privileges	3.3A	O		O				O		O	O																	
CALL REFERENCE	Call identity Point code	3.5	O	O	O				O		O	O	O	O							O								
CALLED PARTY NUMBER	Odd/even indicator	3.6	M																										
CHARGE NUMBER	Nature of address ind. Numbering plan ind. Address signals	3.10	O		O									O															
CALLING GEODETIC LOCATION	Screening LPRI Type of shape Shape description	3.6A	O																										
CALLING PARTY NUMBER	Odd/even indicator Nature of address ind. Numbering plan indicator Address pres. restricted ind. Screening indicator Address signals	3.7	O		O																								

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Table 2.1 - Mandatory or Optional Parameters in ISDN User Part Messages (Sheet 2 of 6) – ATIS-1000113.2015 – Chapter 2

PARAMETER FIELD	SUB-FIELD	Type (Ref ATIS- 1000 113.3)	IAM	INR	INF	CRA	CRM	COT	ACM	EXM	ANM	CPG	FOT	REL	CFN	CVR	CVT RLC	CCR RSC	BLO UBL	BLA UBA	SUS RES	CGB CGU	CGBA CGUA	GRS GRA	CQR	APM	FAC	PRI	SGM
CALLING PARTY'S CATEGORY		3.8	M		O																								
CARRIER IDENTIFICATION		3.8A	O																										
CARRIER SELECTION INFORMATION		3.8B	O																										
CARRIER SERVICE PROVIDER IDENTIFICATION	CSPI type S/P Encoding scheme Identifier	3.8C	O																										
CAUSE INDICATORS	Coding standard Location Cause value Diagnostic	3.9							O			O		M	M														
CIRCUIT ASSIGNMENT MAP	Map type Map	3.10B	O																					O					
CIRCUIT GROUP CHARACTERISTIC INDICATORS	Circuit group carrier indicator Double seizing control indicator Alarm carrier indicator Continuity check req'mts. ind.	3.10A														M													
CIRCUIT GROUP SUPER-VISION MESSAGE TYPE IND.	Type ind.	3.11																				M	M						
CIRCUIT IDENTIFICATION NAME	Trunk number CLLI code (office A and office Z)	3.11A														O													
CIRCUIT STATE INDICATOR		3.11B																							M				
CIRCUIT VALIDATION RESPONSE IND.		3.11C														M													

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Table 2.1 - Mandatory or Optional Parameters in ISDN User Part Messages (Sheet 3 of 6) – ATIS-1000113.2015 – Chapter 2

PARAMETER FIELD	SUB-FIELD	Type (Ref ATIS- 1000 113.3)	IAM	INR	INF	CRA	CRM	COT	ACM	EXM	ANM	CPG	FOT	REL	CFN	CVR	CVT RLC	CCR RSC	BLO UBL	BLA UBA	SUS RES	CGB CGU	CGBA CGUA	GRS GRA	CQR	APM	FAC	PRI	SGM
CLLI CODE		3.13A														O		UCIC	LPA					CQM					
CONNECTION REQUEST	Local reference Point code Protocol class Credit	3.15	O	O	O				O		O																		
CONTINUITY INDICATORS		3.16						M																					
EGRESS SERVICE		3.16A	O																										
EVENT INFORMATION		3.17A									M																		
FORWARD CALL INDICATORS	Incoming international call ind. End-to-end method indicator Interworking indicator IAM segmentation indicator ISDN User Part indicator ISDN User Part preference ind. ISDN access indicator SCCP method indicator Ported number translation ind. Query on Release attempt ind.	3.20	M																										
GENERIC ADDRESS	Type of address Odd/even indicator Nature of address indicator Numbering plan indicator Address present. restricted ind. Address signal	3.20A	O											O															
GENERIC DIGITS	Type of digits Encoding scheme	3.20B	O																										
GENERIC NAME	Presentation Availability Type of name Character	3.20C	O																										
HOP COUNTER		3.20D	O																										

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Table 2.1- Mandatory or Optional Parameters in ISDN User Part Messages (Sheet 4 of 6) – ATIS-1000113.2015 – Chapter 2

PARAMETER FIELD	SUB-FIELD	Type (Ref ATIS- 1000 113.3)	IAM	INR	INF	CRA	CRM	COT	ACM	EXM	ANM	CPG	FOT	REL	CFN	CVR	CVT RLC	CCR RSC	BLO UBL	BLA UBA	SUS RES	CGB CGU	CGBA CGUA	GRS GRA	CQR	APM	FAC	PRI	SGM
INFORMATION INDICATORS	Calling party address resp. ind. Calling party's cat. resp ind. Charge information resp. ind.																	UCIC	LPA										
	Hold provided indicator Solicited information indicator MBG info. response indicator	3.22			M				O		O	O																	
INFORMATION REQUEST INDICATORS	Calling party address req. ind. Calling party's cat'y. req. ind. Charge information req. ind. Malicious call ID request ind. MBG information indicator	3.23	O	M																									
LOCAL SERVICE PROVIDER IDENTIFICATION	LSPI type Encoding scheme Context identification LSPI	3.23B																											
JURISDICTION INFORMATION		3.23A	O																										
MESSAGE COMPATIBILITY INFORMATION		3.23C																											
NATURE OF CONNECTION INDICATORS	Satellite indicator Continuity check indicator Echo control device indicator	3.24	M				M																						
NETWORK MANAGEMENT CONTROLS		3.24AB	O																										
NETWORK TRANSPORT		3.24A	O	O					O		O	O																	
NETWORK SPECIFIC FACILITY	Length of network ID Type of network ID Network ID plan Network specific facility indicator	3.23D	O																										
NOTIFICATION INDICATOR		3.24B							O			O																	
OPERATOR SERVICES INFORMATION	Information type Information value	3.24D	O																										
ORIGINAL CALLED NUMBER	Odd/even indicator Nature of address indicator Numbering plan indicator Address pres. restricted ind. Address signals	3.26	O																										

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Table 2.1 - Mandatory or Optional Parameters in ISDN User Part Messages (Sheet 5 of 6) – ATIS-1000113.2015 – Chapter 2

PARAMETER FIELD	SUB-FIELD	Type (Ref ATIS- 1000 113.3)	IAM	INR	INF	CRA	CRM	COT	ACM	EXM	ANM	CPG	FOT	REL	CFN	CVR	CVT RLC	CCR RSC	BLO UBL	BLA UBA	SUS RES	CGB CGU	CGBA CGUA	GRS GRA	CQR	APM	FAC	PRI	SGM
																		LPA	UCIC					CQM					
OPT. BACKWARD CALL INDICATORS	Inband information indicator User-network interaction ind. Simple segmentation indicator	3.24C							O		O	O																	
OPT. FORWARD CALL INDICATORS	Simple segmentation indicator	3.25	O																										
ORIGINATING LINE INFORMATION		3.26A	O		O																								
OUTGOING TRUNK GROUP NUMBER		3.26B								O																			
PARAMETER COMPATIBILITY INFORMATION		3.26D																											
PIVOT CAPABILITY		3.26E	O																										
PIVOT ROUTING INDICATOR		3.26I																									O		
PRECEDENCE	Look ahead for busy	3.26C	O																										
	Precedence level																												
	MLPP service domain																												
	Network identity																												
RANGE AND STATUS	Range Status	3.27																			M	M	M	M					
REDIRECT BACKWARD INFORMATION		3.28A												O															
REDIRECT CAPABILITY		3.28B	O																										
REDIRECT COUNTER		3.28C	O											O													O		
REDIRECT FORWARD INFORMATION		3.28d	O																										
REDIRECT STATUS		3.28E							O		O	O																O	
REDIRECTION INFORMATION	Original redirecting reason	3.29	O		O				O																				
	Redirecting reason																												
	Redirection counter																												
REDIRECTION NUMBER		3.29A												O													O		
REDIRECTING NUMBER	Odd/even indicator	3.27A	O									O																	
	Nature of address indicator																												
	Numbering plan indicator																												
	Address present. restricted ind.																												
	Address signal																												
REMOTE OPERATIONS	Protocol profile Component(s)	3.29B	O						O		O	O															O		
SERVICE ACTIVATION		3.29C	O						O		O	O		O													O		
SERVICE CODE		3.29D	O																										
SPECIAL PROCESSING REQUEST		3.30A	O																										
SUSPEND/RESUME INDICATORS		3.31A																			M								
TRANSACTION REQUEST	Transaction ID SCCP address	3.31B	O																										
TRANSIT NETWORK SELECTION	Type of network identification Network identification plan Network identification	3.31C	O																										

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Table 2.1 - Mandatory or Optional Parameters in ISDN User Part Messages (Sheet 6 of 6) – ATIS-1000113.2015 – Chapter 2

PARAMETER FIELD	SUB-FIELD	Type (Ref ATIS- 1000 113.3)	IAM	INR	INF	CRA	CRM	COT	ACM	EXM	ANM	CPG	FOT	REL	CFN	CVR	CVT RLC	CCR RSC	BLO UBL	BLA UBA	SUS RES	CGB CGU	CGBA CGUA	GRS GRA	CQR	APM	FAC	PRI	SGM
TRANSMISSION MEDIUM USED		3.32A							O		O	O							LPA	UCIC									
USER SERVICE INFORMATION	Coding standard Information transfer capability Transfer mode Information transfer rate Structure Configuration Establishment Symmetry Multiplier or layer ID User information layer	3.33	M																										
USER SERVICE INFORMATION PRIME	same as for USER SERVICE INFORMATION	3.33A	O																										
USER-TO-USER INDICATORS		3.34							O		O	O																	
USER-TO-USER INFORMATION		3.35	O		O				O		O	O		O															O

Table 2.2 - ISDN User Part Message Acronym List - ATIS-1000113.2015 – Chapter 2

ACM	Address Complete
ANM	Answer
APM	Application Transport
BLA	Blocking Acknowledgement
BLO	Blocking
CCR	Continuity Check Request
CFN	Confusion
CGB	Circuit Group Blocking
CGBA	Circuit Group Blocking Acknowledgement
CGU	Circuit Group Unblocking
CGUA	Circuit Group Unblocking Acknowledgement
COT	Continuity
CPG	Call Progress
CQM	Circuit Query
CQR	Circuit Query Response
CRA	Circuit Reservation Acknowledgement
CRM	Circuit Reservation
CVR	Circuit Validation Response

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CVT	Circuit Validation Test
EXM	Exit
FAC	Facility
FOT	Forward Transfer
GRA	Circuit Group Reset Acknowledgement
GRS	Circuit Group Reset
IAM	Initial Address
INF	Information
INR	Information Request
LPA	Loop Back Acknowledgement
PAM	Pass Along
PRI	Pre-Release Information
REL	Release
RES	Resume
RLC	Release Complete
RSC	Reset Circuit
SGM	Segmentation
SUS	Suspend
UBA	Unblocking Acknowledgement
UBL	Unblocking
UCIC	Unidentified Circuit Identification Code

NOTE - The following acronyms are no longer in use: CMC, CMR, CMRJ, CRG, CSV, CSVS, DRS, FAA, FAD, FAR, FRJ, PAU, SAM.

**Signaling System No. 7 (SS7) --
Integrated Services Digital Network (ISDN) User Part**

Chapter 3

Formats and Codes

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American National Standard on –

Signaling System No.7 (SS7) – Integrated Services Digital Network (ISDN) User Part

Chapter 3: Formats and Codes

1 Scope, Purpose, & Application

ISDN User Part messages are carried on the signaling link by means of signal units the format of which is described in clause 2.2 of ATIS-1000111 – Chapter 3. (This Chapter may contain requirements that reference other American National Standards. If so, when the American National Standards referenced in the requirements are superseded by revisions approved by the American National Standards Institute, Inc., the revision shall apply).

The format of the codes used in the service information octet is described in clause 13.2 of ATIS-1000111 – Chapter 4. The service indicator for the ISDN User Part is coded 0 1 0 1.

The signaling information field of each message signal unit containing an ISDN User Part message consists of an integral number of octets and encompasses the following parts (see Figure 4.1 - ATIS-1000113.2015 – Chapter 3).

1. Routing label;
2. Circuit identification code;
3. Message type code;
4. The mandatory fixed part;
5. The mandatory variable part;
6. The optional part.

A description of the various message parts is given in the following clauses.

1.1 Routing Label

The format and codes used for the routing label are described in 2.2 of ATIS-1000111 – Chapter 4. For each individual circuit connection, the same routing label must be used for each signaling message that is transmitted for that connection.

1.2 Circuit Identification Code

The format of the circuit identification code (CIC) shall be as shown in Figure 4.2 – ATIS-1000113.2015 – Chapter 3.

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The allocation of circuit identification codes to individual circuits is determined by bilateral agreement and/or in accordance with applicable predetermined allocations. Allocations for certain applications are defined below:

1. *2048 kbit/s digital path.* (No procedure specified for the U.S. networks)
2. *8448 kbit/s digital path.* (No procedure specified for the U.S. networks)
3. *Frequency division multiplex (FDM) systems in networks using the 2048 kbit/s pulse code modulation standard.* (No procedure specified for the U.S. network)
4. *1544 kbit/s digital path.* (No allocation scheme standardized)

1.3 Message Type Code

The message type code consists of a one octet field and is mandatory for all messages. The message type code uniquely defines the function and format of each ISDN user part message.

The allocation with reference to the appropriate descriptive clause of this Standard is summarized in Table 4.3 - ATIS-1000113.2015 – Chapter 3.

1.4 Formatting Principles

Each message consists of a number of PARAMETERS listed and described in clause 2. Each parameter has a NAME which is coded as a single octet (see Tables 4.4 - ATIS-1000113.2015 – Chapter 3 and 4.4A - ATIS-1000113.2015 – Chapter 3). The length of a parameter may be fixed or variable, and a LENGTH INDICATOR of one octet for each parameter may be included as described below.

The detailed format is uniquely defined for each message type as described in clause 3.

A general format diagram shall be as shown in Figure 4.3 - ATIS-1000113.2015 – Chapter 3.

1.5 Mandatory Fixed Part

Those parameters that are mandatory and of fixed length for a particular message type will be contained in the Mandatory Fixed Part. The position, length and order of the parameters is uniquely defined by the message type, thus the names of the parameters and the length indicators are not included in the message.

1.6 Mandatory Variable Part

Mandatory parameters of variable length will be included in the mandatory variable part.

Pointers are used to indicate the beginning of each parameter. Each pointer is encoded as a single octet.

The name of each parameter and the order in which the pointers are sent is implicit in the message type. Parameter names are, therefore, not included in the message.

The details of how pointers are encoded are found in clause 2.3. The number of parameters, and thus the number of pointers is uniquely defined by the message type.

A pointer is also included to indicate the beginning of the optional part. If the message type indicates that no optional part is allowed, then this pointer will not be present. If the message type indicates that an optional part is possible (reflected by the presence of an "end of optional parameters" octet in Tables 5 through 23), but there is no optional part included in this particular message then a pointer field containing all zeros will be used. It is recommended that all future message types with a mandatory variable part indicate that an optional part is

allowed. If there are no mandatory variable parameters, but optional parameters are possible, the start of optional parameters pointer (coded all zeros if no optional parameter is present and coded '00000001' if an optional parameter is present) will be included. Because of backward compatibility, the end of optional parameters octet cannot be added to pre-T1.113-1995 messages that lack a start of optional parameters pointer.

All the pointers are sent consecutively at the beginning of the mandatory variable part. Each parameter contains the parameter length indicator followed by the contents of the parameters.

1.7 Optional Part

The optional part consists of parameters that, depending on service requirement, may or may not occur in any particular message type. Both fixed length and variable length parameters may be included. Unless it is explicitly stated to the contrary within this Standard, an optional parameter cannot occur multiple times within one message. Optional parameters may be transmitted in any order. Each optional parameter will include the parameter name (one octet) and the length indicator (one octet) followed by the parameter contents.

1.7A Number of Pointers in a Message

The number of pointers will be equal to the number of mandatory variable parameters in a message, plus one additional pointer if there are any optional parameters allowed in the message.

1.8 End of Optional Parameters Octet

When optional parameters are present and after all optional parameters have been sent an "end of optional parameters" octet containing all zeros will be transmitted. If no optional parameter is present, an "end of optional parameters" octet is not transmitted.

1.9 Order of Transmission

Since all the fields consist of an integral number of octets, the formats are presented as a stack of octets. The first octet transmitted is the one shown at the top of the stack and the last is the one at the bottom (see Figure 4.3 - ATIS-1000113.2015 – Chapter 3).

Within each octet the bits are transmitted with the least significant bit first.

1.10 Coding of Spare Bits

Spare bits are coded 0 unless indicated otherwise.

1.10A Interpretation of Unassigned Code Points

(See clause 2.9.5.3 of ATIS-1000113.2015 – Chapter 4).

1.11 National Message Types & Parameters

If message type codes and parameter codes are required for national uses, the codes chosen should be from the highest code downwards (i.e., starting at code 1 1 1 1 1 1 1). Code 1 1 1 1 1 1 1 for both message and

parameter name codes is reserved to indicate extension of the name code. Codes 1 1 1 1 1 1 1 0 to 1 1 1 1 0 0 0 0 are reserved for individual network use only. Message type codes in the range 1 1 1 1 1 1 1 0 to 1 1 1 0 0 0 0 0 and parameter name codes in the range 1 1 1 1 1 1 1 0 to 1 1 0 0 0 0 0 1 are reserved for national use.

2 Parameter Formats & Codes

2.1 Message Type Codes

The encoding of the message type shall be as shown in Table 4.3 - ATIS-1000113.2015 – Chapter 3 (in alphabetical order) and Table 4.3A - ATIS-1000113.2015 – Chapter 3 (ordered by code value).

2.2 Coding of the Length Indicator

The length indicator field is binary coded to indicate the number of octets in the parameter content field. The length indicator does not include the parameter name octet or the length indicator octet.

2.3 Coding of the Pointers

The pointer value (in binary) gives the number of octets between the pointer itself (included) and the first octet (not included) of the parameter associated with that pointer.

The pointer value all zeros is used to indicate that, in the case of optional parameters, no optional parameter is present.

3 ISDN User Part Parameters.

3.1 Parameter Names

The parameter name codes shall be as shown in Table 4.4 - ATIS-1000113.2015 – Chapter 3 (in alphabetical order) and Table 4.4A – ATIS-1000113.2015 – Chapter 3 (ordered by code value) together with references to the subclauses in which they are described.

3.1A Access Transport

The format of the access transport parameter field shall be as shown in Figure 4.3A - ATIS-1000113.2015 – Chapter 3.

The information element is coded as described in clause 4.5 of ATIS-1000607.2014. Multiple ATIS-1000607.2014 information elements can be included within the access transport parameter. The information elements applicable to a particular usage of the access transport parameter are dependent on and will be determined by the relevant procedures.

3.1B Address Presentation Restriction Indicator

(No procedure specified for U.S. networks).

3.2 Application Transport

The format of the application transport shall be as shown in Figure 4.3AB - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the application transport parameter field:

(1) *Extension indicator (ext.)*

0	octet continues through next octet
1	last octet

(2) *Application context identifier (ACI) (Octet 1 and Octet 1a)*

- a) If the extension bit is set to 1 in octet 1, octet 1a is absent. The value contained in octet 1 Bits 1-7 shall be interpreted as follows:

0 0 0 0 0 0 0	Unidentified Context and Error Handling (UCEH) ASE (No procedures for U.S. networks)
0 0 0 0 0 0 1	PSS1 ASE (VPN) (No procedures for U.S. networks)
0 0 0 0 0 1 0	spare
0 0 0 0 0 1 1	Charging ASE (No procedures for U.S. networks)
0 0 0 0 1 0 0	GAT (No procedures for U.S. networks)
0 0 0 0 1 0 1	BAT ASE
0 0 0 0 1 1 0	Enhanced Unidentified Context and Error Handling ASE (EUCEH ASE)
0 0 0 0 1 1 1	Mobile Service Transport (MST) (NOTE 1)
0 0 0 1 0 0 0	}
to	spare
0 1 1 1 1 1 1	}
1 0 0 0 0 0 0	}
to	Reserved By ITU-T For Non-Standardized APM'98'-User Applications
1 1 1 1 1 1 1	}

NOTE 1: Refer to 3GPP TS 29.205 Annex B for specification of MST.

- b) If the extension bit is set to 0 in octet 1, octet 1a is present. In that case, the ACI is a 14-bit field:

Octet 1a, Bits 1-7	Octet 1, Bits 1-7
0 0 0 0 0 0 1	0 0 0 0 0 0 0 }
to	reserved by ITU-T for non-standardized APM'2000'-user applications

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0 0 0 0 0 0 1	1 1 1 1 1 1 1	
0 0 0 0 0 1 0	0 0 0 0 0 0 0	} ANSI spare (Note 1)
to		
0 1 1 1 1 1 1	1 1 1 1 1 1 1	} reserved for network specific use (Note 2)
1 0 0 0 0 0 0	0 0 0 0 0 0 0	
to		
1 1 1 1 1 1 1	1 1 1 1 1 1 1	

NOTE 1 - Values for ANSI spare are assigned in ascending order from the lowest available value.

NOTE 2 - Values for network specific use are assigned in descending order from the highest available value.

(3) *Application Transport Instruction Indicators (ATII)*

Bit 1	<i>Release call indicator (RCI)</i>
0	do not release call
1	release call
Bit 2	<i>Send notification indicator (SNI)</i>
0	do not send notification
1	send notification

(4) *APM segmentation indicator*

0 0 0 0 0 0	final segment
0 0 0 0 0 1	}
to	indicates the number of following segments
0 0 1 0 0 1	}
0 0 1 0 1 0	}
to	spare
1 1 1 1 1 1	}

NOTE – The compatibility mechanism as defined in ATIS-1000113.2015 – Chapter 4 is not applicable to this field.

(5) *Sequence indicator (SI)*

0	subsequent segment to first segment

1 new sequence

(6) *Segmentation local reference (SLR)*

A unique value to a call used to associate segments in an APM segmentation procedure.

(7) *APM-user information field*

The format of the APM-user information field is shown in Figure 4.3AC - ATIS-1000113.2015 – Chapter 3.

The coding of the APM-user information field is as follows:

a) *Originating address length*

The values are 0, 3-20.

b) *Originating address*

The originating address field is not present if the originating address length is set to zero.

The format of the Originating address field is shown in Figure 4.3AD - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the Originating address and the Destination address fields:

- 1) *Odd/even indicator (O/E) see clause 3.6(1)*
- 2) *Nature of address indicator: see clause 3.6(2)*
- 3) *Spare*
- 4) *Numbering plan indicator: see clause 3.6(3)*
- 5) *Spare*
- 6) *Address signal: see clause 3.6(4)*
- 7) *Filler: as Subclause clause 3.6 (5)*

c) *Destination address length*

The values are 0, 3-20.

d) *Destination address*

The destination address field is not present if the destination address length is set to zero.

The format of the Destination address field is shown in Figure 4.3AD - ATIS-1000113.2015 – Chapter 3.

Coding of the destination address field is as for the originating address field, see b).

e) *Encapsulated application information*

Contains the application specific information.

The format and coding of this field is dependent upon the APM-user application and defined in the appropriate American National Standard. For APM-user applications that wish to provide a service of transparent transport of information (e.g., the case where existing information elements are defined for the transport of certain information), as well as having the ability of passing additional network related information within the public network, then the following guideline is provided:

It is suggested that this field be structured such that the first octet (i.e., first octet of first segment for long APM-user information) is a pointer to information to be transported transparently. The pointer value (in binary) gives the number of octets between the pointer itself (included) and the first octet (not included) of transparent data. The pointer value all

zeros is used to indicate that no transparent data is present. The range of octets between the pointer octet and the first octet of transparent data (to which the pointer octet points) contains the network related information to be passed between the applications residing within the public network. The format and coding of both the transparent information and the network related information is application specific and defined in the appropriate American National Standard.

3.2A Automatic Congestion Level

The format of the automatic congestion level shall be as shown in Figure 4.3B - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the automatic congestion level parameter field:

0 0 0 0 0 0 0 0	spare
0 0 0 0 0 0 0 1	ACL 1
0 0 0 0 0 0 1 0	ACL 2
0 0 0 0 0 0 1 1	ACL 3
0 0 0 0 0 1 0 0	}
to	spare
1 1 1 1 1 1 1 1	}

3.2B Automatic Re-Routing

The format of the automatic re-routing parameter field shall be as shown in Figure 4.3C - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the Automatic Re-routing parameter field:

a) Extension indicator (ext.)

0	octet continues through the next octet (e.g., octet 1 to 1a)
1	last octet

b) Re-routing Inhibit Indicator

0	no indication
1	do not crankback

c) Re-routing Counter

00 0000	not used
00 0001	1 st crankback attempt
00 0010	2 nd crankback attempt
to	to
11 1111	63 rd crankback attempt

d) Re-routing Reason

000 0000	unknown/not available
000 0001	trunk group data
000 0010	cause code
000 0011	routing data

000 0100	
to	spare
011 1111	
100 0000	
to	spare for national use
111 1111	

NOTE - Octet 1a is not present if the extension bit in octet 1 is set to 1.

3.3 Backward Call Indicators

The format of the backward call indicators parameter field is of the type shown in Figure 4.5 - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the backward call indicators parameter field:

Bits	BA:	Charge indicator
	0 0	no indication (default)
	0 1	no charge
	1 0	charge (No procedure specified for U.S. networks)
	1 1	spare
Bits	DC:	Called party's status indicator
	0 0	no indication (default)
	0 1	subscriber free
	1 0	connect when free (No procedure specified for U.S. networks)
	1 1	excessive delay
Bits	FE:	Called party's category indicator
	0 0	no indication (default)
	0 1	ordinary subscriber
	1 0	payphone (No procedure specified for U.S. networks)
	1 1	spare
Bits	HG:	End-to-end method indicator (note)
	0 0	no end-to-end method available
	0 1	pass along method available
	1 0	SCCP method available
	1 1	pass along and SCCP methods available
Bit	I:	Interworking indicator (note)
	0	no interworking encountered
	1	interworking encountered
Bit	J:	IAM segmentation indicator (note)
	0	no indication
	1	additional information has been received and incorporated into call set-up
Bit	K:	ISDN User Part indicator (note)

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	0	ISDN User Part not used all the way
	1	ISDN User Part used all the way
Bit	L:	Holding indicator
	0	holding not required (default)
	1	holding required (No procedure specified for U.S. networks)
Bit	M:	ISDN access indicator
	0	terminating access non-ISDN
	1	terminating access ISDN
Bit	N:	Echo control device indicator
	0	incoming half echo control device not included
	1	incoming half echo control device included
Bits	PO:	SCCP method indicator
	0 0	no indication (default)
	0 1	connectionless method available (No procedure specified for U.S. networks)
	1 0	connection oriented method available (No procedure specified for U.S. networks)
	1 1	connectionless and connection oriented methods available (No procedure specified for U.S. networks)

NOTE - Bits G-K constitute the protocol control indicator.

3.3A Business Group

The format of the business group parameter shall be as shown in Figure 4.5A - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the business group parameter fields:

- 1) *Attendant status*
 - 0 No indication
 - 1 Attendant line
1. *Business group identifier type*
 - 0 Multi-location business group identifier
 - 1 Interworking with private networks identifier
2. *Line privileges information indicator*
 - 0 Fixed line privileges
 - 1 Customer defined line privileges
3. *Party selector*
 - 0000 No indication
 - 0001 Calling party number
 - 0010 Called party number
 - 0011 Connected party number
 - 0100 Redirecting number
 - 0101 Original called number

0110]
 to | spare
 1111]

4. *Business group identifier*

A code expressing in pure binary representation the number allocated to a business group. The number 1 indicates the public network. The number 0 signifies "no indication".

5. *Sub-group identifier*

A code expressing in pure binary representation the number allocated to a sub-group within a business group. The all zeros code indicates the absence of sub-groups.

6. *Line privileges*

1. Line privileges information indicator = 0:

8	5	4	1
Originating restrictions		Terminating restrictions	
Restriction codes			
0 0 0 0	Unrestricted		
0 0 0 1	Semi-restricted		
0 0 1 0	Fully restricted		
0 0 1 1	Fully restricted, intra-switch		
0 1 0 0	Denied		
0 1 0 1	]		
to	spare		
1 1 1 1	]		

2. Line privileges information indicator = 1

Restriction codes

0 0 0 0 0 0 0 0

to customer defined line privilege codes

1 1 1 1 1 1 1 1

3.4 *Call Modification Indicators*

(No procedure specified for U.S. networks)

3.5 *Call Reference*

The format of the call reference parameter shall be as shown in Figure 4.7 - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the call reference parameter field:

- 1) Call identity. A code expressing in pure binary representation the identification number allocated to the call.
- 2) Point code. The code of the signaling point in which the call identity is relevant.

3.6 Called Party Number

The format of the called party number parameter field corresponds to the format shown in Figure 4.8 - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the called party number parameter field:

- (1) Odd/even indicator
 - 0 even number of address signals
 - 1 odd number of address signals
- 2) Nature of address indicator
 - 0 0 0 0 0 0 spare (no interpretation)
 - 0 0 0 0 0 1 subscriber number
 - 0 0 0 0 1 0 spare, reserved for national use (no interpretation)
 - 0 0 0 0 1 1 national (significant) number
 - 0 0 0 1 0 0 international number
 - 0 0 0 1 0 1 }
 - to | spare (no interpretation)
 - 1 1 1 0 0 0 }
 - 1 1 1 0 0 1 subscriber number, operator requested
 - 1 1 1 0 0 1 0 national number, operator requested
 - 1 1 1 0 0 1 1 international number, operator requested
 - 1 1 1 0 1 0 0 no number present, operator requested
 - 1 1 1 0 1 0 1 no number present, cut-through call to carrier
 - 1 1 1 0 1 1 0 950+ call from local exchange carrier public station, hotel/motel, or non-exchange access end office
 - 1 1 1 0 1 1 1 test line test code
 - 1 1 1 1 0 0 0 }
 - to | reserved for network specific use (no interpretation)
 - 1 1 1 1 1 1 0 }
 - 1 1 1 1 1 1 1 spare (no interpretation)
- 3) Numbering plan indicator
 - 0 0 0 unknown (no interpretation)
 - 0 0 1 ISDN (Telephony) numbering plan (Recommendation E.164)
 - 0 1 0 spare (no interpretation)
 - 0 1 1 reserved (ITU-T: Data numbering plan)
 - 1 0 0 reserved (ITU-T: Telex numbering plan)
 - 1 0 1 Private numbering plan
 - 1 1 0 spare (no interpretation)
 - 1 1 1 spare (no interpretation)
- 4) Address signal

0 0 0 0 digit 0
 0 0 0 1 digit 1
 0 0 1 0 digit 2
 0 0 1 1 digit 3
 0 1 0 0 digit 4
 0 1 0 1 digit 5
 0 1 1 0 digit 6
 0 1 1 1 digit 7
 1 0 0 0 digit 8
 1 0 0 1 digit 9
 1 0 1 0 spare (no interpretation)
 1 0 1 1 code 11
 1 1 0 0 code 12
 1 1 0 1 spare (no interpretation)
 1 1 1 0 spare (no interpretation)
 1 1 1 1 ST (Reserved) (no interpretation)

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

5) Filler

In case of an odd number of address signals, the filler code 0 0 0 0 is inserted after the last address signal.

3.6A Calling Geodetic Location

The format of the calling geodetic location parameter field corresponds to the format shown in Figure 4.7A - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the calling geodetic location parameter field:

1) *Location presentation restricted indicator (LPRI)*

00 presentation allowed
 01 presentation restricted
 10 location not available (NOTE)
 11 spare

NOTE - If the Calling Geodetic Location parameter is included and the LPRI indicates location not available, octets 2 to n are omitted and the subfield (2) is coded 11.

2) *Screening indicator*

00 user provided, not verified
 01 user provided, verified and passed
 10 user provided, verified and failed
 11 network provided

3) *Type of shape*

0000000	ellipsoid point
0000001	ellipsoid point with uncertainty
0000010	point with altitude and uncertainty
0000011	ellipse on the ellipsoid
0000100	ellipsoid circle sector
0000101	polygon
0000110	}
to	spare
0111111	}
1000000	}
to	Reserved for national use
1111110	}
1111111	Reserved for future expansion

4) *Extension indicator*

- 0 Information continues through the next octet
- 1 Last octet

5) *Shape description*

The coding of the shape description consists of different elements dependent on the type of shape as detailed in the following sub-clauses.

3.6A.1 Ellipsoid point shape description

The format of the ellipsoid point shape description is shown in Figure 4.7B - ATIS-1000113.2015 – Chapter 3. The following codes are used in the subfields of the ellipsoid point shape description:

a) Lat Sign

- 0 North
- 1 South

b) Degrees of latitude

The relation between the binary coded number N and the range of latitudes X ($0 \leq X < 90$, where X is in degrees but not necessarily an integral number of degrees) it encodes is described by the following equation:

$$N \leq \frac{2^{23}}{90} X < N + 1$$

except for $N=2^{23}-1$, for which the range is extended to include $N+1$.

c) Degrees of longitude

The longitude, expressed in the range $(-180, +180)$ is coded as a number between -2^{23} and $2^{23}-1$, coded in 2's complement binary. The relation between the binary coded number N and the range of longitudes X ($-180 \leq X < +180$, where X is in degrees but not necessarily an integral number of degrees) it encodes is described by the following equation:

$$N \leq \frac{2^{24}}{360} X < N + 1$$

3.6A.2 Ellipsoid point with uncertainty shape description

The format of the ellipsoid point with uncertainty shape description is shown in Figure 4.7C - ATIS-1000113.2015 – Chapter 3. The following codes are used in the subfields of the ellipsoid point with uncertainty shape description:

a) *Lat Sign*

As per clause 3.6A.1a)

b) *Degrees of latitude*

As per clause 3.6A.1b)

c) *Degrees of longitude*

As per clause 3.6A.1c)

d) *Uncertainty code*

The uncertainty r , expressed in meters (in the range 0m to 1800km), is mapped from the binary number K , with the following formula:

$$r = C \left((1 + x)^K - 1 \right)$$

with $C = 10$ and $x = 0.1$.

e) *Confidence*

The confidence by which the location is known to be within the shape description, C (expressed as a percentage) is directly mapped from the binary number K , except for $K=0$ which is used to indicate 'no information', and $100 < K \leq 127$ which are not used.

3.6A.3 Point with altitude and uncertainty shape description

The format of the point with altitude and uncertainty circle shape description is shown in Figure 4.7D - ATIS-1000113.2015 – Chapter 3. The following codes are used in the subfields of the point with altitude and uncertainty circle shape description:

a) *Lat Sign*

As per clause 3.6A.1a)

b) *Degrees of latitude*

As per clause 3.6A.1b)

c) *Degrees of longitude*

As per clause 3.6A.1c)

d) *Uncertainty code*

As per clause 3.6A.2d)

e) *Alt Sign*

0 above the ellipsoid

1 below the ellipsoid

f) *Altitude*

The relation between the binary coded number N and the range of altitudes a (in meters) it encodes is described by the following equation:

$$N \leq a < N + 1$$

except for $N=2^{15}-1$ for which the range is extended to include all greater values of a .

g) *Altitude uncertainty code*

The altitude uncertainty h , expressed in meters (in the range 0m to ≈ 1000 m), is mapped from the binary number K , with the following formula:

$$h = C \left((1 + x)^K - 1 \right)$$

with $C = 45$ and $x = 0.025$.

h) *Confidence*

As per clause 3.6A.2e)

3.6A.4 Ellipse on the ellipsoid shape description

The format of the ellipse on the ellipsoid shape description is shown in Figure 4.7E - ATIS-1000113.2015 – Chapter 3. The following codes are used in the subfields of the ellipse on the ellipsoid shape description:

a) *Lat Sign*

As per clause 3.6A.1a)

b) *Degrees of latitude*

As per clause 3.6A.1b)

c) *Degrees of longitude*

As per clause 3.6A.1c)

d) *Major radius*

The major axis of the ellipse r_{major} , expressed in meters (in the range 1m to 1800km), is mapped from the binary number K , with the following formula:

$$r = C \left((1 + x)^K - 1 \right)$$

with $C = 10$ and $x = 0.1$.

e) *Minor radius*

The minor axis of the ellipse r_{minor} , expressed in meters (in the range 1m to 1800km), is mapped from the binary number K , with the following formula:

$$r = C \left((1 + x)^K - 1 \right)$$

with $C = 10$ and $x = 0.1$.

f) *Orientation*

The orientation of the major axis of the ellipse, θ , expressed in degrees (0° being North, 90° being East, etc with 1° granularity), is mapped from the binary number K , with the following formula:

$$\theta = K$$

except for $180 < K \leq 255$ which are not used.

g) *Confidence*

As per clause 3.6A.2e)

3.6A.5 Ellipsoid circle sector shape description

The format of the ellipsoid circle sector shape description is shown in Figure 4.7F - ATIS-1000113.2015 – Chapter 3. The following codes are used in the subfields of the ellipsoid circle sector shape description:

a) *Lat Sign*

As per clause 3.6A.1a)

b) *Degrees of latitude*

As per clause 3.6A.1b)

c) *Degrees of longitude*

As per clause 3.6A.1c)

d) *Radius*

The radius of the circle sector r , expressed in meters (in the range 1m to 1800km), is mapped from the binary number K , with the following formula:

$$r = C \left((1 + x)^K - 1 \right)$$

with $C = 10$ and $x = 0.1$.

e) *Offset*

The orientation of the offset of the circle sector, $\theta\theta$, expressed in degrees (0° being North, 90° being East, etc with 2° granularity), is mapped from the binary number K , with the following formula:

$$\theta = 2K$$

except for $180 < K \leq 255$ which are not used.

f) *Included angle*

The included angle of the circle sector, β expressed in degrees (0° being North, 90° being East, etc with 2° granularity), is mapped from the binary number K , with the following formula:

$$\beta = 2K$$

except for $180 < K \leq 255$ which are not used.

g) *Confidence*

As per clause 3.6A.2e)

3.6A.6 Polygon shape description

The format of the polygon shape description is shown in Figure 4.7G - ATIS-1000113.2015 – Chapter 3. The following codes are used in the subfields of the polygon shape description:

- a) *Number of points*
 - 0000 Not used
 - 0001 Not used
 - 0010 Not used
 - 0011 }
 - to |Binary value of the number of points (3-15)
 - 1111 }
- b) *Lat Sign 1*
 - As per clause 3.6A.1a)
- c) *Degrees of latitude 1*
 - As per clause 3.6A.1b)
- d) *Degrees of longitude 1*
 - As per clause 3.6A.1c)
- e) *Lat Sign n*
 - As per clause 3.6A.1a)
- f) *Degrees of latitude n*
 - As per clause 3.6A.1b)
- g) *Degrees of longitude n*
 - As per clause 3.6A.1c)
- h) *Confidence*
 - As per clause 3.6A.2e)

3.7 Calling Party Number

The format of the calling party number parameter field corresponds to the format shown in Figure 4.8A - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the calling party number parameter field:

- 1) Odd/even indicator: See clause 3.6(1)
- 2) Nature of address indicator:
 - 0 0 0 0 0 0 spare (no interpretation)
 - 0 0 0 0 0 1 unique subscriber number
 - 0 0 0 0 1 0 spare, reserved for national use (no interpretation)
 - 0 0 0 0 1 1 unique national (significant) number
 - 0 0 0 1 0 0 unique international number
 - 0 0 0 1 0 1 }

to	spare (no interpretation)
1 1 1 0 0 0 0	]
1 1 1 0 0 0 1	non-unique subscriber number
1 1 1 0 0 1 0	spare, reserved for national use (no interpretation)
1 1 1 0 0 1 1	non-unique national (significant) number
1 1 1 0 1 0 0	non-unique international number
1 1 1 0 1 0 1	spare (no interpretation)
1 1 1 0 1 1 0	spare (no interpretation)
1 1 1 0 1 1 1	test line test code
1 1 1 1 0 0 0	]
to	reserved for network specific use (no interpretation)
1 1 1 1 1 1 0	]
1 1 1 1 1 1 1	spare (no interpretation)

- 3) Numbering plan indicator: See clause 3.6(3)
- 4) Address presentation restricted indicator (Pres.)

0 0	presentation allowed
0 1	presentation restricted (default)
1 0	spare
1 1	spare
- 5) Screening indicator

0 0	reserved (for "user provided, not screened")
0 1	user provided, screening passed
1 0	reserved (for "user provided, screening failed")
1 1	network provided
- 6) Address signal: See clause 3.6(4), as applicable
- 7) Filler: See clause 3.6(5)

3.8 Calling Party's Category

The format of the calling party's category parameter field shall be as shown in Figure 4.9 - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the calling party's category parameter field:

0 0 0 0 0 0 0 0	calling party's category unknown (default)
0 0 0 0 0 0 0 1	operator, language French]
0 0 0 0 0 0 1 0	operator, language English

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0 0 0 0 0 1 1	operator, language German (No procedure specified for U.S. networks)
0 0 0 0 1 0 0	operator, language Russian
0 0 0 0 1 0 1	operator, language Spanish
0 0 0 0 1 1 0	}
0 0 0 0 1 1 1	available to administrations for selecting a particular language by mutual
0 0 0 1 0 0 0	agreement
0 0 0 1 0 0 1	national operator (note)
0 0 0 1 0 1 0	ordinary calling subscriber
0 0 0 1 0 1 1	calling subscriber with priority (No procedure specified for U.S. networks)
0 0 0 1 1 0 0	data call (voice band data) (No procedure specified for U.S. networks)
0 0 0 1 1 0 1	test call
0 0 0 1 1 1 0	spare
0 0 0 1 1 1 1	payphone (No procedure specified for U.S. networks)
0 0 0 1 0 0 0 0	}
to	ITU-T spare
1 1 0 1 1 1 1 1	}
1 1 1 0 0 0 0 0	emergency service call
1 1 1 0 0 0 0 1	high priority emergency service call
1 1 1 0 0 0 1 0	National Security and Emergency Preparedness (NS/EP) Call
1 1 1 0 0 0 1 1	}
to	ANSI spare
1 1 1 0 1 1 1 1	}
1 1 1 1 0 0 0 0	}
to	network specific use
1 1 1 1 1 1 1 0	}
1 1 1 1 1 1 1 1	reserved for expansion

NOTE - ITU_T Recommendation Q.104 allows national networks to use this code to indicate that the calling party is a national operator.

3.8A Carrier Identification

The format of the carrier identification parameter field for 3 and 4 digit carrier identifications shall be as shown in Figures 4.9A - ATIS-1000113.2015 – Chapter 3 and 4.9B - ATIS-1000113.2015 – Chapter 3, respectively.

The following codes are used in the carrier identification parameter field:

- 1) *Type of network identification*

0 0 0	spare (no interpretation)
0 0 1	spare (no interpretation)
0 1 0	national network identification
0 1 1	}
to	spare (no interpretation)
1 1 1	}

- 2) *Network identification plan*
- | | |
|---------|----------------------------------|
| 0 0 0 0 | unknown (no interpretation) |
| 0 0 0 1 | 3 - digit carrier identification |
| 0 0 1 0 | 4 - digit carrier identification |
| 0 0 1 1 | } |
| to | spare (no interpretation) |
| 1 1 1 1 | } |
- 3) *Digits 1-3 or 1-4 See clause 3.6(4)*

3.8B Carrier Selection Information

The format of the carrier selection information parameter shall be as shown in Figure 4.9C - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the carrier selection parameter field:

0 0 0 0 0 0 0 0	No indication (default)
0 0 0 0 0 0 0 1	selected carrier identification presubscribed and not input by calling party
0 0 0 0 0 0 1 0	selected carrier identification presubscribed and input by calling party
0 0 0 0 0 0 1 1	selected carrier identification presubscribed, input by calling party undetermined
0 0 0 0 0 1 0 0	selected carrier identification not presubscribed and input by calling party
0 0 0 0 0 1 0 1	primary preferred carrier of the charged party
0 0 0 0 0 1 1 0	alternate preferred carrier of the charged party
0 0 0 0 0 1 1 1	selected carrier identification presubscription unknown (verbal) instructions from the calling party
0 0 0 0 1 0 0 0	selected carrier identification presubscription unknown (verbal) instructions from the charged party
0 0 0 0 1 0 0 1	emergency call handling
0 0 0 0 1 0 1 0	}
to	spare
1 1 1 1 1 1 1 0	}
1 1 1 1 1 1 1 1	reserved

3.8C Carrier Service Provider Identification

The format of the carrier service provider identification parameter field shall be as shown in Figure 4.9D - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the carrier service provider identification parameter field:

- 1) *Carrier Service Provider Identifier (CSPI) Type*
- | | |
|------|------------------------|
| 0000 | spare |
| 0001 | IntraLATA toll carrier |
| 0010 | InterLATA carrier |
| 0011 | international carrier |

0100 }
 to | spare
 1111 }

2) Selected/Potential (S/P)

selected carrier

potential carrier

3) Encoding scheme

000	spare
001	BCD 4-digit
010	IA5 4-character
011	}
to	spare
111	}

4) Identifier

The most significant digit or character is sent first. For BCD encoding, the first digit appears in bits 1 through 4 of the first octet. Subsequent digits are sent in successive 4-bit fields, in the case of BCD encoding, or in successive octets, in the case of IA5 encoding.

3.9 Cause Indicators

The format of the cause indicators parameter field shall be as shown in Figures 4.10 - ATIS-1000113.2015 – Chapter 3 and 4.10A - ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the cause indicators parameter field:

1) Extension indicator (Ext)

0 octet continues through the next octet (for example, octet 1 to 1a, 2 to 2a)

1 last octet

If octet 1 or 2 is extended, the cause value is interpreted as if coded 1111111.

2) Coding standard

0 0 ITU-T standard (default)

0 1 reserved for other international standards

1 0 ANSI standard

1 1 reserved

If coded 01 or 11, the cause value is interpreted as if coded 1111111.

3) Location (see note)

0 0 0 0 user

0 0 0 1 local private network

0 0 1 0 local local network

0 0 1 1 transit network

0 1 0 0 remote local network

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- 0 1 0 1 remote private network
- 0 1 1 0 local interface controlled by this signaling link
- 0 1 1 1 international network
- 1 0 1 0 network beyond interworking point (default)

All other values are reserved

NOTE - Depending on the location of the users, the local local network may be the same network serving the remote user. Rules for defining the location field are defined in Appendix A.

4) Cause value.

The cause value is divided into two fields, a class (bits 5 through 7) and a value within a class (bits 1 through 4). The decimal equivalent of the cause value shall be as shown in brackets beside the cause value.

a) ITU-T standard (Coding standard 0 0)

Class 000 and 001, normal event

0 0 0 0 0 0 1	(1)	unallocated (unassigned) number
0 0 0 0 0 1 0	(2)	no route to specified transit network
0 0 0 0 0 1 1	(3)	no route to destination
0 0 0 0 1 0 0	(4)	send special information tone
0 0 0 0 1 0 1	(5)	misdialed trunk prefix (No procedure specified for U.S. networks)
0 0 0 1 0 0 0	(8)	preemption
0 0 0 1 0 0 1	(9)	preemption - circuit reserved for reuse
0 0 1 0 0 0 0	(16)	normal clearing
0 0 1 0 0 0 1	(17)	user busy
0 0 1 0 0 1 0	(18)	no user responding
0 0 1 0 0 1 1	(19)	no answer from user (user alerted)
0 0 1 0 1 0 0	(20)	subscriber absent
0 0 1 0 1 0 1	(21)	all rejected
0 0 1 0 1 1 0	(22)	number changed
0 0 1 0 1 1 1	(23)	redirect to new destination
0 0 1 1 0 1 1	(27)	destination out of service
0 0 1 1 1 0 0	(28)	invalid number format (address incomplete)
0 0 1 1 1 0 1	(29)	facility rejected
0 0 1 1 1 1 1	(31)	normal - unspecified (default)

Class 0 1 0, resource unavailable

0 1 0 0 0 1 0	(34)	no circuit/channel available
0 1 0 0 1 1 0	(38)	network out of order
0 1 0 1 0 0 1	(41)	temporary failure
0 1 0 1 0 1 0	(42)	switching equipment congestion
0 1 0 1 0 1 1	(43)	access information discarded
0 1 0 1 1 0 0	(44)	requested circuit/channel not available

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0 1 0 1 1 1 0	(46)	precedence call blocked
0 1 0 1 1 1 1	(47)	resource unavailable - unspecified (default)

Class 0 1 1, service or option unavailable

0 1 1 0 0 1 0	(50)	requested facility not subscribed
0 1 1 0 1 0 1	(53)	outgoing calls barred within CUG (No procedure specified for U.S. networks)
0 1 1 0 1 1 1	(55)	incoming calls barred within CUG (No procedure specified for U.S. networks)
0 1 1 1 0 0 1	(57)	bearer capability not authorized
0 1 1 1 0 1 0	(58)	bearer capability not presently available
0 1 1 1 1 1 0	(62)	inconsistency in designated outgoing access information and subscriber class
0 1 1 1 1 1 1	(63)	service or option not available - unspecified (default)

Class 1 0 0, service or option not implemented

1 0 0 0 0 0 1	(65)	bearer capability not implemented
1 0 0 0 1 0 1	(69)	requested facility not implemented
1 0 0 0 1 1 0	(70)	only restricted digital information bearer capability is available
1 0 0 1 1 1 1	(79)	service or option not implemented - unspecified (default)

Class 1 0 1, invalid message (for example, parameter out of range)

1 0 1 0 1 1 1	(87)	user not member of CUG (No procedure specified for U.S. networks)
1 0 1 1 0 0 0	(88)	incompatible destination
1 0 1 1 0 1 0	(90)	non-existent CUG (No procedure specified for U.S. networks)
1 0 1 1 0 1 1	(91)	invalid transit network selection
1 0 1 1 1 1 1	(95)	invalid message, unspecified (default)

Class 1 1 0, protocol error (for example, unknown message)

1 1 0 0 0 0 1	(97)	message type non-existent or not implemented
1 1 0 0 0 1 1	(99)	information element/parameter non-existent or not implemented - discarded
1 1 0 0 1 1 0	(102)	recovery on timer expiry
1 1 0 0 1 1 1	(103)	parameter non-existent or not implemented - passed on
1 1 0 1 1 1 0	(110)	message with unrecognized parameter discarded
1 1 0 1 1 1 1	(111)	protocol error, unspecified (default)

Class 1 1 1, interworking class

1 1 1 1 1 1 1	(127)	interworking, unspecified (default)

b) *ANSI standard* (coding standard value 1 0)

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Class 000 and 001, normal event

0 0 1 0 1 1 1	(23)	unallocated destination number
0 0 1 1 0 0 0	(24)	unknown business group
0 0 1 1 0 0 1	(25)	exchange routing error
0 0 1 1 0 1 0	(26)	misrouted call to a ported number
0 0 1 1 0 1 1	(27)	Number Portability (NP) Query on Release (QoR) - number not found (No procedure specified for U.S. networks.)

Class 0 1 0, resource unavailable

0 1 0 1 1 0 1	(45)	preemption (Used by T1.113-1988 and T1.619-1992)
0 1 0 1 1 1 0	(46)	precedence call blocked (Used by T1.113-1988 and ATIS-1000619.1992(R2015))

Class 0 1 1, service or option not available

0 1 1 0 0 1 1	(51)	call type incompatible with service request
0 1 1 0 1 1 0	(54)	call blocked due to group restrictions

NOTE: Spare values in the ANSI standard domain of values are interpreted as value 127 in the ITU-T domain of values.

- 5) *Diagnostic* The format and existence of the diagnostic field is dependent on the cause value and the location of generation. For causes generated by a local or transit network, the following diagnostics may be included:

Cause	Diagnostic	Format (Note)
22	Called party number (new)	See clause 3.6
38	Transit network identity	See clause 3.31C
42	Transit network identity	See clause 3.31C
57	Attribute identity	See below
58	Attribute identity	See below
65	Attribute identity	See below

NOTE - Diagnostics based on a parameter field shall also include the parameter name and length octets.

Attribute identity. The format of the diagnostic field when coded with an attribute identity shall be as shown in Figure 4.10A - ATIS-1000113.2015 – Chapter 3. The attribute number subfield identifies the rejected attribute as follows:

0 1 1 0 0 0 1	Information transfer capability
0 1 1 0 0 1 0	Information transfer mode
0 1 1 0 0 1 1	Information transfer rate
0 1 1 0 1 0 0	Structure
0 1 1 0 1 0 1	Configuration
0 1 1 0 1 1 0	Establishment
0 1 1 0 1 1 1	Symmetry
0 1 1 1 0 0 0	Information transfer rate (destination to origination)
0 1 1 1 0 0 1	Layer identification and corresponding user information

The rejected attribute and available attribute subfields are coded the same as in the equivalent octet of the user service information parameter field (see Clause 3.33). If more than one bearer capability attribute was rejected, the diagnostic field can be repeated.

The extension bit (ext), when coded 0, indicates that this diagnostic continues to the next octet (for example, octet 3a to 3b). The inclusion of the available attribute subfield is optional.

3.10 Charge Number

The format of the charge number parameter field shall be as shown in Figure 4.10B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the charge number parameter field:

- 1) *Odd/even indicator. See clause 3.6(1)*
- 2) *Nature of address indicator*

0 0 0 0 0 0	spare
0 0 0 0 0 1	ANI of the calling party; subscriber number
0 0 0 0 1 0	ANI not available or not provided
0 0 0 0 1 1	ANI of the calling party; national number
0 0 0 1 0 0	spare
0 0 0 1 0 1	ANI of the called party; subscriber number
0 0 0 1 1 0	ANI of the called party; no number present
0 0 0 1 1 1	ANI of the called party; national number
0 0 0 1 0 0	}
to	spare
1 1 1 0 1 1	}
1 1 1 1 0 0	}
to	reserved for network specific use
1 1 1 1 1 0	}
1 1 1 1 1 1	spare
- 3) *Numbering plan indicator. See clause 3.6(3)*
- 4) *Address signal. see clause 3.6(4), as applicable*
- 5) *Filler. see clause 3.6(5)*

3.10A Circuit Group Characteristic Indicators

The format of the circuit group characteristic indicators parameter field shall be as shown in Figure 4.10C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the circuit group characteristic indicators parameter field:

Bits	BA:	Circuit group carrier indicator
	0 0	unknown
	0 1	analog

	1 0	digital
	1 1	digital and analog
Bits	DC:	Double seizing control indicator
	0 0	no circuit control
	0 1	odd CIC control
	1 0	even CIC control
	1 1	all circuit control
Bits	FE:	Alarm carrier indicator
	0 0	unknown (default))
	0 1	software carrier handling
	1 0	hardware carrier handling
	1 1	spare
Bits	HG:	Continuity check requirements indicator
	0 0	unknown
	0 1	none
	1 0	statistical
	1 1	per call

3.10B Circuit Assignment Map

The format of the circuit assignment map parameter field shall be as shown in Figure 4.10BA of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the circuit assignment map parameter field:

1) *Map type*

0 0 0 0 0 0	spare
0 0 0 0 0 1	DS1 map format (64 kbit/s base rate)
0 0 0 0 1 0	}
to	spare
1 1 1 1 1 1	}

2) *Map format*

a) DS1 map

Each bit position on the map (octets 2-4) indicates whether the corresponding 64 kbit/s circuit is used in the NxDS0 connection. The bits are coded as follows:

- 0 64 kbit/s circuit is not used
- 1 64 kbit/s circuit is used

3.11 Circuit Group Supervision Message Type Indicator

The format of the circuit group supervision message type indicator parameter field shall be as shown in Figure 4.11 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the circuit group supervision message type indicator parameter field:

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Bits	BA:	Circuit group blocking type indicator
	0 0	block without release
	0 1	block with immediate release
	1 0	reserved for national use (note)
	1 1	spare (no interpretation)

Bits C-H: spare

NOTE - This value may be received from T1.113-1988 exchanges. The treatment of this value in current version exchanges is a vendor option. In a multi-vendor situation the applicable default value (00 or 01) is determined by mutual agreement between vendors.

3.11A Circuit Identification Name

The format of the circuit identification name parameter field shall be as shown in Figure 4.11A of ATIS-1000113.2015 – Chapter 3. With respect to offices A and Z the following conventions are used:

- For one-way trunk groups, the originating switch that offers traffic to the trunk group is office A.
- For two-way trunk groups, the switch with the lower alphanumeric CLLI code is designated office A.
- For one-way subgroups of a divided trunk group, the originating switch is designated office A.
- For two-way subgroups of a divided trunk group, the switch with the lower alphanumeric CLLI code is designated office A.

All octets are coded with IA5 characters. The CLLI codes are described in Clause 3.13A.

3.11B Circuit State Indicator

The format of the circuit state indicator parameter field shall be as shown in Figure 4.11B of ATIS-1000113.2015 – Chapter 3.

The number of octets in the circuit state indicator parameter field is equal to the specified range + 1, and is limited to 24 octets (32 internationally). Each circuit state indicator octet is associated with a circuit identification code such that octet n is associated with circuit identification code m + n - 1, where m is the circuit identification code contained in the message.

The following codes are used in each circuit state indicator octet:

0 0 0 0 0 0 0 0	transient
0 0 0 0 0 0 0 1	spare (no interpretation)
0 0 0 0 0 0 1 0	spare (no interpretation)
0 0 0 0 0 0 1 1	unequipped
0 0 0 0 0 1 0 0	incoming circuit busy, active
0 0 0 0 0 1 0 1	incoming circuit busy, locally blocked
0 0 0 0 0 1 1 0	incoming circuit busy, remotely blocked
0 0 0 0 0 1 1 1	incoming circuit busy, locally blocked, and remotely blocked

0 0 0 0 1 0 0 0	outgoing circuit busy, active
0 0 0 0 1 0 0 1	outgoing circuit busy, locally blocked
0 0 0 0 1 0 1 0	outgoing circuit busy, remotely blocked
0 0 0 0 1 0 1 1	outgoing circuit busy, locally blocked, and remotely blocked
0 0 0 0 1 1 0 0	idle
0 0 0 0 1 1 0 1	idle, locally blocked
0 0 0 0 1 1 1 0	idle, remotely blocked
0 0 0 0 1 1 1 1	idle, locally blocked, and remotely blocked
0 0 0 1 0 0 0 0	}
to	spare (no interpretation)
1 1 1 1 1 1 1 1	}

3.11C Circuit Validation Response Indicator

The format of the circuit validation response indicator parameter field shall be as shown in Figure 4.11C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the circuit validation response indicator parameter field:

0 0 0 0 0 0 0 0	successful
0 0 0 0 0 0 0 1	failure (default)
0 0 0 0 0 0 1 0	}
to	spare
1 1 1 1 1 1 1 1	}

3.12 Closed User Group Check Response Indicators

(No procedure specified for U.S. networks).

3.13 Closed User Group Interlock Code

(No procedure specified for U.S. networks).

3.13A COMMON LANGUAGE Location Identification (CLLI) Code

The format of the CLLI¹ (common language location identification) code parameter field shall be as shown in Figure 4.13A of ATIS-1000113.2015 – Chapter 3.

All octets are coded with IA5 characters.

¹COMMON LANGUAGE is a registered trademark and CLLI is a trademark of Telcordia Technologies, Inc.

3.14 Compatibility Information

(No procedure specified for U.S. networks).

3.14A Connected Number

(No procedure specified for U.S. networks).

3.15 Connection Request

The format of the connection request parameter field shall be as shown in Figure 4.14 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the connection request parameter field:

- 1) Local reference. A code indicating the local reference allocated by the signaling connection control part to the end-to-end connection.
- 2) Point code. A code identifying the signaling point at which the connection request originated.
- 3) Protocol class. A code identifying in pure binary representation the protocol class requested for the end-to-end connection (see ATIS-1000112.2005(R2015) – Chapter 3).
- 4) Credit. A code identifying in pure binary representation the window size requested for the end-to-end connection (see ATIS-1000112.2005(R2015) – Chapter 3).

NOTE - The credit subfield is required only for protocol class 3 and class 4.

3.16 Continuity Indicators

The format of the continuity indicators parameter field shall be as shown in Figure 4.15 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the continuity indicators parameter field:

Bit	A:	Continuity indicator
	0	continuity check failed
	1	continuity check successful
Bits	B-H:	spare

3.16A Egress Service

The format of the egress service parameter field shall be as shown in Figure 4.15A of ATIS-1000113.2015 – Chapter 3. The codes used in the egress service parameter field are network specific and are not part of this standard.

3.17 End of Optional Parameters Indicator

The last optional parameter field of a message is followed by the end of optional parameters indicator, which occupies a one octet field containing all zeros.

3.17A Event Information

The format of the Event Information parameter shall be as shown in Figure 4.15B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the event information parameter field:

1) *Event indicator*

0 0 0 0 0 0 0	spare (no interpretation)
0 0 0 0 0 0 1	ALERTing
0 0 0 0 0 1 0	PROGress
0 0 0 0 0 1 1	inband information or appropriate pattern is now available
0 0 0 0 1 0 0	call forwarded on busy (No procedure specified for U.S. networks)
0 0 0 0 1 0 1	call forwarded on no reply (No procedure specified for U.S. networks)
0 0 0 0 1 1 0	call forwarded unconditional (No procedure specified for U.S. networks)
0 0 0 0 1 1 1	spare (no interpretation)
0 0 0 1 0 0 0	notification for supplementary service
0 0 0 1 0 0 1	}
to	spare (no interpretation)
1 1 0 1 1 1 0	}
1 1 0 1 1 1 1	service information included
1 1 1 0 0 0 0	}
to	spare (no interpretation)
1 1 1 1 1 1 0	}
1 1 1 1 1 1 1	reserved (no interpretation)

2) *Event presentation restricted indicator (restrict)*

0	no indication
1	presentation restricted

3.18 Facility Indicator

(No procedure specified for U.S. networks)

3.19 Facility Information Indicators

(No procedure specified for U.S. networks).

3.20 Forward Call Indicators

The format of the forward call indicators parameter field shall be as shown in Figure 4.18 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the forward call indicators parameter field:

Bit	A:	Incoming international call indicator
	0	not an incoming international call
	1	incoming international call
Bits	CB:	End-to-end method indicator (note)
	0 0	no end-to-end method available
	0 1	pass along method available
	1 0	SCCP method available
	1 1	pass along and SCCP methods available
Bit	D:	Interworking indicator (note)
	0	no interworking encountered (No. 7 signaling all the way)
	1	interworking encountered
Bit	E:	spare
Bit	F:	ISDN user part indicator (note)
	0	ISDN user part not used all the way
	1	ISDN user part used all the way
Bits	HG:	ISDN user part preference indicator
	0 0	ISDN user part preferred all the way (default)
	0 1	ISDN user part not required all the way
	1 0	ISDN user part required all the way
	1 1	spare
Bit	I:	ISDN access indicator
	0	originating access non-ISDN
	1	originating access ISDN
Bits	KJ:	SCCP method indicator
	0 0	no indication
	0 1	connectionless method available (No procedure specified for U.S. networks.)
	1 0	connection oriented method available (No procedure specified for U.S. networks.)
	1 1	connectionless and connection oriented method available (No procedure specified for U.S. networks.)
Bit	L:	spare
Bit	M:	Ported number translation indicator
	0	number not translated
	1	number translated
Bit	N:	Query on Release (QoR) attempt indicator (No procedure specified for U.S. networks.)
Bits	O-P:	Reserved for national use

NOTE - Bits B-F constitute the protocol control indicator.

3.20A Generic Address Parameter

The format of the generic address parameter field shall be as shown in Figure 4.18A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the sub-fields of the generic address parameter field:

- 1) Type of Address

0 0 0 0 0 0 0	dialled number
0 0 0 0 0 0 1	destination number

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0 0 0 0 0 0 1 0	supplemental user provided calling address - failed network screening
0 0 0 0 0 0 1 1	supplemental user provided calling address - not screened
0 0 0 0 0 1 0 0	completion number
0 0 0 0 0 1 0 1	}
to	ITU-T spare
0 1 1 1 1 1 1 1	}
1 0 0 0 0 0 0 0	}
to	network specific use
1 0 1 1 1 1 1 1	}
1 1 0 0 0 0 0 0	ported number
1 1 0 0 0 0 0 1	}
to	ANSI spare
1 1 1 1 0 1 0 1	}
1 1 1 1 0 1 1 0	alternately billed number (third number)
1 1 1 1 0 1 1 1	associated forward number
1 1 1 1 1 0 0 0	transfer number 6 (note)
1 1 1 1 1 0 0 1	transfer number 5 (note)
1 1 1 1 1 0 1 0	transfer number 4 (note)
1 1 1 1 1 0 1 1	transfer number 3 (note)
1 1 1 1 1 1 0 0	transfer number 2 (note)
1 1 1 1 1 1 0 1	transfer number 1 (note)
1 1 1 1 1 1 1 0	Caller's Emergency Service Identification (CESID) (note)
1 1 1 1 1 1 1 1	reserved for expansion

NOTE – Previously used in T1.628-1993.

2) Odd/even indicator. See clause 3.6(1)

3) Nature of address indicator.

For type of address = dialled number

0 0 0 0 0 0 0	spare
0 0 0 0 0 0 1	subscriber number
0 0 0 0 0 1 0	spare reserved, for national use
0 0 0 0 0 1 1	national number
0 0 0 0 1 0 0	international number
0 0 0 0 1 0 1	spare
0 0 0 0 1 1 0	abbreviated number
0 0 0 0 1 1 1	}
to	spare
1 1 1 1 1 1 1	}

For type of address = destination number, see type of address = dialled number

For type of address = supplemental user provided calling address, see clause 3.7(2) as applicable

For type of address = completion number, see clause 3.6(2) as applicable

For type of address = ported number

0 0 0 0 0 1 1 national (significant) number

4) Numbering plan indicator.

For type of address = ported number

001 ISDN (Telephony) numbering plan

For other types of address, see clause 3.6(3).

5) Address presentation restricted indicator (Pres.). See clause 3.7(4)

Not applicable for type of address of ported number.

6) Address signal. See clause 3.6(4), as applicable

7) Filler. See clause 3.6(5)

3.20B Generic Digits Parameter

The format of the generic digits parameter field shall be as shown in Figure 4.18B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the generic digits parameter field:

1) *Type of Digits*

0 0 0 0 0 Account code

0 0 0 0 1 Authorization code

0 0 0 1 0 Private network travelling class mark

0 0 0 1 1 business communication group identity (no procedure specified for U.S. networks)

0 0 1 0 0 }

to |ANSI spare

0 1 1 0 0 }

0 1 1 0 1 location identification number

0 1 1 1 0 spare

0 1 1 1 1 bill-to number

1 0 0 0 0 }

to | reserved for network specific use

1 1 1 1 0 }

1 1 1 1 1 reserved for extension.

2) *Encoding scheme*

0 0 0 BCD even

0 0 1 BCD odd

0 1 0 IA5

0 1 1 binary

1 0 0 }

to | spare

1 1 1 }

3) *Digits*

The most significant digit is sent first. For BCD encodings, the first digit appears in bits 1 through 4 of the first octet. Subsequent digits are sent in successive 4-bit fields, in the case of BCD encoding, or in successive octets, in the case of IA5 or binary encoding. If the digits field is carrying an odd number of digits encoded using BCD, the filler code 0000 is inserted after the last digit.

3.20C Generic Name Parameter

The format of the generic name parameter field shall be as shown in Figure 4.18C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the generic name parameter field:

1) *Presentation (Pres.)*

0 0	presentation allowed
0 1	presentation restricted
1 0	blocking toggle
1 1	no indication

2) *Availability (Avail.)*

0	name available/unknown
1	name not available

3) *Type of name*

0 0 0	spare
0 0 1	calling name
0 1 0	original called name
0 1 1	redirecting name
1 0 0	connected name
1 0 1	]
to	spare
1 1 1	]

4) *Character (1-n)*

Up to 15 characters of name information are coded in IA5 format.

3.20D Hop Counter Parameter

The format of the hop counter parameter field shall be as shown in Figure 4.18D of ATIS-1000113.2015 – Chapter 3.

The hop counter subfield contains the binary representation of the number of contiguous SS7 interexchange circuits that are allowed to complete the call.

3.21 Index

(No procedure specified for U.S. networks).

3.22 Information Indicators

The format of the information indicators parameter field shall be as shown in Figure 4.20 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the information indicators parameter field:

Bits	BA:	Calling party address response indicator
	0 0	calling party address not included
	0 1	calling party address not available
	1 0	spare
	1 1	calling party address included, hold not provided
Bit	C:	Hold provided indicator
	0	hold not provided (default)
	1	hold provided (No procedure specified for U.S. networks.)
Bits	ED:	spare
Bit	F:	Calling party's category response indicator
	0	calling party's category not included
	1	calling party's category included (No procedure specified for U.S. networks.)
Bit	G:	Charge information response indicator
	0	charge information not included
	1	charge information included (No procedure specified for U.S. networks.)
Bit	H:	Solicited information indicator (see note)
	0	solicited
	1	unsolicited
Bit	I:	spare (see note)
Bit	J:	spare
Bits	K-O:	spare
Bit	P:	Multi-location business group information response indicator
	0	multi-location business group information not included
	1	multi-location business group information included

NOTE - Redirecting address response indicators (formerly bits IH): deleted, not supported in previous versions of ATIS-1000113.2015 and the ITU-T White Book.

3.23 Information Request Indicators

The format of the information request indicators parameter field shall be as shown in Figure 4.21 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the information request indicators parameter field:

Bit	A:	Calling party address request indicator
	0	calling party address not requested
	1	calling party address requested

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Bit	B:	Holding indicator
	0	holding not requested
	1	holding requested (No procedure specified for U.S. networks.)
Bit	C	spare
Bit	D:	Calling party's category request indicator
	0	calling party's category not requested
	1	calling party's category requested (No procedure specified for U.S. networks.)
Bit	E:	Charge information request indicator
	0	charge information not requested
	1	charge information requested (No procedure specified for U.S. networks.)
Bit	F:	spare
Bit	G:	spare
Bit	H:	Malicious call identification request indicator
	0	malicious call identification not requested (default)
	1	malicious call identification requested (No procedure specified for U.S. networks.)
Bit	I:	spare
Bits	J-O:	spare (no interpretation)
Bit	P:	Multi-location business group information indicator
	0	multi-location business group information not requested
	1	multi-location business group information requested

3.23A Jurisdiction Information

The format of the jurisdiction information parameter field shall be as shown in Figure 4.21A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the jurisdiction information parameter field:

Address signal. See clause 3.6(4), as applicable

3.23B Local Service Provider Identification

The format of the local service provider identification parameter field shall be as shown in Figure 4.21B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the local service provider identification parameter field:

- 1) *Local Service Provider Identification (LSPI) Type*

00000	spare
00001	switch owner
00010	account owner

00011 }
 to | spare
 11111 }

2) *Encoding scheme*

000 spare
 001 BCD odd
 010 BCD even
 011 IA5
 100 binary
 101 }
 to | spare
 111 }

3) *Context identification*

0000 null
 0001 native
 0010 unbundled
 0011 resold
 0100 wireless native
 0101 wireless resold
 0110 }
 to | spare
 1111 }

NOTE - The context identification field will have the value “null” when the LSPI Type is coded “switch owner”.

4) *Local Service Provider Identity*

For BCD and IA5 encoding schemes, the most significant character is sent first. For BCD encodings, the first digit appears in bits 1 through 4 of the first octet. Subsequent digits are sent in successive 4-bit fields. If the Local Service Provider Identity field is carrying an odd number of digits encoded using BCD, the filler code 0000 is inserted after the last digit. In the case of IA5 encoding, each character is encoded in one octet. In the case of binary encoding, the entire LSPI value will be represented by a binary number.

3.23C Message Compatibility Information

The format of the message compatibility information parameter field shall be as shown in Figure 4.21C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the message compatibility information parameter field:

3. *Instruction indicators*

The format of the instruction indicators subfield is shown in Figure 4.21D of ATIS-1000113.2015 – Chapter 3. The following codes are used in the instruction indicators subfield:

Bit	A:	Transit at intermediate exchange indicator
	0	transit interpretation
	1	end node interpretation

Bit	B:	release call indicator
	0	do not release call
	1	release call
Bit	C:	send notification indicator
	0	do not send notification
	1	send notification
Bit	D:	Discard message indicator
	0	do not discard message (pass on)
	1	discard message
Bit	E:	Pass on not possible indicator
	0	release call
	1	discard information
Bits	G-F:	Broadband/narrowband interworking indicator
	00	pass on
	01	discard message
	10	release call
	11	reserved, assume 00

4. Extension indicator

0	information continues through the next octet
1	last octet

5. More instruction indicators

The bits will be defined when required.

3.23D Network Specific Facility

The format of the network specific facility parameter field shall be as shown in Figure 4.21E of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the network specific facility parameter field:

1) Length of network identification

The field contains the length, in octets, of the network identification found in octets 1a, 1b, and 1c. If the value is 0000 0000, then octets 1a-1c are omitted.

2) Type of network identification

0 0 0	spare
0 1 0	national network identification
0 1 1	reserved for international network identification (note)

All other values are spare.

NOTE – The value 011 is reserved for international use, in case the parameter will be accepted for international use in the future.

3) Network identification plan

a) For national network identification

0 0 0 0	unknown (no interpretation)
0 0 0 1	3-digit carrier identification
0 0 1 0	4-digit carrier identification
0 0 1 1	}
to	reserved (no interpretation)
0 1 1 1	}
1 0 0 0	}
to	reserved for network specific use (no interpretation)
1 1 1 1	}

4) *Digits 1-3 or 1-4* See clause 3.6(4)

For 3-digit carrier identification, bits 5-8 of octet 1c will be coded 0000.

5) *Network specific facility indicator*

This field is encoded according to the rules specified by the identified network. This indicator is the same as the Network specific facility specification field in the Network-specific facilities information element in ATIS-1000607.2014.

3.24 Nature of Connection Indicators

The format of the nature of connection indicators parameter field shall be as shown in Figure 4.22 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the nature of connection indicators parameter field:

Bits	BA:	Satellite indicator
	0 0	no satellite circuit in the connection
	0 1	one satellite circuit in the connection
	1 0	two satellite circuits in the connection
	1 1	three or more satellite circuits in the connection
Bits	DC:	Continuity check indicator
	0 0	continuity check not required (default)
	0 1	continuity check required on this circuit
	1 0	continuity check performed on a previous circuit
	1 1	spare
Bit	E:	Echo control device indicator
	0	outgoing half echo control device not included
	1	outgoing half echo control device included
Bits	F-H:	spare

3.24A Network Transport

The format of the Network Transport Parameter shall be as shown in Figure 4.22A of ATIS-1000113.2015 – Chapter 3. This parameter serves as an envelope for one or more of the other ISDN User Part parameters defined in this clause.

3.24AB Network Management Controls

The format of the network management controls parameter field shall be as shown in Figure 4.22AB of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the network management controls parameter field:

Bit	A:	Temporary Alternative Routing (TAR) indicator
	0	no indication
	1	TAR controlled call
Bits	G-B:	spare
Bit	H:	Extension indicator
	1	information continues through the next octet
	0	last octet

3.24B Notification Indicator

The format of the Notification Indicator shall be as shown in Figure 4.22B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the notification indicator parameter field:

1) *Extension indicator (ext)*

0	octet continues through the next octet
1	last octet

2) *Notification indicator*

0 0 0 0 0 0 0	}
to	spare (no interpretation)
0 0 0 0 0 1 1	}
0 0 0 0 1 0 0	call completion delay
0 0 0 0 1 0 1	}
to	spare (no interpretation)
1 0 1 1 1 1 1	}
1 1 0 0 0 0 0	call is a waiting call
1 1 0 0 0 0 1	reserved for transfer in progress
1 1 0 0 0 1 0	reserved for call isolated from conference call
1 1 0 0 0 1 1	reserved for call split from conference call
1 1 0 0 1 0 0	reserved for call reattached to conference call
1 1 0 0 1 0 1	reserved for call added to conference call
1 1 0 0 1 1 0	}
to	spare (no interpretation)
1 1 0 1 0 0 0	}
1 1 0 1 0 0 1	call transfer, alerting

1 1 0 1 0 1 0	call transfer, active
1 1 0 1 0 1 1	}
to	spare (no interpretation)
1 1 1 1 0 0 0	}
1 1 1 1 0 0 1	remote hold
1 1 1 1 0 1 0	remote hold released
1 1 1 1 0 1 1	call is forwarded/deflected
1 1 1 1 1 0 0	}
to	spare (no interpretation)
1 1 1 1 1 1 0	}
1 1 1 1 1 1 1	reserved (no interpretation)

3.24C Optional Backward Call Indicators

The format of the optional backward call indicators parameter field shall be as shown in Figure 4.22C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the optional backward call indicators parameter fields:

Bit	A:	Inband Information Indicator
	0	no indication
	1	inband information or an appropriate pattern is now available
Bit	B:	Call Forwarding May Occur Indicator
	0	no indication
	1	call forwarding may occur (No procedure specified for U.S. networks)
Bits	C:	Simple Segmentation Indicator
	0	no additional information will be sent
	1	additional information will be sent in a segmentation Message
Bit	D:	MLPP User Indicator
	0:	no indication
	1:	MLPP user (No procedure specified for U.S. networks)
Bits	E-F:	reserved for national use
Bit	G:	Network Excessive Delay Indicator
	0	no indication
	1	network excessive delay encountered
Bit	H:	User-Network Interaction Indicator
	0	no indication
	1	user-network interaction occurs, cut through in both directions

3.24D Operator Services Information

The format of the operator services information parameter field shall be as shown in Figure 4.22BA of ATIS-1000113.2015 – Chapter 3.

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The following codes are used in the operator services information parameter fields:

1) *Extension indicator (ext)*

- 0 octet continues through the next octet
- 1 last octet

2) *Information type*

- 0 0 0 unknown
- 0 0 1 original access prefix
- 0 1 0 bill-to information entry type and handling type
- 0 1 1 bill-to type
- 1 0 0 bill-to specific information
- 1 0 1 special handling
- 1 1 0 spare
- 1 1 1 access signaling

3) *Information value*

a) For information type 0 0 1:

- 0 0 0 0 unknown
- 0 0 0 1 1+ or 011+
- 0 0 1 0 0+ or 01+
- 0 0 1 1 0-
- 0 1 0 0]
- to | spare
- 1 0 0 1]
- 1 0 1 0]
- to | reserved for network specific use
- 1 1 1 1]

b) For information type 0 1 0:

- 0 0 0 0 information entry unknown, unknown handling
- 0 0 0 1 information entry manual by operator, station handling
- 0 0 1 0 information entry manual by operator, person handling
- 0 0 1 1 information entry automated by tone input, station handling
- 0 1 0 0 information entry unknown, station handling
- 0 1 0 1 information entry unknown, person handling
- 0 1 1 0 information entry manual by operator, unknown handling
- 0 1 1 1 information entry automated by tone input, unknown handling
- 1 0 0 0 information entry automated by tone input, person handling
- 1 0 0 1 information entry automated by spoken input, unknown handling
- 1 0 1 0 information entry automated by spoken input, station handling
- 1 0 1 1 information entry automated by spoken input, person handling
- 1 1 0 0]

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	to	spare
1 1 0 1		]
1 1 1 0		]
	to	reserved for network specific use
1 1 1 1		]

c) For information type 0 1 1:

0 0 0 0		unknown
0 0 0 1		card - 14 digit format
0 0 1 0		card - 89C format
0 0 1 1		card - other format
0 1 0 0		collect
0 1 0 1		third number
0 1 1 0		sent paid
0 1 1 1		]
	to	spare
1 0 1 0		]
1 0 1 1		]
	to	reserved for network specific use
1 1 1 1		]

d) For information type 1 0 0:

0 0 0 0		unknown
0 0 0 1		NIDB authorizes
0 0 1 0		NIDB reports, verify by automated means
0 0 1 1		NIDB reports, verify by operator
0 1 0 0		no NIDB query
0 1 0 1		no NIDB response
0 1 1 0		NIDB reports unavailable
0 1 1 1		no NIDB response - timeout
1 0 0 0		no NIDB response - reject component
1 0 0 1		no NIDB response - ACG in effect
1 0 1 0		no NIDB response - SCCP failure
1 0 1 1		spare
1 1 0 0		]
	to	reserved for network specific use
1 1 1 1		]

e) For information type 1 0 1:

0 0 0 0		unknown
0 0 0 1		call completion
0 0 1 0		rate information
0 0 1 1		trouble reporting

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0 1 0 0	time and charges
0 1 0 1	credit reporting
0 1 1 0	general assistance
0 1 1 1	}
to	spare
1 0 1 0	}
1 0 1 1	}
to	reserved for network specific use
1 1 1 1	}

f) For information type 1 1 1:

0 0 0 0	unknown
0 0 0 1	dial pulse
0 0 1 0	dual tone multifrequency
0 0 1 1	}
to	spare
1 0 0 1	}
1 0 1 0	}
to	reserved for network specific use
1 1 1 1	}

3.25 Optional Forward Call Indicators

The format of the optional forward call indicators parameter field shall be as shown in Figure 4.23 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the optional forward call indicators parameter fields:

Bits	B A:	Closed user group call indicator (No procedure specified for U.S. Networks)
	0 0	non-CUG call (No procedure specified for U.S. Networks)
	0 1	spare
	1 0	closed user group call, outgoing access not allowed (No procedure specified for U.S. Networks)
	1 1	closed user group call, outgoing access not allowed (No procedure specified for U.S. Networks)
Bit	C:	Simple segmentation indicator
	0	no additional information will be sent
	1	additional information will be sent in a segmentation message
Bits	G-D:	spare
Bit	H:	Connected line identity request indicator (No procedure specified for U.S. Networks)
	0	not requested (No procedure specified for U.S. Networks)
	1	requested (No procedure specified for U.S. Networks)

3.26 Original Called Number

The format of the original called number parameter field shall be as shown in Figure 4.23A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the original called number parameter fields:

- 1) *Odd/even indicator. See clause 3.6(1)*
- 2) *Nature of address indicator. See clause 3.7(2), as applicable*
- 3) *Numbering plan indicator. See clause 3.6(3)*
- 4) *Address presentation restricted indicator. See clause 3.7(4)*
- 5) *Address signal. See clause 3.6(4), as applicable*
- 6) *Filler. See clause 3.6(5)*

3.26A Originating Line Information

The format of the originating line information parameter field shall be as shown in Figure 4.23B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the originating line information parameter field:

0 0 0 0 0 0 0 0	}	
to		binary equivalent of the II digits ² (administered by the NANP Administrator).
0 1 1 0 0 0 1 1	}	See Annex C)
0 1 1 0 0 1 0 0	}	
to		reserved for future expansion (no interpretation)
1 1 1 1 1 1 1 1	}	

3.26B Outgoing Trunk Group Number

The format of the outgoing trunk group number parameter field shall be as shown in Figure 4.23C of ATIS-1000113.2015 – Chapter 3. The digit subfields are coded in binary coded decimal, where the most significant digit is sent first. The trunk group number may consist of either 2, 4, or 6 digits.

3.26C Precedence

The format of the precedence parameter field shall be as shown in Figure 4.23D of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the precedence parameter field:

- 1) *Look ahead for busy (LFB)*

0 0	look ahead for busy allowed
0 1	path reserved
1 0	look ahead for busy not allowed

² The existing II digit values can be found in the Telcordia Technologies "Local Exchange Routing Guide".

1 1 spare

2) *Precedence level*

0 0 0 0	flash override (0)
0 0 0 1	flash (1)
0 0 1 0	immediate (2)
0 0 1 1	priority (3)
0 1 0 0	routine (4)
0 1 0 1	}
to	spare
1 1 1 1	}

3) *Network identity (NI)*

Each digit is coded in binary coded decimal representation from 0 to 9.

The first digit of this field is coded 0. The TCC (Telephone Country Code) follows in the second to fourth NI digits (the most significant TCC digit is in the 2nd NI digit). If the TCC is one or two digits long, the excess digit(s) is inserted with the code for RPOA or network identification, if necessary. If the 3rd and 4th NI digits are not required, they are coded all zeros.

4) *MLPP service domain*

A code expressing in pure binary representation the number allocated to an MLPP Service Domain. These numbers are allocated in accordance with the procedures in Annex B, ATIS-1000113.2015 – Chapter 3.

3.26D Parameter Compatibility Information

The format of the parameter compatibility information parameter field shall be as shown in Figure 4.23E of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the parameter compatibility information parameter field:

a) *Nth upgraded parameter name*

This field contains the parameter name of the nth upgraded parameter in accordance with Table 4.4 of ATIS-1000113.2015 – Chapter 3.

b) *Instruction indicators*

The format of the instruction indicators subfield is shown in Figure 4.23F of ATIS-1000113.2015 – Chapter 3. The following codes are used in the instruction indicators subfield:

Bit	A:	Transit at intermediate exchange indicator
	0	transit interpretation
	1	end node interpretation
Bit	B:	Release call indicator
	0	do not release call
	1	release call
Bit	C:	Send notification indicator
	0	do not send notification
	1	send notification

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Bit	D:	Discard message indicator
	0	do not discard message (pass on)
	1	discard message
Bit	E:	Discard parameter indicator
	0	do not discard parameter (pass on)
	1	discard parameter
Bits	G-F:	Pass on not possible indicator
	00	release call
	01	discard message
	10	discard parameter
	11	reserved (interpreted as 00)

c) *Extension indicator*

- 0 information continues through the next octet
- 1 last octet

d) *bits J-I Broadband/narrowband interworking indicator*

- 00 pass on
- 01 discard message
- 10 release call
- 11 discard parameter

e) *bits O-K spare*

f) *More instruction indicators*

The bits will be defined when required.

3.26E Pivot Capability

The format of the pivot capability parameter field shall be as shown in Figure 4.23G of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the pivot capability parameter field:

Bits	CBA:	Pivot Possible Indicator
	000	no indication
	001	Pivot routing possible before ACM
	010	Pivot routing possible before ANM
	011	Pivot routing possible any time during the call
Bits	GFED:	spare
Bit	H:	Extension indicator
	0	information continues through the next octet
	1	last octet

3.26F Pivot Counter

(No procedure specified for U.S. networks).

3.26G Pivot Routing Backward Information

(No procedure specified for U.S. networks).

3.26H Pivot Routing Forward Information

(No procedure specified for U.S. networks).

3.26I Pivot Routing Indicator

The format of the pivot routing indicator parameter field shall be as shown in Figure 4.23H of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the pivot routing indicator parameter field:

0000000	no indication
0000001	Facility Request to Pivot
0000010	Facility Request to Pivot cancel
0000011	Facility Request to Pivot failure
0000100	}
to	spare
1111111	}
Bit	H: Extension indicator
	0 information continues through the next octet
	1 last octet

3.26J Pivot Status

(No procedure specified for U.S. networks)

3.27 Range & Status

The format of the range and status parameter field shall be as shown in Figure 4.24 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the range and status parameter field:

- Range.** A number in pure binary representation ranging from 0 to 23 (31 internationally). Range code 0 indicates absence of the status field. The number represented by a non-zero range code plus 1 indicates the range of circuits affected by the message.
- Status.** The status subfield contains from 1 to 24 (32 internationally) status bits numbered from 0 to 23 (31 internationally). Status bit 0 is located in bit position 1 of the first status subfield octet. Other

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status bits follow in numerical order. The number of relevant status bits in a given status subfield is equal to range plus 1.

Each status bit is associated with a circuit identification code such that status bit n is associated with circuit identification code $m+n$, where m is the circuit identification code contained in the message.

The status bits are coded as follows:

1. In Circuit Group Blocking messages
 - 0 no blocking
 - 1 blocking
2. In Circuit Group Blocking Acknowledgement messages
 - 0 no blocking acknowledgement
 - 1 blocking acknowledgement
3. In Circuit Group Unblocking messages
 - 0 no unblocking
 - 1 unblocking
4. In Circuit Group Unblocking Acknowledgement messages
 - 0 no unblocking acknowledgement
 - 1 unblocking acknowledgement
5. In Circuit Group Reset Acknowledgement messages
 - 0 no blocking
 - 1 blocked

3.27A Redirecting Number

The format of the redirecting number parameter field shall be as shown in Figure 4.25 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the redirecting number parameter field:

- 1) Odd/even indicator. See clause 3.6(1)
- 2) Nature of address indicator. See clause 3.7(2), as applicable
- 3) Numbering plan indicator. See clause 3.6(3)
- 4) Address presentation restricted indicator. See clause 3.7(4)
- 5) Address signal. See clause 3.6(4), as applicable
- 6) Filler. See clause 3.6(5).

3.28A Redirect Backward Information

The redirect backward information parameter field is a constructor with the format as shown in Figure 4.24A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the redirect backward information parameter field:

- 1) *Information Type Tag*

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0000 0000	not used
0000 0001	return to invoking exchange duration
0000 0010	return to invoking exchange call identifier
0000 0011	invoking redirect reason
0000 0100	}
to	spare
1111 1111	}

2) Information Type Value

(A) Return to invoking exchange duration

Return to invoking exchange duration is encoded in units of seconds as a variable length (of length 1-2 octets) integer with the least significant bit in the first octet.

(B) Return to invoking exchange call identifier

Return to invoking exchange call identifier is encoded in the same format as the Call Reference Parameter.

(C) Invoking redirect reason

The format of the invoking redirect reason is as shown in Figure 4.24AB of ATIS-1000113.2015 – Chapter 3. Invoking redirect reason is coded as follows:

1) Invoking Redirect Reason

0 0 0 0 0 0	unknown/not available
0 0 0 0 0 1	service provider portability (No procedure specified for U.S. networks)
0 0 0 0 1 0	location portability (No procedure specified for U.S. networks)
0 0 0 0 1 1	service portability (No procedure specified for U.S. networks)
0 0 0 1 0 0	}
to	spare
1 0 0 0 0 0	}
1 0 0 0 0 1	}
to	reserved for national use
1 1 1 1 1 1	}

2) Extension indicator

0	information continues through the next octet
1	last octet

3.28B Redirect Capability

The format of the redirect capability parameter field shall be as shown in Figure 4.24B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the redirect capability parameter field:

Bits	CBA:	Redirection possible indicator
	0 0 0	not used
	0 0 1	redirection possible before ACM

	0 1 0	redirection possible before ANM
	0 1 1	redirection possible at any time during the call
	1 0 0	}
	to	spare
	1 1 1	}
Bits	G-D:	spare
Bit	H:	Extension indicator
	0	information continues through the next octet
	1	last octet

3.28C Redirect Counter

The format of the redirect counter parameter field shall be as shown in Figure 4.24C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the redirect counter parameter field:

Bits	EDCBA:	Redirect counter
		This subfield contains the binary representation of the number of redirections.
Bits	HGF:	spare

3.28D Redirect Forward Information

The format of the redirect forward information parameter field shall be as shown in Figure 4.24D of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the redirect forward information parameter field:

1) Information Type Tag

0000 0000	not used
0000 0001	return to invoking exchange possible
0000 0010	return to invoking exchange call identifier
0000 0011	perform redirect indicator
0000 0100	invoking redirect reason
0000 0101	}
to	spare
1111 1111	}

2) Information Type Value

(A) Return to invoking exchange possible

Return to invoking exchange possible has length zero and has no information type value.

(B) Return to invoking exchange call identifier

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Return to invoking exchange call identifier is encoded in the same format as the Call Reference Parameter as shown in Figure 4.24DA of ATIS-1000113.2015 – Chapter 3. This parameter may be encoded by the invoking exchange either:

1. As the call reference value received, or
2. With the call identity subfield as a pure binary representation of the identification number allocated to the call at the invoking exchange and the point code as the code of the signaling point in which the call identity is relevant (i.e., the invoking exchange).

(C) *Performing redirect indicator*

Performing redirect indicator is encoded as shown in Figure 4.24DB of ATIS-1000113.2015 – Chapter 3. The plural sets of Performing Redirect Reason and Redirect Possible Indicator at Performing Exchange could be set in one PPI like a Service Activation parameter. Each Redirect Possible Indicator associates with the Performing Redirect Reason in the next octet. The following codes are used in the subfields:

1. *Extension indicator (Ext)*

As in clause 3.28A

2. *Performing Redirect Reason (octet 2n-1)*

0 0 0 0 0 0	unknown/ not available
0 0 0 0 0 1	service provider portability (No procedure specified for U.S. networks)
0 0 0 0 1 0	location portability (No procedure specified for U.S. networks)
0 0 0 0 1 1	service portability (No procedure specified for U.S. networks)
0 0 0 1 0 0	}
to	spare
0 1 1 1 1 1	}
1 0 0 0 0 0	}
to	reserved for national use
1 1 1 1 1 1	}

3. *Redirect Possible Indicator at Performing Exchange (octet 2n)*

000	no indication
001	redirection possible before ACM
010	redirection possible before ANM
011	redirection possible any time during the call
100	}
to	spare
111	}

(D) *Invoking Redirect Reason*

Invoking redirect reason is not used in the redirect forward information parameter.

3.28E Redirect Status

The format of the redirect status parameter field shall be as shown in Figure 4.24E of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the redirect status parameter field:

Bits	BA:	Redirect Possible Indicator
	00	not used
	01	acknowledgement of redirection
	10	redirection will not be invoked
	11	spare
Bits	GFEDC:	spare
Bit	H:	Extension indicator
	0	information continues through the next octet
	1	last octet

3.28F Redirection Indicators

Replaced by clause 3.29, Redirection Information.

3.29 Redirection Information

The format of the redirection information parameter field shall be as shown in Figure 4.25A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the redirection information parameter field:

1) *Redirecting indicator* (No procedure specified for U.S. networks.)

2) *Original redirecting reason*

0 0 0 0	unknown/not available (default)
0 0 0 1	user busy
0 0 1 0	no reply
0 0 1 1	unconditional
0 1 0 0	deflection
0 1 0 1	}
to	spare
1 1 1 0	}
1 1 1 1	reserved

3) *Redirection counter*

Number of redirections the call has undergone expressed as a binary number

4) *Redirecting reason*

0 0 0 0	unknown/not available (default)
0 0 0 1	user busy
0 0 1 0	no reply
0 0 1 1	unconditional
0 1 0 0	deflection
0 1 0 1	}
to	spare

1 1 1 1]

3.29A Redirection Number

The format of the redirection number parameter field shall be as shown in Figure 4.25B of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the subfields of the redirection number parameter field:

- 1) *Odd/even indicator. See clause 3.6(1)*
- 2) *Nature of address indicator. See clause 3.6(2), as applicable*
- 3) *Numbering plan indicator. See clause 3.6(3)*
- 4) *Address signal. See clause 3.6(4), as applicable*
- 5) *Filler. See clause 3.6(5).*

3.29B Remote Operations

The format of the remote operations parameter shall be as shown in Figure 4.25BA of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the remote operations parameter field:

- 1) *Extension indicator (ext)*

0	octet continues through the next octet
1	last octet

- 2) *Protocol profile*

0 0 0 0 0	]	
to		spare (no interpretation)
1 0 0 0 0	]	
1 0 0 0 1		remote operations protocol
1 0 0 1 0	]	
to		spare (no interpretation)
1 1 1 1 1	]	

- 3) *Component(s)*

The coding of the component is described in Annex D. The component may be repeated any number of times within the Remote Operations parameter. In case of multiple service requests, the receiving node shall treat the repetition of invoke components identically to the case where multiple Remote Operations parameters are received in a single message.

3.29C Service Activation

The format of the service activation parameter shall be as shown in Figure 4.25C of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the service activation parameter field:

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Feature code indicator

0 0 0 0 0 0 0 0	}
to	reserved for international use (no interpretation)
0 1 1 1 1 0 1 1	}
0 1 1 1 1 1 0 0	call waiting originating invoked
0 1 1 1 1 1 0 1	dial call waiting invoked
0 1 1 1 1 1 1 0	complete call request, ISDN user part used all the way
0 1 1 1 1 1 1 1	complete call request, ISDN user part not used all the way
1 0 0 0 0 0 0 0	network service attached
1 0 0 0 0 0 0 1	network service released
1 0 0 0 0 0 1 0	coin collect
1 0 0 0 0 0 1 1	coin return
1 0 0 0 0 1 0 0	network service recall
1 0 0 0 0 1 0 1	billing verification
1 0 0 0 0 1 1 0	hold available
1 0 0 0 0 1 1 1	hold not available
1 0 0 0 1 0 0 0	hold request
1 0 0 0 1 0 0 1	hold acknowledgement
1 0 0 0 1 0 1 0	hold release request
1 0 0 0 1 0 1 1	hold release acknowledgement
1 0 0 0 1 1 0 0	hold continuation request
1 0 0 0 1 1 0 1	disconnect request
1 0 0 0 1 1 1 0	reconnect request
1 0 0 0 1 1 1 1	Number Portability - Release to Pivot (No procedure specified for U.S. networks)
1 0 0 1 0 0 0 0	intercept – regular
1 0 0 1 0 0 0 1	hold request, acknowledge required
1 0 0 1 0 0 1 0	hold release request, acknowledge required
1 0 0 1 0 0 1 1	resume operator services
1 0 0 1 0 1 0 0	ICD notification (end-to-end significance)
1 0 0 1 0 1 0 1	ringback request
1 0 0 1 0 1 1 0	intercept – blank number
1 0 0 1 0 1 1 1	intercept – trouble
1 0 0 1 1 0 0 0	}
to	spare (no interpretation)
1 0 1 1 1 1 1 1	}
1 1 0 0 0 0 0 0	}
to	network specific use
1 1 1 1 1 1 1 0	}
1 1 1 1 1 1 1 1	reserved for network specific use (no interpretation)

3.29D Service Code

The format of the service code parameter shall be as shown in Figure 4.25D of ATIS-1000113.2015 – Chapter 3. The codes used in the service code parameter are the binary equivalents of the decimal codes used in the service code digits in Facility Service Selective Signaling (FSS). The codes are assigned by the North American Numbering Plan Administrator.

3.30 Signaling Point Code

(No procedure specified for U.S. networks)

3.30A Special Processing Request

The format of the special processing request parameter shall be as shown in Figure 4.26A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the special processing request parameter:

0 0 0 0 0 0 0 0	spare (no interpretation)
0 0 0 0 0 0 0 1	}
to	reserved for international use (no interpretation)
0 0 0 0 1 1 1 1	}
0 0 0 1 0 0 0 0	}
to	reserved for national use (no interpretation)
0 1 1 1 1 1 1 0	}
0 1 1 1 1 1 1 1	service processing requested
1 0 0 0 0 0 0 0	}
to	reserved for network specific use (no interpretation)
1 1 1 1 1 1 1 0	}
1 1 1 1 1 1 1 1	spare (no interpretation)

3.31 Subsequent Number

(No procedure specified for U.S. networks)

3.31A Suspend/Resume Indicators

The format of the suspend/resume indicators parameter field shall be as shown in Figure 4.27A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the suspend/resume indicators parameter field:

Bit	A:	Suspend/Resume indicator
	0	ISDN subscriber initiated (No procedure specified for U.S. networks)
	1	network initiated (default)
Bits	B-H:	spare

3.31B Transaction Request

The format of the transaction request parameter field shall be as shown in Figure 4.27B of ATIS-1000113.2015 – Chapter 3. The Transaction ID field is used to identify a TC transaction to be associated with further call processing using TC, by that TC Application Service Element (ASE) indicated in the SCCP address field. The Transaction ID field is coded per clause 3.5 of Chapter T1.114.3.

The SCCP address field is used to identify a TC Application Service Element (ASE) in a signaling point. It is coded per Clause 3.4 of ATIS-1000112 – Chapter 3.

3.31C Transit Network Selection

The formats of the transit network selection parameter field for 3 and 4 digit carrier identifications are shown in Figures 4.27C - ATIS-1000113.2015 – Chapter 3. and 4.27D - ATIS-1000113.2015 – Chapter 3, respectively.

The following codes are used in the subfields of the transit network selection parameter field:

1) Type of network identification

0 0 0 ITU-T-standardized identification

0 1 0 national network identification

All other values are reserved (no interpretation)

2) Network identification plan

(A) For ITU-T-standardized identification

0 0 0 0 unknown (no interpretation)

0 0 1 1 public data network identification code (see note)
(DNIC - ITU-T Recommendation X.121)

0 1 1 0 public land mobile network identification code
(MNIC - ITU-T Recommendation E.212) (see note)

All other values are reserved (no interpretation)

NOTE - Routing to these networks using the ISDN User Part is for further study.

(B) For national network identification

0 0 0 0 unknown (no interpretation)

0 0 0 1 3-digit carrier identification with circuit code (see note)

0 0 1 0 4-digit carrier identification with circuit code (see note)

0 0 1 1 }

to | reserved (no interpretation)

0 1 1 1 }

1 0 0 0 }

to | reserved for network specific use (no interpretation)

1 1 1 1 }

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NOTE - Carrier Identification assignments are administered by the North American Numbering Plan Administrator.

3) *Digits 1-3 or 1-4 See clause 3.6(4)*

4) *Circuit code*

0 0 0 0	unspecified (no interpretation)
0 0 0 1	international call, no operator requested
0 0 1 0	international call, operator requested
0 0 1 1	}
to	spare (no interpretation)
0 1 1 1	}
1 0 0 0	}
to	reserved for network specific use (no interpretation)
1 1 1 1	}

3.32 Transmission Medium Requirements

(No procedure specified for U.S. networks. See instead 3.33, *User Service Information*.)

3.32A Transmission Medium Used

The format of the transmission medium used parameter field shall be as shown in Figure 4.28A of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the transmission medium used parameter field:

0 0 0 0 0 0 0 0	speech
0 0 0 0 0 0 0 1	spare
0 0 0 0 0 0 1 0	64 kbit/s unrestricted
0 0 0 0 0 0 1 1	3.1 kHz audio
0 0 0 0 0 1 0 0	reserved
0 0 0 0 0 1 0 1	reserved
0 0 0 0 0 1 1 0	64 kbit/s preferred (also known as unrestricted digital information with tones and announcements, UDI-TA)
0 0 0 0 0 1 1 1	}
to	reserved
0 0 0 0 1 0 1 0	}
0 0 0 0 1 0 1 1	}
to	spare
1 1 1 1 1 1 1 1	}

3.33 User Service Information

The format of the user service information parameter field shall be as shown in Figure 4.29 of ATIS-1000113.2015 – Chapter 3. This format is the same as the bearer capability information element from ATIS-1000607 and not all capabilities coded here are supported at this time.

The following codes are used in the subfields of the user service information parameter field:

1) *Extension indicator (ext)*

0 octet continues through the next octet (for example, octet 2 to 2a, 2a to 2b, 3 to 3a)

1 last octet

Octets 1 - 3a

2) *Coding standard (octet 1)*

0 0 ITU-T standardized coding (see note)

1 0 national standard as described below

All other values are reserved (no interpretation)

NOTE - The coding described below is the ITU-T coding, except those codepoints indicated as national standard.

3) *Information transfer capability (octet 1)*

0 0 0 0 speech

0 1 0 0 unrestricted digital information

0 1 0 1 restricted digital information (see note)

1 0 0 0 3.1 kHz audio

1 0 0 1 unrestricted digital information with tones and announcements (UDI-TA)
(formerly, 7 kHz audio)

All other values are reserved (no interpretation)

NOTE - Only permitted in conjunction with 64 kbit/s information transfer rate. See ITU-T Recommendation I.340, Appendix 1, for details.

4) *Transfer mode (octet 2)*

0 0 circuit mode

1 0 packet mode

All other values are reserved (no interpretation)

5) *Information transfer rate (octets 2 and 2b) (see note 1)*

0 0 0 0 This code shall be used for packet mode calls

1 0 0 0 64 kbit/s (see note 2)

1 0 0 1 384 kbit/s

1 0 1 0 1472 kbit/s (see note 3)

1 0 1 0 1536 kbit/s

1 0 1 1 1920 kbit/s

1 1 0 0 Multi-rate (64 kbit/s based) (see note 4)

All other values are reserved (no interpretation)

NOTES -

(1) When octet 2b is omitted, the bearer capability is bi-directional symmetric at the information transfer rate specified in octet 2. When octet 2b is included, the information rate in octet 2 refers to the origination to destination direction.

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(2) This information transfer rate is also used for voiceband analog circuits.

(3) This is an American national code point and can be used only with the national standard.

(4) Specification of a multi-rate code point shall be accompanied by the corresponding multiplier information in octet 2.1.

6) *Structure (octet 2a)*

0 0 0 default (see note)

0 0 1 8 kHz integrity

1 0 0 service data unit integrity

1 1 1 unstructured

All other values are reserved (no interpretation)

NOTE - If octet 2a is omitted, or the structure field is coded 0 0 0, then the value of the structure attribute is according to the following:

Transfer Mode	Transfer Capability	Structure
circuit	speech	8 kHz integrity
circuit	unrestricted digital	8 kHz integrity
circuit	restricted digital	8 kHz integrity
circuit	audio	8 kHz integrity
circuit	video	8 kHz integrity
packet	unrestricted digital	service data unit integrity

7) *Configuration (octet 2a) (see note)*

0 0 point-to-point

All other values are reserved (no interpretation)

NOTE - If octet 2a is omitted, the configuration is assumed to be point to point.

8) *Establishment (octet 2a) (see note)*

0 0 demand

All other values are reserved (no interpretation)

NOTE - If octet 2a is omitted, the method establishment is assumed to be "demand".

9) *Symmetry (octet 2b) (see note)*

0 0 bi-directional symmetric

All other values are reserved (no interpretation)

NOTE - If octet 2b is omitted, bi-directional symmetry is assumed.

10) *Rate multiplier (octet 2.1)*

0 0 0 0 0 0 (0) reserved

0 0 0 0 0 1 (1) 1

to to

0 0 1 1 0 0 (24) 24

0 0 1 1 0 1 (25)]

to | No procedures specified for U. S. networks

0 0 1 1 1 0 (30)]

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0 0 1 1 1 1 1	(31)	}	
to			reserved
1 1 1 1 1 1 1	(127)	}	

11) *User information layer 1 protocol (octet 3) (see note 1)*

0 0 0 0 1	ITU-T standardized rate adaption V.110/X.30. This implies the presence of octet 3a and optionally octets 3b, 3c, and 3d as defined below
0 0 0 1 0	Recommendation G.711 μ -law speech
0 0 1 0 1	Recommendation G.722 and G.725 7 kHz audio
0 0 1 1 0	ITU-T Recommendations H.223 and H.245
0 0 1 1 1	Non-ITU-T standardized rate adaption. This implies the presence of octet 3a and, optionally, octets 3b, 3c, and 3d. (see note 2)
0 1 0 0 0	ITU-T standardized rate adaption V.120. This implies the presence of octets 3a, and 3b as described below, and optionally octets 3c and 3d.
0 1 0 0 1	ITU-T standardized rate adaption X.31 HDLC flag stuffing

All other values are reserved

NOTES -

(1) If the transfer mode is "circuit mode" and if the information transfer capability is "unrestricted digital information" or "restricted digital information" and if the user information layer 1 protocol is not to be identified to the network, then octet 3 shall be omitted. If the transfer mode is packet mode, octet 3 may be omitted. Otherwise, octet 3 shall be present.

(2) The use of this code point indicates that the user rate specified in octet 3a is defined by the user. Additionally, octets 3b, 3c, and 3d, if present, are defined consistent with the user specified rate adaption.

12) *Synchronous/asynchronous (octet 3a) (see note)*

0	synchronous
1	asynchronous

NOTE - The protocols synchronous and asynchronous refer to the R reference point. In case of asynchronous user rate except for half duplex operation, octets 3c and 3d may be omitted for Rec. V.110 or V.120.

13) *Negotiation (octet 3a) (see note)*

0	In-band negotiation not possible
1	In-band negotiation possible

NOTE - Applicable to Rec. V.110 and X.30, otherwise reserved.

14) *User rate (octet 3a)*

0 0 0 0 0	rate is indicated by E-bits specified in Rec. I.460	
0 0 0 0 1	0.6 kbit/s	Recommendations V.6 and X.1
0 0 0 1 0	1.2 kbit/s	Recommendations V.6
0 0 0 1 1	2.4 kbit/s	Recommendations V.6 and X.1
0 0 1 0 0	3.6 kbit/s	Recommendations V.6
0 0 1 0 1	4.8 kbit/s	Recommendations V.6 and X.1
0 0 1 1 0	7.2 kbit/s	Recommendations V.6
0 0 1 1 1	8.0 kbit/s	Recommendation I.460
0 1 0 0 0	9.6 kbit/s	Recommendations V.6 and X.1
0 1 0 0 1	14.4 kbit/s	Recommendations V.6
0 1 0 1 0	16.0 kbit/s	Recommendation I.460

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0 1 0 1 1	19.2 kbit/s	Recommendations V.6
0 1 1 0 0	32.0 kbit/s	Recommendation I.460
0 1 1 0 1	38.4 kbit/s	Recommendation V.110
0 1 1 1 0	48.0 kbit/s	Recommendations V.6 and X.1
0 1 1 1 1	56.0 kbit/s	Recommendation V.6
1 0 0 0 0	64 kbit/s	Recommendations X.1
1 0 0 1 1	28.8 kbit/s	Recommendation V.110
1 0 1 0 1	0.1345 kbit/s	Recommendations X.1
1 0 1 1 0	0.100 kbit/s	Recommendations X.1
1 0 1 1 1	0.075/1.2 kbit/s	Recommendations V.6 and X.1 (see note)
1 1 0 0 0	1.2/0.075 kbit/s	Recommendations V.6 and X.1 (see note)
1 1 0 0 1	0.050 kbit/s	Recommendations V.6 and X.1
1 1 0 1 0	0.075 kbit/s	Recommendations V.6 and X.1
1 1 0 1 1	0.110 kbit/s	Recommendations V.6 and X.1
1 1 1 0 0	0.150 kbit/s	Recommendations V.6 and X.1
1 1 1 0 1	0.200 kbit/s	Recommendations V.6 and X.1
1 1 1 1 0	0.300 kbit/s	Recommendations V.6 and X.1
1 1 1 1 1	12 kbit/s	Recommendations V.6

All other values are reserved

NOTE - The first rate is the transmit rate in the forward direction of the call. The second rate is the transmit rate in the backward direction of the call.

Octet 3b for V.110/X.30 rate adaption

15) Intermediate rate (octet 3b)

0 0	not used
0 1	8 kbit/s
1 0	16 kbit/s
1 1	32 kbit/s

16) Network independent clock (NIC) on transmission (TX) (octet 3b) (see note)

0	not required to send data with network independent clock
1	required to send data with network independent clock

NOTE - Refers to transmission in the forward direction of the call.

17) Network independent clock (NIC) on reception (RX) (octet 3b) (see note)

0	cannot accept data with independent clock (i.e., sender does not support this optional procedure)
1	can accept data with independent clock (i.e., sender does support this optional procedure)

NOTE - Refers to transmission in the backward direction of the call.

18) Flow control on transmission (TX) (octet 3b) (see note)

0	not required to send data with flow control mechanism
1	required to send data with flow control mechanism

NOTE - Refers to transmission in the forward direction of the call.

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19) Flow control on reception (RX) (octet 3b) (see note)

- 0 cannot accept data with flow control mechanism (i.e., sender does not support this optional procedure)
- 1 can accept data with flow control mechanism (i.e., sender does support this optional procedure)

Octet 3b for V.120 rate adaption

20) Rate adaption header/no header (octet 3b)

- 0 rate adaption header not included
- 1 rate adaption header included

21) Multiple frame establishment support in data link (octet 3b)

- 0 multiple frame establishment not supported. Only UI frames are allowed
- 1 multiple frame establishment supported

22) Mode of operation (octet 3b)

- 0 bit transparent mode of operation
- 1 protocol sensitive mode of operation

23) Logical link identifier (LLI) negotiation (octet 3b)

- 0 default LLI = 256
- 1 LLI negotiation (see note)

NOTE - A connection over which LLI negotiation will be carried is indicated in bit 2 of octet 3b.

24) Assignor/Assignee (octet 3b)

- 0 message originator is "Default Assignee"
- 1 message originator is "Assignor Only"

25) In-band/out-of-band negotiation (octet 3b)

- 0 not applicable to this standard
- 1 negotiation is done in-band using logical link zero

Octets 3c - 5

26) Number of stop bits (octet 3c)

- 0 0 not used
- 0 1 1 bit
- 1 0 1.5 bits
- 1 1 2 bits

27) Number of data bits excluding parity bit (octet 3c) (see note)

- 0 0 not used
- 0 1 5 bits
- 1 0 7 bits
- 1 1 8 bits

NOTE - If bit 7 of octet 3a is "0", then these bits, when present, are set to "0" on transmission and ignored on reception.

28) Parity information (octet 3c) (see note)

0 0 0 odd
 0 1 0 even
 0 1 1 none
 1 0 0 forced to 0
 1 0 1 forced to 1

All other values are reserved.

NOTE - If bit 7 of octet 3a is "0", then these bits, when present, are set to "0" on transmission and ignored on reception.

29) *Duplex mode (octet 3d)*

0 half duplex
 1 full duplex

30) *Modem type (octet 3d)*

Bits 6 - 1 coded according to network specific rules.

31) *User information layer 2 protocol (octet 4)*

0 0 0 1 0 T1.602
 0 0 1 1 0 Rec. X.25 link level
 All other values are reserved

32) *User information layer 3 protocol (octet 5)*

0 0 0 1 0 T1.607
 0 0 1 1 0 Rec. X.25 packet layer
 All other values are reserved

3.33A User Service Information Prime

The format of the user service information prime parameter field shall be as shown in Figure 4.29 of ATIS-1000113.2015 – Chapter 3, except that the coding rules for optional parameter are applied. The codings are identical to the codings in Clause 3.33 of ATIS-1000113.2015 – Chapter 3.

3.34 User-to-User Indicators

The format of the user-to-user indicators parameter field shall be as shown in Figure 4.30 of ATIS-1000113.2015 – Chapter 3.

The following codes are used in the user-to-user indicators parameter field:

Bit	A:	Type
	0	request (no procedure specified for U. S. networks)
	1	response

If bit A equals 1 (response):

Bits	CB:	Service 1 (no procedure specified for U. S. networks)
Bits	ED:	Service 2 (no procedure specified for U. S. networks)
Bits	GF:	Service 3 (no procedure specified for U. S. networks)

Bit	H:	Network discard indicator
	0	no information (no procedure specified for U. S. networks)
	1	user-to-user information discarded by the network

3.35 User-to-User Information

The format of the user-to-user information parameter field shall be as shown in Figure 4.31 of ATIS-1000113.2015 – Chapter 3. The user-to-user information parameter field shall be coded identically to the protocol discriminator plus the user information field of the DSS1 user-user information element described in ATIS-1000621.

4 ISDN User Part Messages & Codes

4.1 General

4.1.1 Message & Parameter Tables

In Table 4.3 to Table 4.23 of ATIS-1000113.2015 – Chapter 3 the format and coding of ISDN user part messages is specified.

For each message a list of the relevant parameters is given in a tabular form. For each parameter the table also includes:

- 1) *Reference clause.* A reference to the clause where the formatting and coding of the parameter content is specified;
- 2) *Type of the parameter.* The following types are used in the tables:
 F = mandatory fixed length parameter
 V = mandatory variable length parameter
 O = optional parameter of fixed or variable length
- 3) *Length³ of the parameter.* The value in the table includes:
 - a) *For type F parameters* the length, in octets, of the parameter content.
 - b) *For type V parameters* the length, in octets, of the length indicator and of the parameter content. The minimum and the maximum length are indicated.
 - c) *For type O parameters* the length, in octets, of the parameter name, length indicator and parameter content. For variable length parameters the minimum and maximum length is indicated.

4.1.2 Principles

For each message type, type F parameters and the pointers for the type V parameters shall be sent in the order specified in Table 4.5 to Table 4.23 of ATIS-1000113.2015 – Chapter 3.

The routing label and circuit identification code fields, which are transmitted ahead of the message type field if required, are not shown. Parameter names, pointers to mandatory variable fields and the optional part, length indicators, and the end of optional parameters field appear in the message in accordance with Figure 4.3 - ATIS-

³ The length of mandatory variable and optional parameters are provided as guidelines. These values can vary for network specific applications.

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1000113.2015 – Chapter 3 and are not shown explicitly in Tables 4.3 through 4.23 of ATIS-1000113.2015 – Chapter 3.

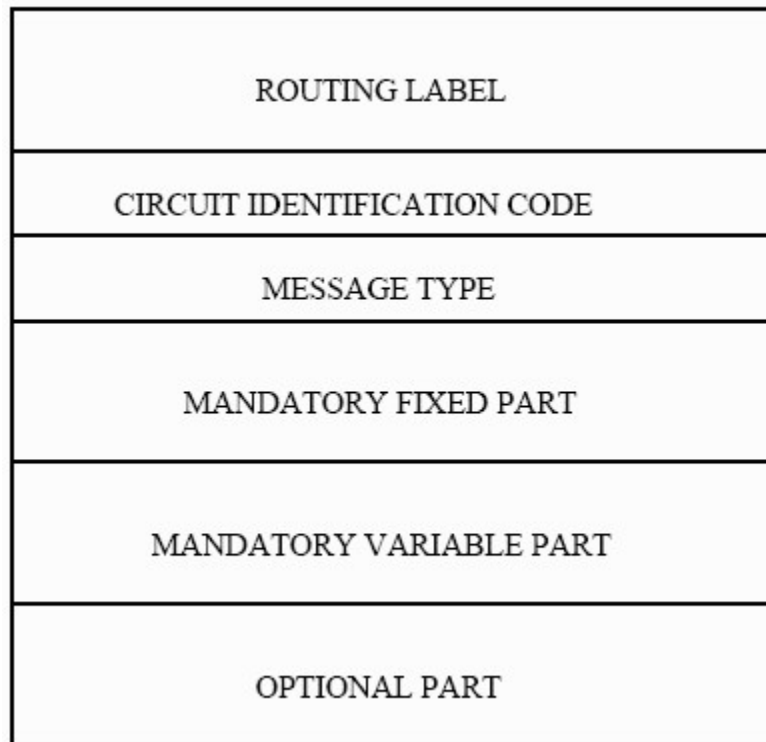


Figure 4.1 - ISDN USER PART MESSAGE PARTS - ATIS-1000113.2015 – Chapter 3

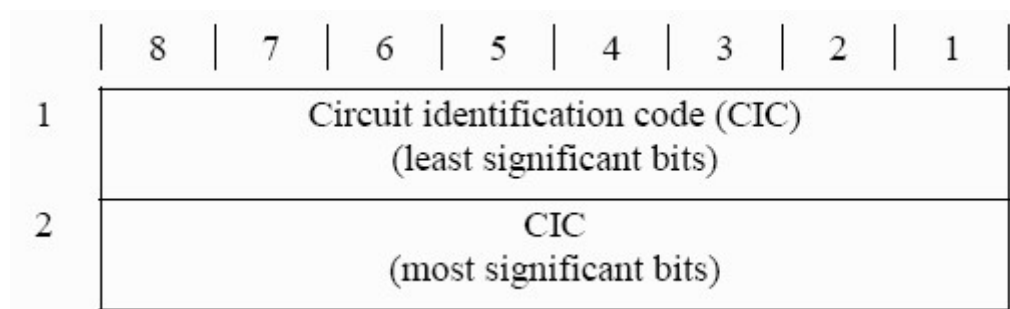


Figure 4.2 - Circuit Identification Code Field – ATIS-10000113.2015 – Chapter 3

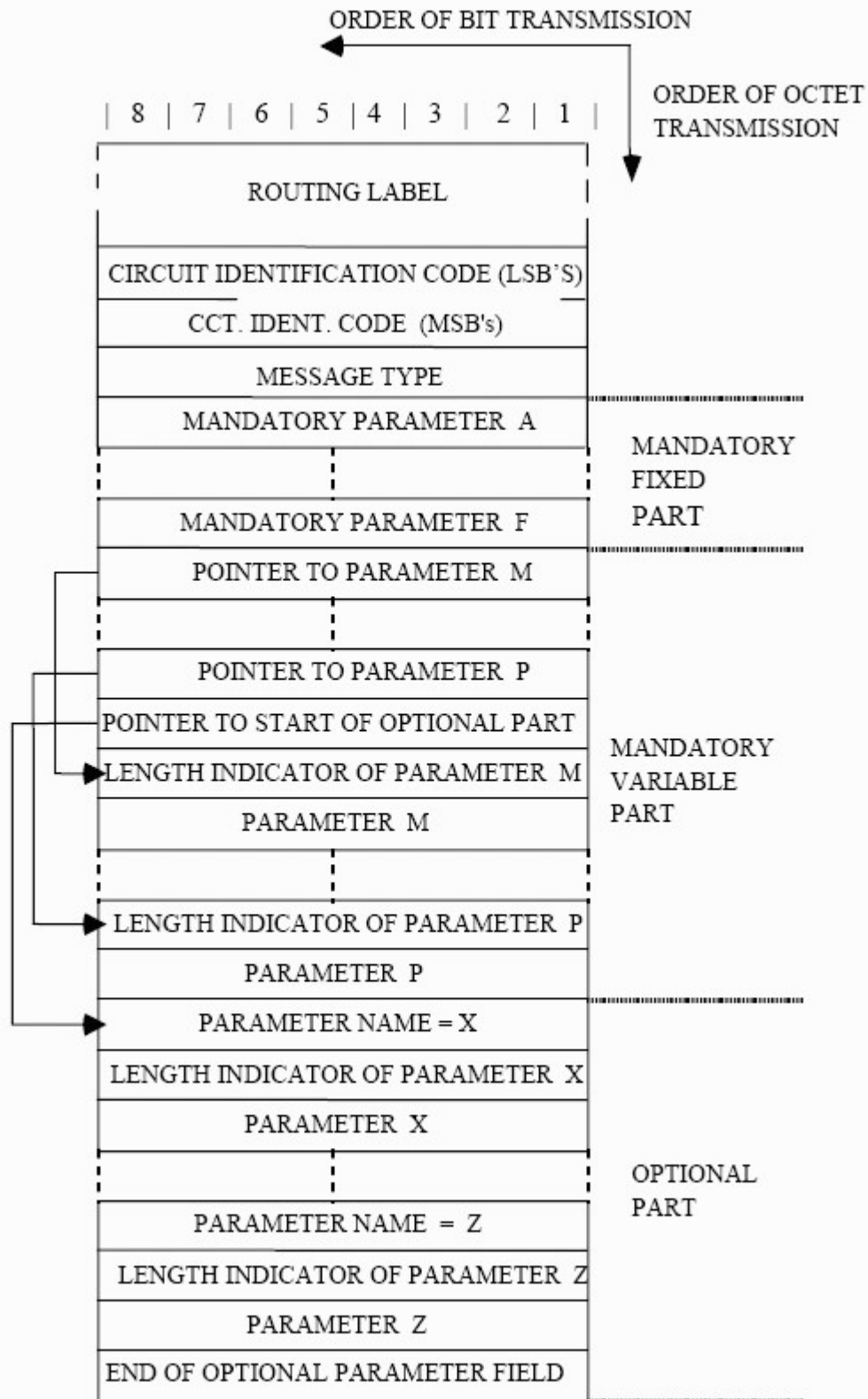


Figure 4.3 - General Message Structure – ATIS-1000113.2015 – Chapter 3

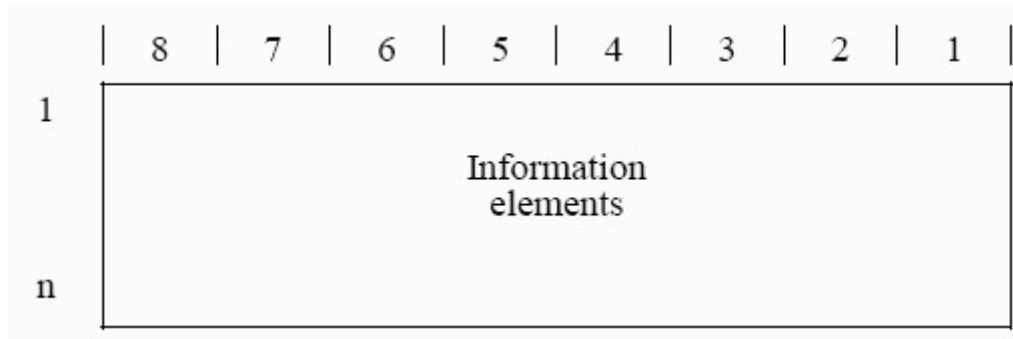


Figure 4.3.a - Access Transport Parameter Field – ATIS-1000113.2015 – Chapter 3

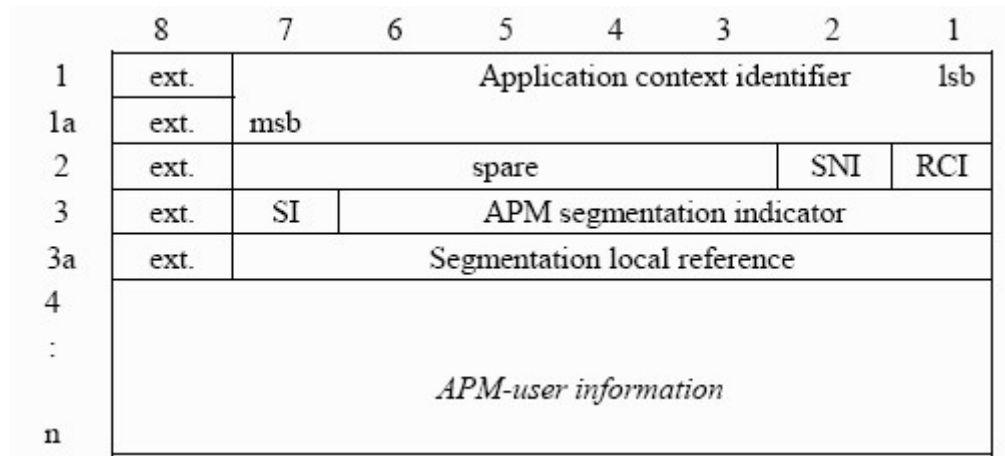


Figure 4.3.A/B - Access Transport Parameter Field – ATIS-1000113.2015 – Chapter 3

4	Originating Address length
4a	Originating Address
.	
4n	
5	Destination Address length
5a	Destination Address
.	
5n	
6	Encapsulated Application Information
.	
n	

Figure 4.3.AC – Contents of the APM-user information field – ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	O/E	Nature of address indicator						
2	Spare	Numbering plan			Spare			
3	2nd address signal				1st address signal			
..								
m	Filler (if necessary)				nth address signal			

Figure 4.3.A/D – Contents of the Originating address (Destination address) field – ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Automatic congestion level							

Figure 4.3.B- Automatic Congestion Level Parameter Field - ATIS-1000113.2015 – Chapter 3

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	8	7	6	5	4	3	2	1
1	Ext.	Re- routing Inhibit Indicator	Re-routing Counter					
1a	Ext. 1	Re-routing Reason						

Figure 4.3.C- Contents of the APM-user information field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.4 - Address Presentation Restriction Indicators Parameter Field – ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

Figure 4. 5 - Backward Call Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

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	8	7	6	5	4	3	2	1
1	Spare	Atten dant status	BGID ident.	Line privil. info. indic.	Party selector			
2	Most significant bit							
3	Business group identifier							
4	Least significant bit							
5	Most significant bit							
6	Sub-group identifier							
6	Least significant bit							
7	Line privileges							

Figure 4.5.A - Backward Call Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

NOTE - Octets 1-7 are repeated as required to identify multilocation business group information for multiple parties.

Deleted. (No procedure specified for U.S. networks)

Figure 4.6 - Call Modification Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Call identity							
2								
3								
4	Point Code							
5								
6								

NOTE - The least significant octet is sent first for each subfield

Figure 4.7 - Call Reference Parameter Field - ATIS-1000113.2015 – Chapter 3

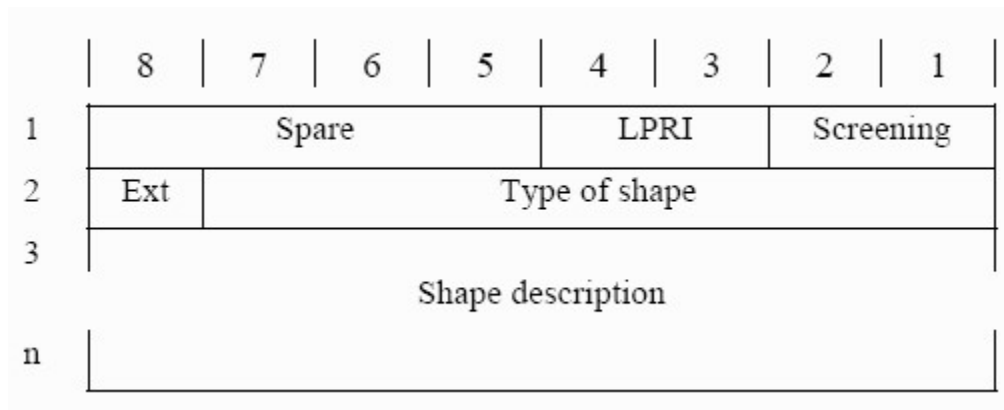


Figure 4.7.A - Calling Geodetic Location Parameter Field - ATIS-1000113.2015 – Chapter 3

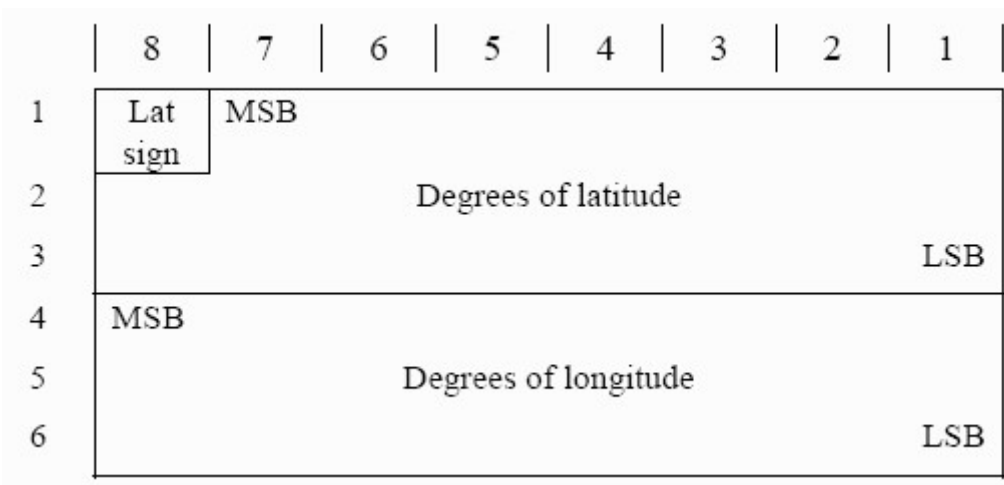


Figure 4.7.B - Ellipsoid point shape description - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Lat sign	MSB						
2	Degrees of latitude							
3								LSB
4	MSB							
5	Degrees of longitude							
6								LSB
7	Spare	Uncertainty code						
8	Spare	Confidence						

Figure 4.7.C - Shape description of an ellipsoid point with uncertainty - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1				
1	Lat sign	MSB										
2	Degrees of latitude											
3								LSB				
4	MSB											
5	Degrees of longitude											
6								LSB				
7	Spare	Uncertainty code										
8	Alt sign	MSB			Altitude							
9								LSB				
10	Spare	Altitude uncertainty code										
11	Spare	Confidence										

Figure 4.7.D - Shape description of an ellipsoid point with uncertainty - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Lat sign	MSB Degrees of latitude LSB						
2								
3								
4	MSB	Degrees of longitude LSB						
5								
6								
7	Spare	Major radius						
8	Spare	Minor radius						
9	Orientation							
10	Spare	Confidence						

Figure 4.7.E - Shape description of an ellipse on the ellipsoid - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Lat sign	MSB Degrees of latitude LSB						
2								
3								
4	MSB	Degrees of longitude LSB						
5								
6								
7	Spare	Radius						
8	Offset							
9	Included angle							
10	Spare	Confidence						

Figure 4.7.F - Shape description of an ellipsoid circle sector - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1	
1	Spare					Number of points			
2	Lat sign 1	MSB							
3	Degrees of latitude 1							LSB	
4									
5	MSB							LSB	
6	Degrees of longitude 1								
7									
:									
6n-4	Lat sign n	MSB							
6n-3	Degrees of latitude n							LSB	
6n-2									
6n-1	MSB							LSB	
6n	Degrees of longitude n								
6n+1									
6n+2	Spare	Confidence							

Figure 4.7.G - Shape description of polygon - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Odd/ Even	Nature of address indicator						
2	Spare	Numbering plan			Reserved			
3	2nd address signal				1st address signal			
n	Filler (if necessary)				nth address signal			

NOTE - If the nature of address indicator subfield indicates no number present, octets 2 through n are omitted.

Figure 4.8 - Called Party Number Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Odd/ Even	Nature of address indicator						
2	Spare	Numbering plan			Pres		Screening	
3	2nd address signal				1st address signal			
n	Filler (if necessary)				nth address signal			

NOTE - If the nature of address indicator subfield indicates no number present, octets 2 through n are omitted.

Figure 4.8.A - Calling Party Number Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Calling party's category							

Figure 4.9 - Calling Party's Category Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Spare	Type of network identification			Network identification plan			
Digit 2				Digit 1			
0	0	0	0	Digit 3			

Figure 4.9.A - Carrier Identification Parameter Field; 3-digit carrier identification - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Spare	Type of network identification			Network identification plan			
Digit 2				Digit 1			
Digit 4				Digit 3			

Figure 4.9.B - Carrier Identification Parameter Field; 4-digit carrier identification - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Carrier selection information							

Figure 4.9.C - Carrier Selection Information Parameter Field - ATIS-1000113.2015 – Chapter 3

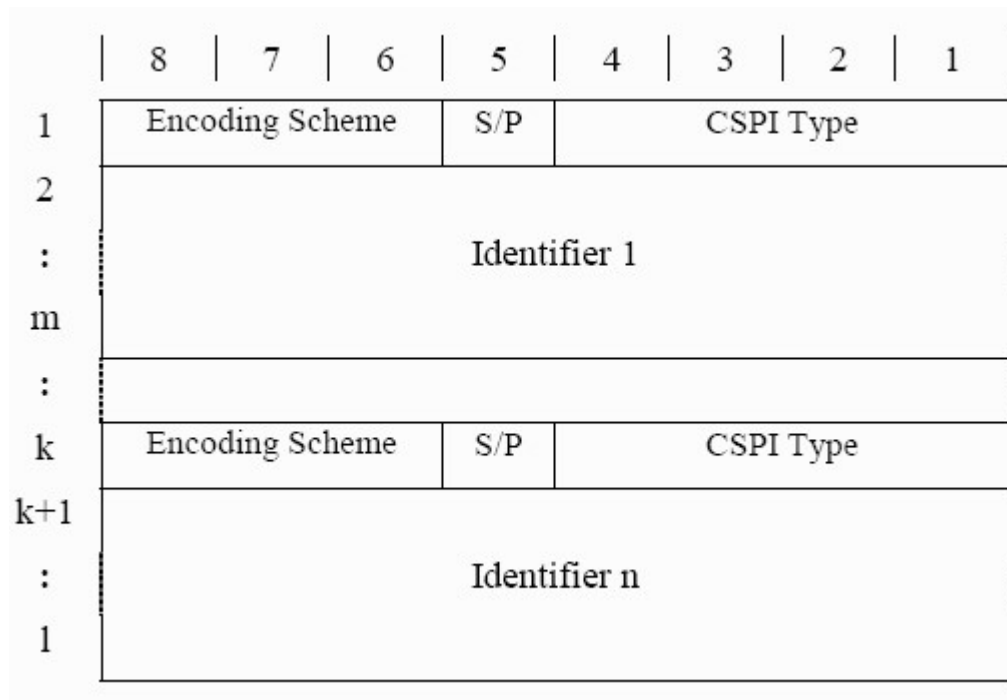


Figure 4.9.D - Carrier Service Provider Identification Parameter Field - ATIS-1000113.2015 – Chapter 3

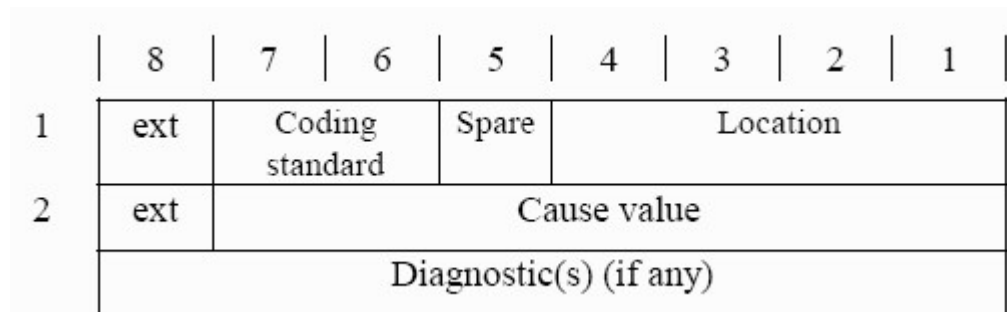


Figure 4.10 - Cause Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

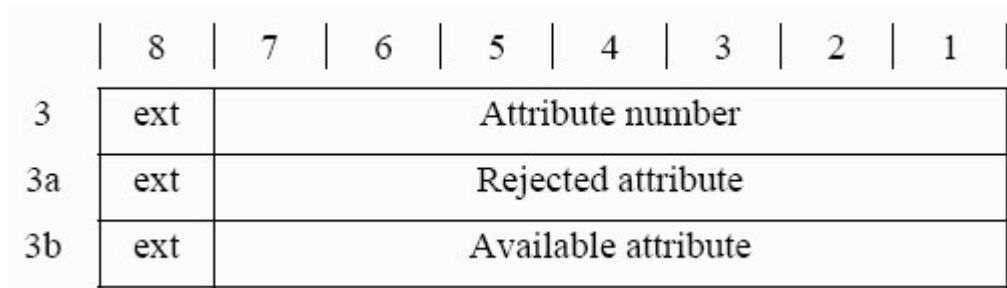


Figure 4.10.A - Diagnostic Field for Attribute Identity - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Odd/ Even	Nature of address indicator						
2	Spare	Numbering plan			Reserved			
3	2nd address signal				1st address signal			
n	Filler (if necessary)				nth address signal			

Figure 4.10.B - Charge Number Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Spare		Map type					
2	8	7	6	5	4	3	2	1
3	16	15	14	13	12	11	10	9
4	24	23	22	21	20	19	18	17

Figure 4.10.B.A - Circuit Assignment Map Parameter Field (DS1 Map Format) - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.10.C - Circuit Group Characteristics Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.11 - Circuit Group Supervision Message Type Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Spare	Trunk number (1st digit)						
.								
4	Spare	Trunk number (4th digit)						
5	Spare	CLLI code - office A						
15								
16	CLLI code - office Z							
26	Spare							

Figure 4.11.A - Circuit Identification Name Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Circuit state indicator							
.								
n	Circuit state indicator							

Figure 4.11.B - Circuit State Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
	Circuit validation response							

Figure 4.11.C - Circuit Validation Response Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.12 - Closed User Group Check Response Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.13 - Closed User Group Interlock Code - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Spare	Town (1st character)						
.								
4	Spare	Town (4th character)						
5	Spare	State (1st character)						
6	Spare	State (2nd character)						
7	Spare	Building (1st character)						
8	Spare	Building (2nd character)						
9	Spare	Building Subdivision (1st character)						
10	Spare	Building Subdivision (2nd character)						
11	Spare	Building Subdivision (3rd character)						

Figure 4.13.A - COMMON LANGUAGE Location Identification - ATIS-1000113.2015 – Chapter 3

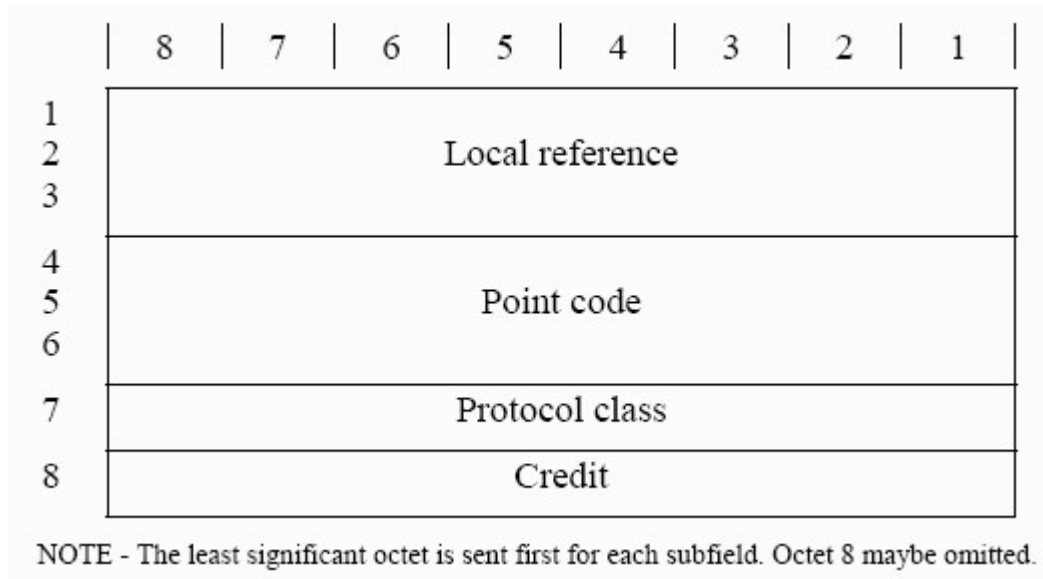


Figure 4.14 - Connection Request Parameter Field - ATIS-1000113.2015 – Chapter 3

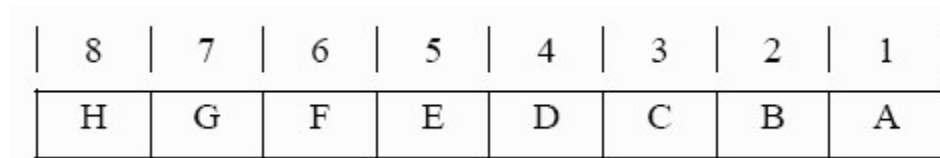


Figure 4.15 - Continuity Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

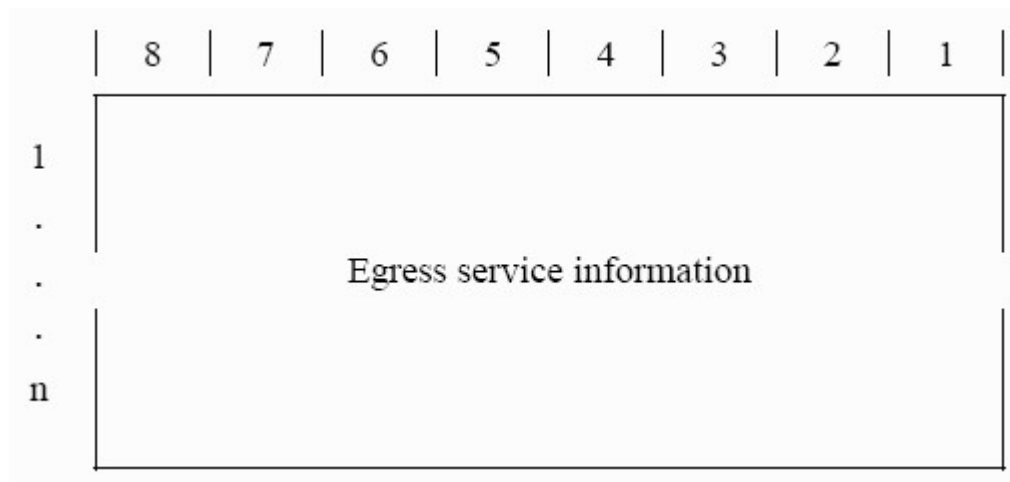


Figure 4.15.A - Egress Service Parameter Field - ATIS-1000113.2015 – Chapter 3

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8	7	6	5	4	3	2	1
Restrict	Event indicator						

Figure 4.15. B - Event Information Parameter Field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.16 - Facility Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.17 - Facility Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

Figure 4.18 - Forward Call Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Type of address							
2	Odd/ Even	Nature of address indicator						
3	Spare	Numbering plan			Pres		Reserved	
4	2nd address signal				1st address signal			
n	Filler (if necessary)				nth address signal			

Figure 4.18.A - Generic Address Parameter Field - ATIS-1000113.2015 – Chapter 3

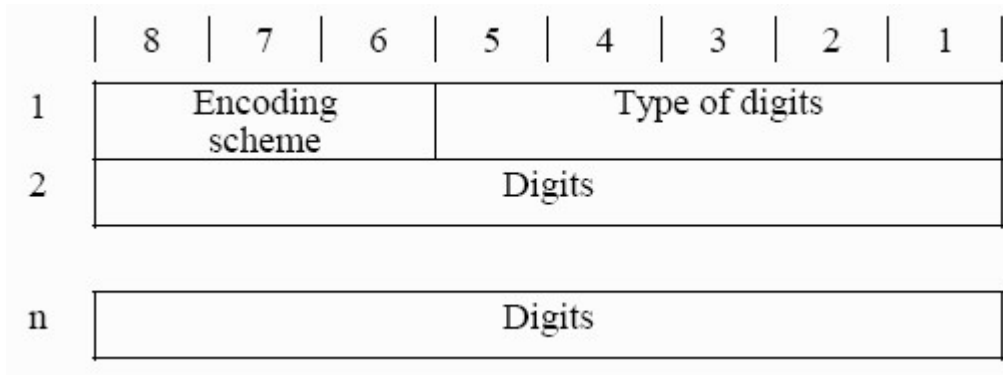


Figure 4.18.B - Generic Digits Parameter Field - ATIS-1000113.2015 – Chapter 3

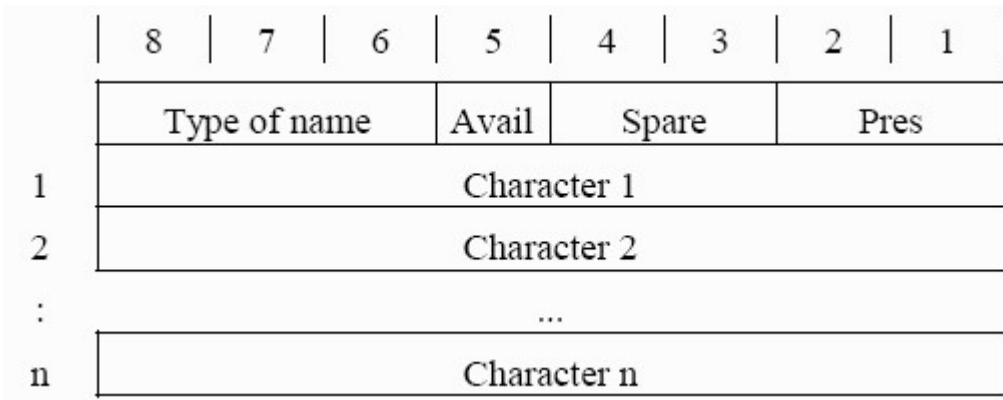


Figure 4.18.C - Generic Name Parameter Field - ATIS-1000113.2015 – Chapter 3

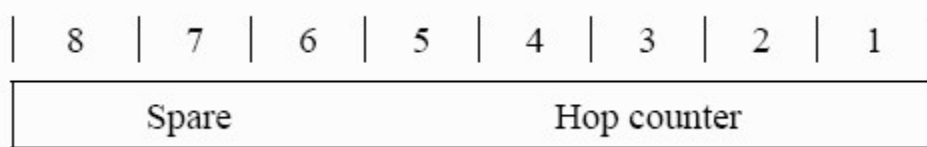


Figure 4.18.D - Hop Counter Parameter Field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.19 - Index Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

Figure 4.20 - Information Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	H	G	F	E	D	C	B	A
2	P	O	N	M	L	K	J	I

Figure 4.21 - Information Request Indicators Parameter Field - aTIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
2nd Address signal				1st Address signal			
4th Address signal				3rd Address signal			
6th Address signal				5th Address signal			

Figure 4.21.A - Jurisdiction Information Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Encoding Scheme			LSPI Type				
2	spare				Context Identification			
3	Local Service Provider Identity							
:								
n								

Figure 4.21. B - Local Service Provider Identification Parameter Field - ATIS-1000113.2015 – Chapter 3

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8	7	6	5	4	3	2	1
ext	Instruction indicators						

Figure 4.21.C - Message Compatibility Information Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	ext/1	G	F	E	D	C	B	A
1a	ext/1	More instruction indicators if required						
.					.			
.					.			
1n	1	More instruction indicators if required						

Figure 4.21.D - Instruction Indicators Subfield - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Length of network identification							
1a	Ext	Type of network Id.			Network Identification Plan			
1b	Digit 2				Digit 1			
1c	Digit 4				Digit 3			
2	Network specific facility indicator							
.								
.								
n								

Figure 4.21.E - Network Specific Facility Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.22 - Network Specific Facility Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Name of ISDN User Part parameter 1							
2	Length indicator of parameter 1							
3	Contents of parameter 1							
n	Name of ISDN User Part parameter n							
	Length indicator of parameter n							
	Contents of parameter n							

Figure 4.22.A - Network Transport Parameter Field - ATIS-100113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.22.A.B – Network Management Controls Parameter Field – ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.22.B - Notification Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

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8	7	6	5	4	3	2	1
ext	Information Type			Information Value			

Figure 4.22.B.A – Operator Service Information Parameter Field – ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.22.C - Optional Backward Call Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.23 - Optional Forward Call Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Odd/ Even	Nature of address indicator						
2	Spare	Numbering Plan			Pres		Reserved	
3	2nd address signal				1st address signal			
n	Filler (if necessary)				nth address signal			

Figure 4.23.A - Original Called Number Parameter Field - ATIS-1000113.2015 – Chapter 3

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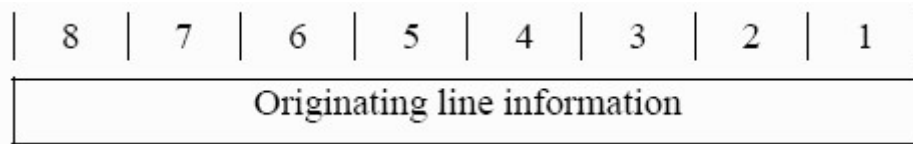


Figure 4.23.B - Originating Line Information Parameter Field - ATIS-1000113.2015 – Chapter 3

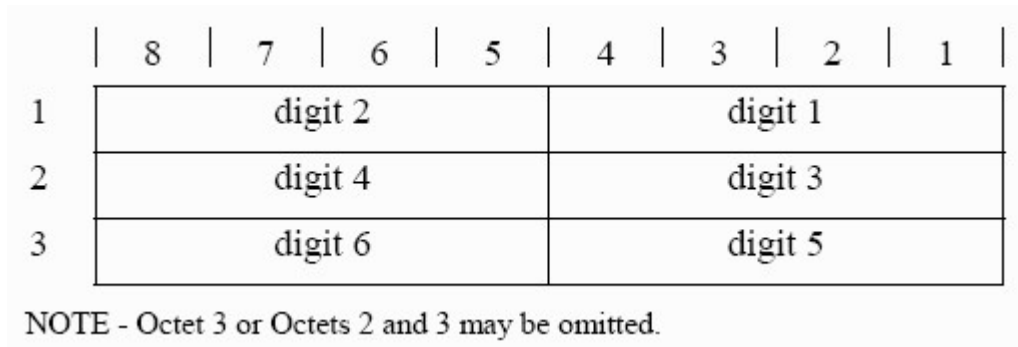


Figure 4.23.C - Outgoing Trunk Group Number Parameter Field - ATIS-1000113.2015 – Chapter 3

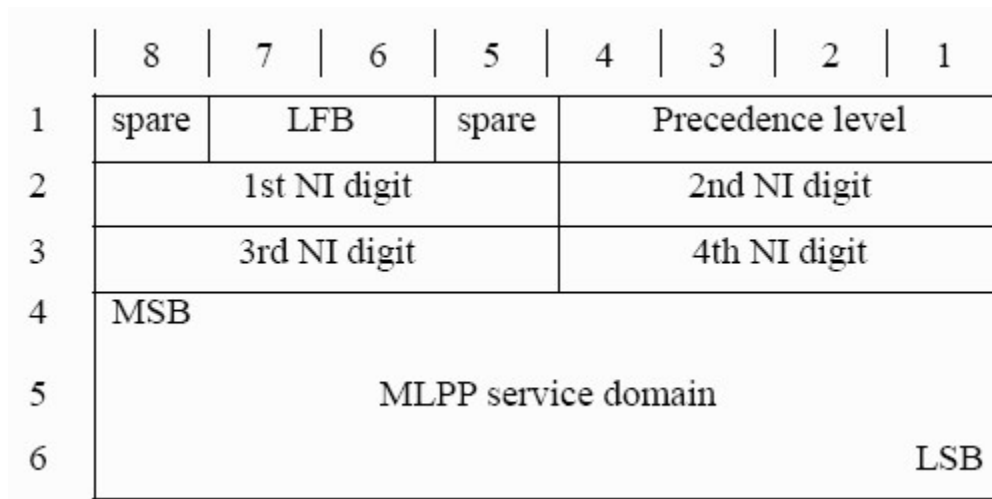


Figure 4.23.D - Precedence Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	1st upgraded parameter							
2	Instruction indicators							
.	.							
.	.							
n	nth upgraded parameter							
n+1	Instruction indicators							

Figure 4.23.E - Parameter Compatibility Information Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	ext/1	G	F	E	D	C	B	A
1a	ext/1	O	N	M	L	K	J	I
1b	ext/1	More instruction indicators if required						
.		.						
.		.						
1n	1	More instruction indicators if required						

Figure 4.23.F - Instruction Indicators Subfield - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	H	Spare				C	B	A

Figure 4.23.G - Pivot Capability Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	H	Pivot routing indicator						

Figure 4.23.H - Pivot Routing Indicator Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Range							
2								
.								
.								
n	Status							

Figure 4.24 - Range and Status Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Information type tag							
2	Information type length							
3	Information type value							
:								
m								
:	Information type tag							
k								
k+1								
k+2	Information type length							
:								
1								
	Information type value							

Figure 4.24.A - Redirect Backward Information Parameter Field – ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Ext	Invoking Redirect Reason						

Figure 4.24.A.B – Invoking Redirect Reason – ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.24.B - Redirect Capability Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
H	G	F	E	D	C	B	A

Figure 4.24.C - Redirect Counter Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Information type tag							
2	Information type length							
3	Information type value							
:								
m								
:								
k	Information type tag							
k+1	Information type length							
k+2	Information type value							
:								
1								

Figure 4.24.D - Redirect Forward Information Parameter Field - ATIS-1000113.2015 – Chapter 3

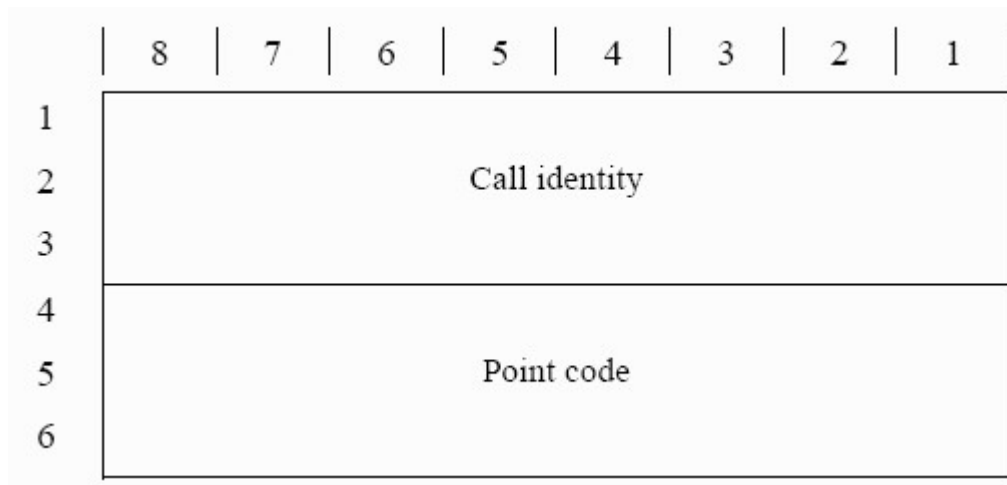


Figure 4.24.D.A– Call Reference – ATIS-1000113.2015 – Chapter 3

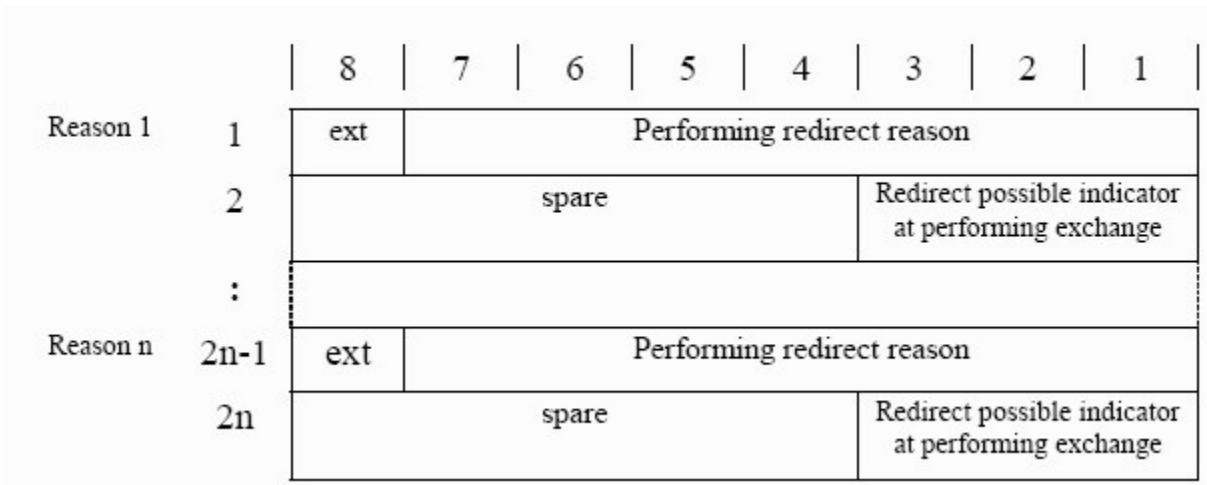


Figure 4.24.D.B – Performing Redirect Indicator – ATIS-1000113.2015 – Chapter 3

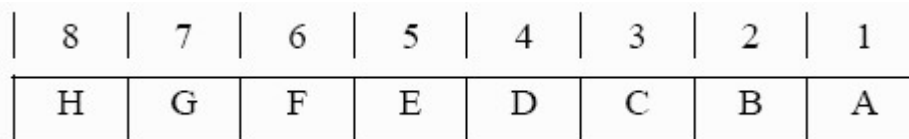


Figure 4.24.E - Redirect Status Parameter Field

	8	7	6	5	4	3	2	1
1	Odd/ Even	Nature of address indicator						
2	Spare	Numbering plan			Pres		Reserved	
3	2nd address signal				1st address signal			
n	Filler (if necessary)				nth address signal			

Figure 4.25 - Redirecting Number Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	Original redirecting reason				Reser -ved	Redirecting indicator		
2	Redirecting reason				Redirection counter			

Figure 4.25.A - Redirection Information Parameter Field - ATIS-1000113.2015 – Chapter 3

1	Odd/ Even	Nature of address indicator	
2	Spare	Numbering plan	Reserved
3	2nd address signal		1st address signal
n	Filler (if necessary)		nth address signal

Figure 4.25.B - Redirection Number Parameter Field - ATIS-1000113.2015 – Chapter 3

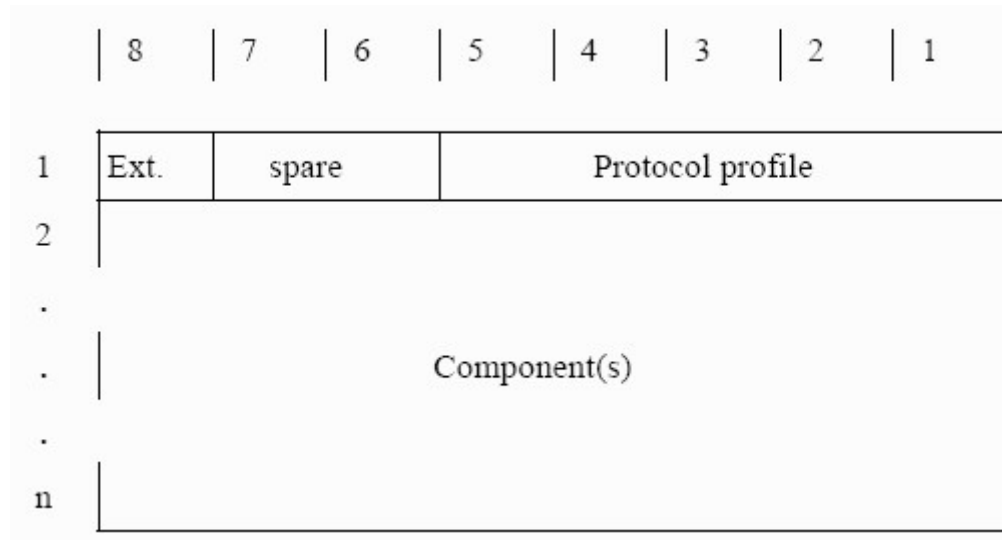


Figure 4.25.B.A/ATIS-1000113.2015 – Chapter 3 - Remote Operations Parameter Field

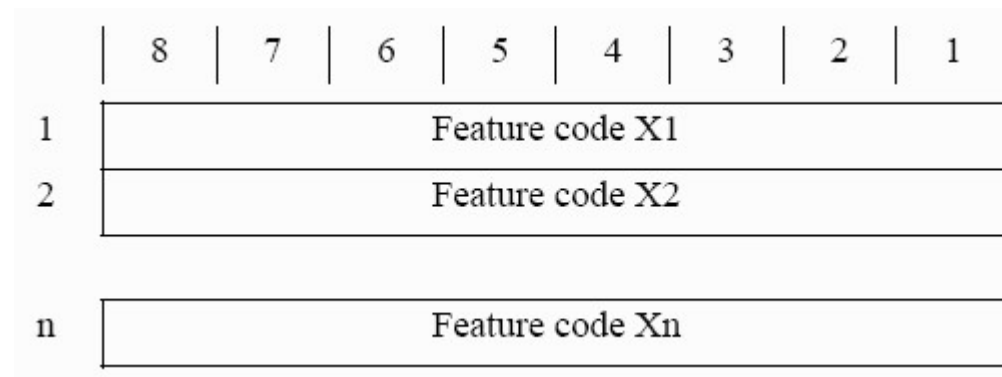


Figure 4.25.C - Service Activation Parameter Field - ATIS-1000113.2015 – Chapter 3

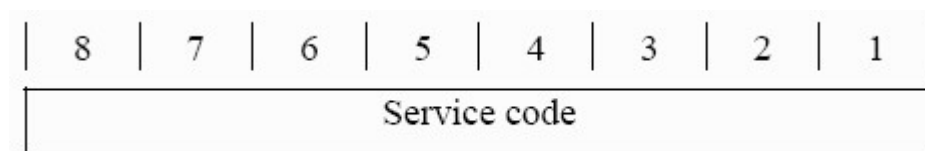


Figure 4.25.D - Service Code Parameter Field - ATIS-1000113.2015 – Chapter 3

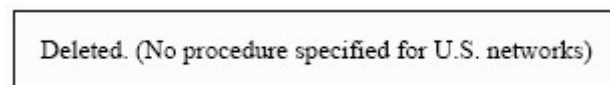


Figure 4.26 - Signaling Point Code Parameter Field - ATIS-1000113.2015 – Chapter 3

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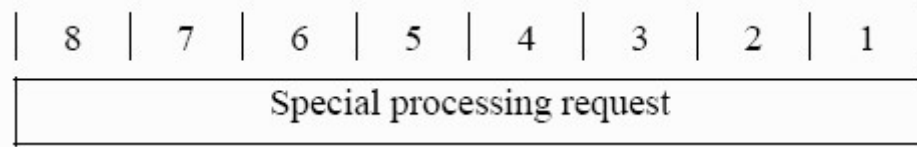


Figure 4.26.A - Special Processing Request Parameter Field - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.27 - Subsequent Number Parameter Field - ATIS-1000113.2015 – Chapter 3

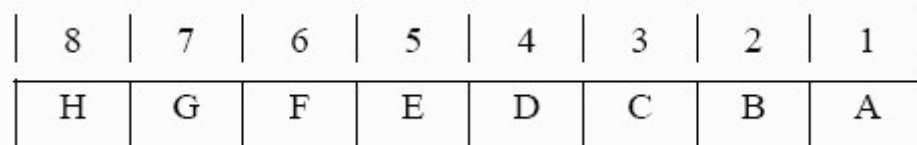


Figure 4.27.A - Suspend/Resume Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

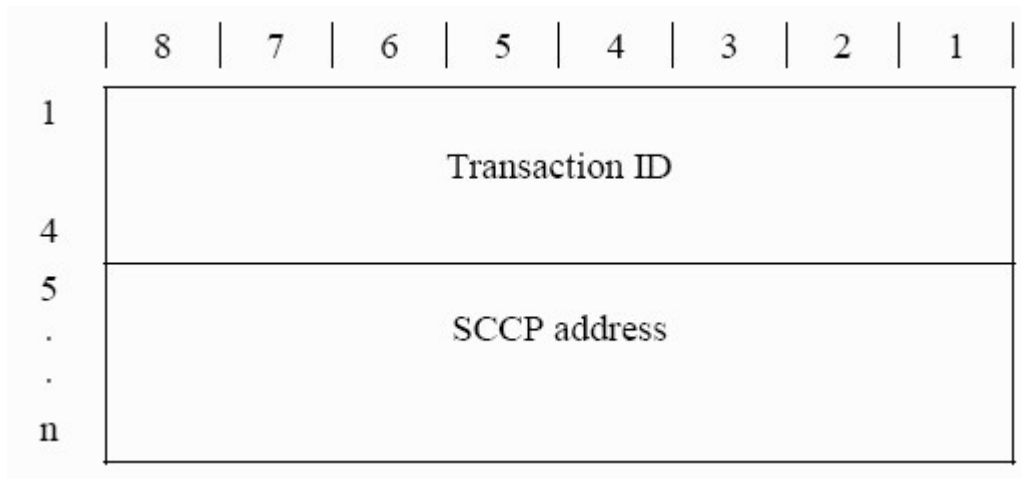


Figure 4.27.B - Transaction Request Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Spare	Type of Network identification			Network identification plan			
Digit 2				Digit 1			
Circuit code				Digit 3			

Figure 4.27.C - Transit Network Selection Parameter Field; 3-digit transit network selection code - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Spare	Type of Network identification			Network identification plan			
Digit 2				Digit 1			
Digit 4				Digit 3			
Circuit code				Reserved			

Figure 4.27.D - Transit Network Selection Parameter Field; 4-digit transit network selection code - ATIS-1000113.2015 – Chapter 3

Deleted. (No procedure specified for U.S. networks)

Figure 4.28 - Transmission Medium Requirements Parameter Field - ATIS-1000113.2015 – Chapter 3

8	7	6	5	4	3	2	1
Transmission medium used							

Figure 4.28.A - Transmission Medium Used Parameter Field - ATIS-1000113.2015 – Chapter 3

	8	7	6	5	4	3	2	1
1	1 ext	Coding standard		Information transfer capability				
2	0/1 ext	Transfer mode		Information transfer rate				
2a* Note 1	0/1 ext	Structure			Configuration		Establishment	
2b* Note 1	1 ext	Symmetry		Information transfer rate (destination to origination)				
2.1* Note 5	1 ext	Rate Multiplier						
3*	0/1 ext	0	1	User information layer 1 protocol				
3a* Note 4	0/1 ext	synch/ asynch	negot.	User rate				
3b* Note 2	0/1 ext	Intermediate rate		NIC on Tx	NIC on Rx	Flow control on Tx	Flow control on Rx	spare
3b* Note 3	0/1 ext	Hdr/ no hdr	Multi frame	Mode	LLI negot.	Assignor/ assignee	Inband outband	spare
3c* Note 4	0/1 ext	Number of stop bits		Number of data bits		Parity		
3d* Note 4	1 ext	Duplex mode	Modem type					
4*	1 ext	1	0	User information layer 2 protocol				
5*	1 ext	1	1	User information layer 3 protocol				

* Optional octet

NOTES:

- (1) If default values are used for all fields of octets 2a and 2b, then these octets shall not be included. If default values are used for all fields of octet 2b, but not for one or more fields of octet 2a, then only octet 2a shall be included. Otherwise both octets 2a and 2b shall be included.
- (2) This octet is present only if octet 3 indicates ITU-T standardized rate adaption V.110/X.30
- (3) This octet is present if octet 3 indicates ITU-T standardized rate adaption V.120
- (4) This octet may be present if octet 3 indicates either of the ITU-T standardized rate adaptations V.110/x.30 or V.120.
- (5) This octet is present only if octet 2 indicates multi-rate (64 kbit/s base rate)

Figure 4.29 - User Service Information Parameter Field - ATIS-1000113.2015 – Chapter 3

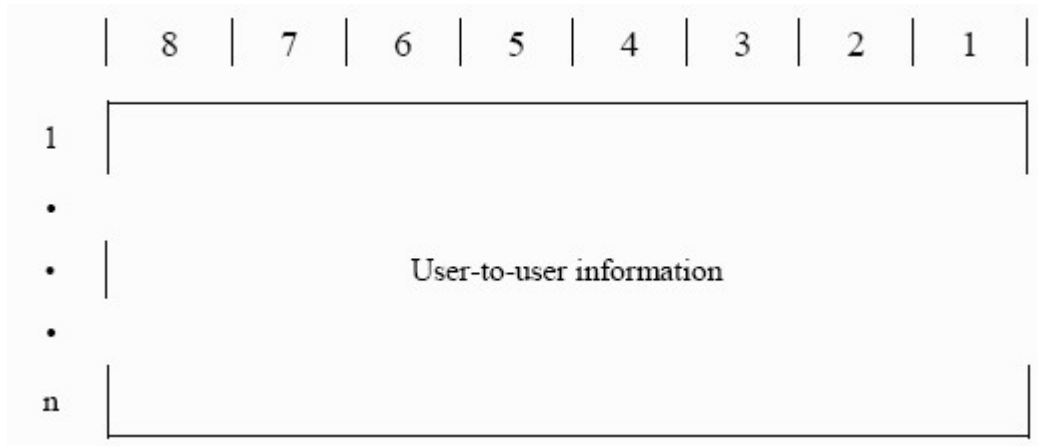


Figure 4.30 - User-to-User Indicators Parameter Field - ATIS-1000113.2015 – Chapter 3

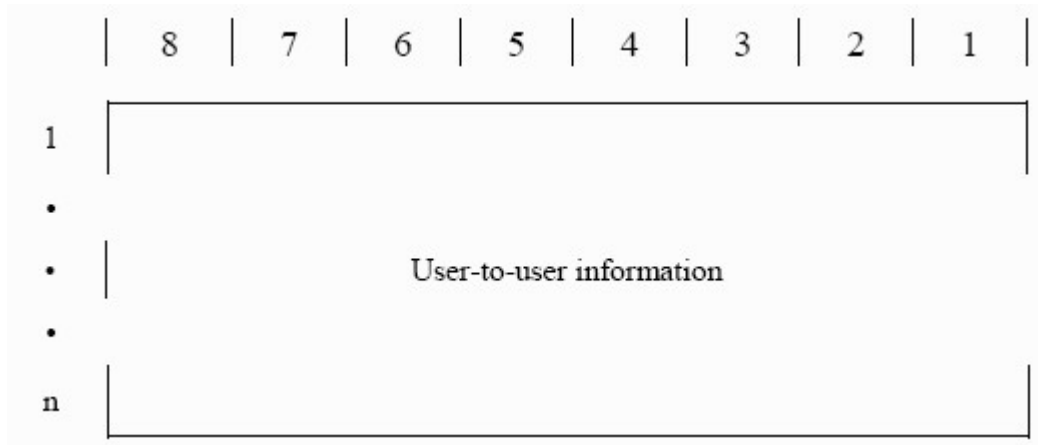


Figure 4.31 - User-to-User Information Parameter Field - ATIS-1000113.2015 – Chapter 3

Table 4.1 - 8448 kbit/s Digital Path Circuit Allocations - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.2 - 2048 kbit/s FDM System Circuit Allocations - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.3 - Message Type Codes - ATIS-1000113.2015 – Chapter 3

Message Type	Reference Table	Code
Address Complete	5	0 0 0 0 0 1 1 0
Answer	6	0 0 0 0 1 0 0 1
Application Transport	25	0 1 0 0 0 0 0 1
Blocking	18	0 0 0 1 0 0 1 1
Blocking Acknowledgement	18	0 0 0 1 0 1 0 1
Call Modification Completed (No procedure specified for U.S. networks)	19	0 0 0 1 1 1 0 1
Call Modification Reject (No procedure specified for U.S. networks)	19	0 0 0 1 1 1 1 0
Call Modification Request (No procedure specified for U.S. networks)	19	0 0 0 1 1 1 0 0
Call Progress	6A	0 0 1 0 1 1 0 0
Circuit Group Blocking	20	0 0 0 1 1 0 0 0
Circuit Group Blocking Acknowledgement	20	0 0 0 1 1 0 1 0
Circuit Group Reset	21	0 0 0 1 0 1 1 1
Circuit Group Reset Acknowledgement	21	0 0 1 0 1 0 0 1
Circuit Group Unblocking	20	0 0 0 1 1 0 0 1
Circuit Group Unblocking Acknowledgement	20	0 0 0 1 1 0 1 1
Circuit Query	21	0 0 1 0 1 0 1 0
Circuit Query Response	6B	0 0 1 0 1 0 1 1
Circuit Reservation	6C	1 1 1 0 1 0 1 0
Circuit Reservation Acknowledgement	18	1 1 1 0 1 0 0 1
Circuit Validation Response	6D	1 1 1 0 1 0 1 1
Circuit Validation Test	18	1 1 1 0 1 1 0 0
Closed User Group Selection and Validation Request (No procedure specified for U. S. networks)	7	0 0 1 0 0 1 0 1
Closed User Group Selection and Validation Response (No procedure specified for U. S. networks)	8	0 0 1 0 0 1 1 0
Confusion	8A	0 0 1 0 1 1 1 1
Connect (No procedure specified for U.S. networks)		0 0 0 0 0 1 1 1
Continuity	9	0 0 0 0 0 1 0 1
Continuity Check Request	18	0 0 0 1 0 0 0 1
Delayed Release (No procedure specified for U.S. networks)	17B	0 0 1 0 0 1 1 1
Exit	9A	1 1 1 0 1 1 0 1
Facility	9B	0 0 1 1 0 0 1 1
Facility Accepted (No procedure specified for U.S. networks)	22	0 0 1 0 0 0 0 0
Facility Deactivated (No procedure specified for U.S. networks)	22	0 0 1 0 0 0 1 0
Facility Information (No procedure specified for U.S. networks)	10	0 0 1 0 0 0 1 1
Facility Reject (No procedure specified for U.S. networks)	11	0 0 1 0 0 0 0 1
Facility Request (No procedure specified for U.S. networks)	22	0 0 0 1 1 1 1 1
Forward Transfer	17	0 0 0 0 1 0 0 0
Information	12	0 0 0 0 0 1 0 0

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Message Type	Reference Table	Code
Information Request	13	0 0 0 0 0 0 1 1
Initial Address	14	0 0 0 0 0 0 0 1
Loop Back Acknowledgement	18	0 0 1 0 0 1 0 0
Network Resource Management (No procedure specified for U.S. networks)		0 0 1 1 0 0 1 0
Overload (No procedure specified for U.S. networks)	18	0 0 1 1 0 0 0 0
Pass Along	23	0 0 1 0 1 0 0 0
Pre-Release Information	26	0 1 0 0 0 0 1 0
Release	14A	0 0 0 0 1 1 0 0
Release Complete	18	0 0 0 1 0 0 0 0
Reset Circuit	18	0 0 0 1 0 0 1 0
Resume	17A	0 0 0 0 1 1 1 0
Segmentation	24	0 0 1 1 1 0 0 0
Subsequent Address (No procedure specified for U.S. networks)	15	0 0 0 0 0 0 1 0
Suspend	17A	0 0 0 0 1 1 0 1
Unblocking	18	0 0 0 1 0 1 0 0
Unblocking Acknowledgement	18	0 0 0 1 0 1 1 0
Unequipped Circuit Identification Code	18	0 0 1 0 1 1 1 0
User Part Available (No procedure specified for U.S. networks)		0 0 1 1 0 1 0 1
User Part Test (No procedure specified for U.S. networks)		0 0 1 1 0 1 0 0
User-to-User Information (No procedure specified for U.S. networks)		0 0 1 0 1 1 0 1
Reserved by ITU-T		0 0 0 0 1 0 1 0 0 0 0 0 1 0 1 1 0 0 0 0 1 0 1 0

Table 4.3.A - Message Type Codes (ordered by code value) - ATIS-1000113.2015 – Chapter 3

Message Type	Reference Table	Code
Initial Address	14	0 0 0 0 0 0 0 1
Subsequent Address (No procedure specified for U.S. networks)	15	0 0 0 0 0 0 1 0
Information Request	13	0 0 0 0 0 0 1 1
Information	12	0 0 0 0 0 1 0 0
Continuity	9	0 0 0 0 0 1 0 1
Address Complete	5	0 0 0 0 0 1 1 0
Connect (No procedure specified for U.S. networks)		0 0 0 0 0 1 1 1
Forward Transfer	17	0 0 0 0 1 0 0 0
Answer	6	0 0 0 0 1 0 0 1
Release	14A	0 0 0 0 1 1 0 0
Suspend	17A	0 0 0 0 1 1 0 1
Resume	17A	0 0 0 0 1 1 1 0
Release Complete	18	0 0 0 1 0 0 0 0
Continuity Check Request	18	0 0 0 1 0 0 0 1
Reset Circuit	18	0 0 0 1 0 0 1 0
Blocking	18	0 0 0 1 0 0 1 1
Unblocking	18	0 0 0 1 0 1 0 0
Blocking Acknowledgement	18	0 0 0 1 0 1 0 1

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Message Type	Reference Table	Code
Unblocking Acknowledgement	18	0 0 0 1 0 1 1 0
Circuit Group Reset	21	0 0 0 1 0 1 1 1
Circuit Group Blocking	20	0 0 0 1 1 0 0 0
Circuit Group Unblocking	20	0 0 0 1 1 0 0 1
Circuit Group Blocking Acknowledgement	20	0 0 0 1 1 0 1 0
Circuit Group Unblocking Acknowledgement	20	0 0 0 1 1 0 1 1
Call Modification Request (No procedure specified for U.S. networks)	19	0 0 0 1 1 1 0 0
Call Modification Completed (No procedure specified for U.S. networks)	19	0 0 0 1 1 1 0 1
Call Modification Reject (No procedure specified for U.S. networks)	19	0 0 0 1 1 1 1 0
Facility Request (No procedure specified for U.S. networks)	22	0 0 0 1 1 1 1 1
Facility Accepted (No procedure specified for U.S. networks)	22	0 0 1 0 0 0 0 0
Facility Reject (No procedure specified for U.S. networks)	11	0 0 1 0 0 0 0 1
Facility Deactivated (No procedure specified for U.S. networks)	22	0 0 1 0 0 0 1 0
Facility Information (No procedure specified for U.S. networks)	10	0 0 1 0 0 0 1 1
Loop Back Acknowledgement	18	0 0 1 0 0 1 0 0
Closed User Group Selection and Validation Request (No procedure specified for U.S. networks)	7	0 0 1 0 0 1 0 1
Closed User Group Selection and Validation Response (No procedure specified for U.S. networks)	8	0 0 1 0 0 1 1 0
Delayed Release (No procedure specified for U.S. networks)	17B	0 0 1 0 0 1 1 1
Pass Along	23	0 0 1 0 1 0 0 0
Circuit Group Reset Acknowledgement	21	0 0 1 0 1 0 0 1
Circuit Query	21	0 0 1 0 1 0 1 0
Circuit Query Response	6B	0 0 1 0 1 0 1 1
Call Progress	6A	0 0 1 0 1 1 0 0
User-to-User Information (No procedure specified for U.S. networks)		0 0 1 0 1 1 0 1
Unequipped Circuit Identification Code	18	0 0 1 0 1 1 1 0
Confusion	8A	0 0 1 0 1 1 1 1
Overload (No procedure specified for U.S. networks)	18	0 0 1 1 0 0 0 0
Network Resource Management (No procedure specified for U.S. networks)		0 0 1 1 0 0 1 0
Facility	9B	0 0 1 1 0 0 1 1
User Part Test (No procedure specified for U.S. networks)		0 0 1 1 0 1 0 0
User Part Available (No procedure specified for U.S. networks)		0 0 1 1 0 1 0 1
Segmentation	24	0 0 1 1 1 0 0 0
Application Transport	25	0 1 0 0 0 0 0 1
Pre-Release Information	26	0 1 0 0 0 0 1 0
Circuit Reservation Acknowledgement	18	1 1 1 0 1 0 0 1
Circuit Reservation	6C	1 1 1 0 1 0 1 0
Circuit Validation Response	6D	1 1 1 0 1 0 1 1
Circuit Validation Test	18	1 1 1 0 1 1 0 0
Exit	9A	1 1 1 0 1 1 0 1
Reserved by ITU-T		0 0 0 0 1 0 1 0 0 0 0 0 1 0 1 1 0 0 0 0 1 1 1 1

Table 4.4 - Parameter Name Codes - ATIS-1000113.2015 – Chapter 3

Parameter Name	Clause	Code
Access transport	3.1A	0 0 0 0 0 0 1 1

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Parameter Name	Clause	Code
Application transport	3.2	0 1 1 1 1 0 0 0
Automatic congestion level	3.2A	0 0 1 0 0 1 1 1
Automatic re-routing	3.2B	1 0 0 1 0 1 1 0
Backward call indicators	3.3	0 0 0 1 0 0 0 1
Business group	3.3A	1 1 0 0 0 1 1 0
Call modification indicators (No procedure specified for U.S. networks)	3.4	0 0 0 1 0 1 1 1
Call reference	3.5	0 0 0 0 0 0 0 1
Called party number	3.6	0 0 0 0 0 1 0 0
Calling geodetic location	3.6A	1 0 0 0 0 0 0 1
Calling party number	3.7	0 0 0 0 1 0 1 0
Calling party's category	3.8	0 0 0 0 1 0 0 1
CARRIER IDENTIFICATION	3.8A	1 1 0 0 0 1 0 1
Carrier selection information	3.8B	1 1 1 0 1 1 1 0
Carrier service provider identification	3.8C	1 1 1 0 0 0 1 0
Cause indicators	3.9	0 0 0 1 0 0 1 0
Charge number	3.10	1 1 1 0 1 0 1 1
Circuit assignment map (Note - proposed ITU-T code)	3.10B	0 0 1 0 0 1 0 1
Circuit group characteristic indicator	3.10A	1 1 1 0 0 1 0 1
Circuit group supervision message type indicator	3.11	0 0 0 1 0 1 0 1
Circuit identification name	3.11A	1 1 1 0 1 0 0 0
Circuit state indicator	3.11B	0 0 1 0 0 1 1 0
Circuit validation response indicator	3.11C	1 1 1 0 0 1 1 0
Closed user group check response indicators (No procedure specified for U.S. networks)	3.12	0 0 0 1 1 1 0 0
Closed user group interlock code (No procedure specified for U.S. networks)	3.13	0 0 0 1 1 0 1 0
COMMON LANGUAGE location identification (CLLI) code	3.13A	1 1 1 0 1 0 0 1
Connected number (No procedure specified for U.S. networks)	3.14A	0 0 1 0 0 0 0 1
Connection request	3.15	0 0 0 0 1 1 0 1
Continuity indicators	3.16	0 0 0 1 0 0 0 0
Egress	3.16A	1 1 0 0 0 0 1 1
End of optional parameters	1.8, 3.17	0 0 0 0 0 0 0 0
Event information indicators	3.17A	0 0 1 0 0 1 0 0
Facility indicator (No procedure specified for U.S. networks)	3.18	0 0 0 1 1 0 0 0
Facility information indicators (No procedure specified for U.S. networks)	3.19	0 0 0 1 1 0 0 1
Forward call indicators	3.20	0 0 0 0 0 1 1 1
Generic address	3.20A	1 1 0 0 0 0 0 0
Generic digits	3.20B	1 1 0 0 0 0 0 1
Generic name	3.20C	1 1 0 0 0 1 1 1
Hop counter	3.20D	0 0 1 1 1 1 0 1
Index (No procedure specified for U.S. networks)	3.21	0 0 0 1 1 0 1 1
Information indicators	3.22	0 0 0 0 1 1 1 1
Information request indicators	3.23	0 0 0 0 1 1 1 0
Jurisdiction	3.23A	1 1 0 0 0 1 0 0

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Parameter Name	Clause	Code
Local service provider identification	3.23B	1 1 1 0 0 1 0 0
Message compatibility information	3.23C	0 0 1 1 1 0 0 0
Nature of connection indicators	3.24	0 0 0 0 0 1 1 0
Network management controls	3.24AB	0 1 0 1 1 0 1 1
Network transport	3.24A	1 1 1 0 1 1 1 1
Network specific facility	3.23D	0 0 1 0 1 1 1 1
Notification indicator	3.24B	1 1 1 0 0 0 0 1
Operator services information	3.24D	1 1 0 0 0 0 1 0
Optional backward call indicators	3.24C	0 0 1 0 1 0 0 1
Optional forward call indicators	3.25	0 0 0 0 1 0 0 0
Original called number	3.26	0 0 1 0 1 0 0 0
Originating line information	3.26A	1 1 1 0 1 0 1 0
Outgoing trunk group number	3.26B	1 1 1 0 0 1 1 1
Parameter compatibility information	3.26D	0 0 1 1 1 0 0 1
Pivot capability	3.26E	0 1 1 1 1 0 1 1
Pivot counter (No procedure specified for U.S. networks)	3.26F	1 0 0 0 0 1 1 1
Pivot routing backward information (No procedure specified for U.S. networks)	3.26G	1 0 0 0 1 0 0 1
Pivot routing forward information (No procedure specified for U.S. networks)	3.26H	1 0 0 0 1 0 0 0
Pivot routing indicator	3.26I	0 1 1 1 1 1 0 0
Pivot status (No procedure specified for U.S. networks)	3.26J	1 0 0 0 0 1 1 0
Precedence	3.26C	0 0 1 1 1 0 1 0
Range and status	3.27	0 0 0 1 0 1 1 0
Redirect backward information	3.28A	1 0 0 0 1 1 0 0
Redirect capability	3.28B	0 1 0 0 1 1 1 0
Redirect counter	3.28C	0 1 1 1 0 1 1 1
Redirect forward information	3.28D	1 0 0 0 1 0 1 1
Redirect status	3.28E	1 0 0 0 1 0 1 0
Redirecting number	3.27A	0 0 0 0 1 0 1 1
Redirection information	3.29	0 0 0 1 0 0 1 1
Redirection number	3.29A	0 0 0 0 1 1 0 0
Remote operations	3.29B	0 0 1 1 0 0 1 0
Service activation	3.29C	0 0 1 1 0 0 1 1
Service code indicator	3.29D	1 1 1 0 1 1 0 0
Signaling point code (No procedure specified for U.S. networks)	3.30	0 0 0 1 1 1 1 0
Special processing request	3.30A	1 1 1 0 1 1 0 1
Subsequent number (No procedure specified for U.S. networks)	3.31	0 0 0 0 0 1 0 1
Suspend/resume indicators	3.31A	0 0 1 0 0 0 1 0
Transaction request	3.31B	1 1 1 0 0 0 1 1
Transit network selection	3.31C	0 0 1 0 0 0 1 1
Transmission medium requirements (No procedure specified for U.S. networks)	3.32	0 0 0 0 0 0 1 0
Transmission medium used	3.32A	0 0 1 1 0 1 0 1
User service information	3.33	0 0 0 1 1 1 0 1
User service information prime	3.33A	0 0 1 1 0 0 0 0

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Parameter Name	Clause	Code
User-to-user indicators	3.34	0 0 1 0 1 0 1 0
User-to-user information	3.35	0 0 1 0 0 0 0 0
Reserved by ITU-T		0 0 0 1 0 1 0 0 0 0 0 1 1 1 1 1

Table 4.4.A - Parameter Name Codes (ordered by code value) - ATIS-1000113.2015 – Chapter 3

Parameter Name	Clause	Code
End of optional parameters	1.8, 3.17	0 0 0 0 0 0 0 0
Call reference	3.5	0 0 0 0 0 0 0 1
Transmission medium requirements (No procedure specified for U.S. networks)	3.32	0 0 0 0 0 0 1 0
Access transport	3.1A	0 0 0 0 0 0 1 1
Called party number	3.6	0 0 0 0 0 1 0 0
Subsequent number (No procedure specified for U.S. networks)	3.31	0 0 0 0 0 1 0 1
Nature of connection indicators	3.24	0 0 0 0 0 1 1 0
Forward call indicators	3.20	0 0 0 0 0 1 1 1
Optional forward call indicators	3.25	0 0 0 0 1 0 0 0
Calling party's category	3.8	0 0 0 0 1 0 0 1
Calling party number	3.7	0 0 0 0 1 0 1 0
Redirecting number	3.27A	0 0 0 0 1 0 1 1
Redirection number	3.29A	0 0 0 0 1 1 0 0
Connection request	3.15	0 0 0 0 1 1 0 1
Information request indicators	3.23	0 0 0 0 1 1 1 0
Information indicators	3.22	0 0 0 0 1 1 1 1
Continuity indicators	3.16	0 0 0 1 0 0 0 0
Backward call indicators	3.3	0 0 0 1 0 0 0 1
Cause indicators	3.9	0 0 0 1 0 0 1 0
Redirection information	3.29	0 0 0 1 0 0 1 1
Circuit group supervision message type indicator	3.11	0 0 0 1 0 1 0 1
Range and status	3.27	0 0 0 1 0 1 1 0
Call modification indicators (No procedure specified for U.S. networks)	3.4	0 0 0 1 0 1 1 1
Facility indicator (No procedure specified for U.S. networks)	3.18	0 0 0 1 1 0 0 0
Facility information indicators (No procedure specified for U.S. networks)	3.19	0 0 0 1 1 0 0 1
Closed user group interlock code (No procedure specified for U.S. networks)	3.13	0 0 0 1 1 0 1 0
Index (No procedure specified for U.S. networks)	3.21	0 0 0 1 1 0 1 1
Closed user group check response indicators (No procedure specified for U.S. networks)	3.12	0 0 0 1 1 1 0 0
User service information	3.33	0 0 0 1 1 1 0 1
Signaling point code (No procedure specified for U.S. networks)	3.30	0 0 0 1 1 1 1 0
User-to-user information	3.35	0 0 1 0 0 0 0 0
Connected number (No procedure specified for U.S. networks)	3.14A	0 0 1 0 0 0 0 1
Suspend/resume indicators	3.31A	0 0 1 0 0 0 1 0

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Parameter Name	Clause	Code
Transit network selection	3.31C	0 0 1 0 0 0 1 1
Event information indicators	3.17A	0 0 1 0 0 1 0 0
Circuit assignment map (Note - proposed ITU-T code)	3.10B	0 0 1 0 0 1 0 1
Circuit state indicator	3.11B	0 0 1 0 0 1 1 0
Automatic congestion level	3.2A	0 0 1 0 0 1 1 1
Original called number	3.26	0 0 1 0 1 0 0 0
Optional backward call indicators	3.24C	0 0 1 0 1 0 0 1
User-to-user indicators	3.34	0 0 1 0 1 0 1 0
Network specific facility	3.23D	0 0 1 0 1 1 1 1
User service information prime	3.33A	0 0 1 1 0 0 0 0
Remote operations	3.29B	0 0 1 1 0 0 1 0
Service activation	3.29C	0 0 1 1 0 0 1 1
Transmission medium used	3.32A	0 0 1 1 0 1 0 1
Message compatibility information	3.23C	0 0 1 1 1 0 0 0
Parameter compatibility information	3.26D	0 0 1 1 1 0 0 1
Precedence	3.26C	0 0 1 1 1 0 1 0
Hop counter	3.20D	0 0 1 1 1 1 0 1
Redirect capability	3.28B	0 1 0 0 1 1 1 0
Network management controls	3.24AB	0 1 0 1 1 0 1 1
Redirect counter	3.28C	0 1 1 1 0 1 1 1
Application transport	3.2	0 1 1 1 1 0 0 0
Pivot capability	3.26E	0 1 1 1 1 0 1 1
Pivot routing indicator	3.26I	0 1 1 1 1 1 0 0
Calling geodetic location	3.6A	1 0 0 0 0 0 0 1
Pivot status (No procedure specified for U.S. networks)	3.26J	1 0 0 0 0 1 1 0
Pivot counter (No procedure specified for U.S. networks)	3.26F	1 0 0 0 0 1 1 1
Pivot routing forward information (No procedure specified for U.S. networks)	3.26H	1 0 0 0 1 0 0 0
Pivot routing backward information (No procedure specified for U.S. networks)	3.26G	1 0 0 0 1 0 0 1
Redirect status	3.28E	1 0 0 0 1 0 1 0
Redirect forward information	3.28D	1 0 0 0 1 0 1 1
Redirect backward information	3.28A	1 0 0 0 1 1 0 0
Automatic re-routing	3.2B	1 0 0 1 0 1 1 0
Generic address	3.20A	1 1 0 0 0 0 0 0
Generic digits	3.20B	1 1 0 0 0 0 0 1
Operator services information	3.24D	1 1 0 0 0 0 1 0
Egress	3.16A	1 1 0 0 0 0 1 1
Jurisdiction	3.23A	1 1 0 0 0 1 0 0
Carrier identification	3.8A	1 1 0 0 0 1 0 1
Business group	3.3A	1 1 0 0 0 1 1 0
Generic name	3.20C	1 1 0 0 0 1 1 1
Notification indicator	3.24B	1 1 1 0 0 0 0 1
Carrier service provider identification	3.8C	1 1 1 0 0 0 1 0
Transaction request	3.31B	1 1 1 0 0 0 1 1

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Parameter Name	Clause	Code
Local service provider identification	3.23B	1 1 1 0 0 1 0 0
Circuit group characteristic indicator	3.10A	1 1 1 0 0 1 0 1
Circuit validation response indicator	3.11C	1 1 1 0 0 1 1 0
Outgoing trunk group number	3.26B	1 1 1 0 0 1 1 1
Circuit identification name	3.11A	1 1 1 0 1 0 0 0
COMMON LANGUAGE location identification (CLLI) code	3.13A	1 1 1 0 1 0 0 1
Originating line information	3.26A	1 1 1 0 1 0 1 0
Charge number	3.10	1 1 1 0 1 0 1 1
Service code indicator	3.29D	1 1 1 0 1 1 0 0
Special processing request	3.30A	1 1 1 0 1 1 0 1
Carrier selection information	3.8B	1 1 1 0 1 1 1 0
Network transport	3.24A	1 1 1 0 1 1 1 1
Reserved by ITU-T		0 0 0 1 0 1 0 0 0 0 0 1 1 1 1 1

Table 4.5 - ATIS-1000113.2015 – Chapter 3 to Table 4.23 - ATIS-1000113.2015 – Chapter 3 - Message Formats
(Parameters which are not supported in U.S. networks are not shown in Table 4.5 - ATIS-1000113.2015 – Chapter 3 to Table 4.23 - ATIS-1000113.2015 – Chapter 3)

Table 4.5 - Message Formats - Message type: Address Complete - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Backward call indicators	3.3	F	2
Access transport	3.1A	O	3 - n
Application transport (note 1)	3.2	O	5 - n
Business Group	3.3A	O	9 - n
Call reference	3.5	O	8
Cause indicators	3.9	O	4 - n
Connection request	3.15	O	9 - 10
Information indicators	3.22	O	4
Network transport parameter	3.24A	O	6 - n
Notification Indicator	3.24B	O	3
Optional backward call indicators	3.24C	O	3
Redirect status	3.28E	O	3
Redirection information	3.29	O	4
Remote operations	3.29B	O	n
Service activation	3.29C	O	3- n
Transmission medium used	3.32A	O	3
User-to-user indicators	3.34	O	3
User-to-user information	3.35	O	3 - 131
End of optional parameters	1.8, 3.17	O, 1	
NOTE 1 - Multiple application transport parameters can be sent in the same message, provided that they belong to different segmentation sequences.			

Table 4.6 - Message Formats - Message type: Answer - ATIS-1000113.2015 – Chapter 3

Parameter	Reference Clause	Type	Length (octets)
Message type	2.1	F	1
Access transport	3.1A	O	3-n
Application transport (note 1)	3.2	O	5-n
Backward call indicators	3.3	O	4
Business Group	3.3a	O	9-n
Call reference	3.5	O	8
Connection request	3.15	O	9-10
Information indicators	3.22	O	4
Network transport parameter	3.24A	O	6-n
Notification Indicator (note 2)	3.24B	O	3
Optional backward call indicators	3.24C	O	3
Remote operations	3.29B	O	n
Redirect status	3.28E	O	3
Service activation	3.29C	O	3- n
Transmission medium used	3.32A	O	3
User-to-user indicators	3.34	O	3
User-to-user information	3.35	O	3 - 131
End of optional parameters	1.8, 3.17	O	1
NOTE 1 - Multiple application transport parameters can be sent in the same message, provided that they belong to different segmentation sequences.			
NOTE 2 - The parameter may be repeated within the message.			

Table 4.6.A - Message Formats - Message type: Call Progress - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Event information	3.17A	F	1
Access transport	3.1A	O	3 - n
Application transport (note 1)	3.2	O	5-n
Backward call indicators	3.3	O	4
Business Group	3.3A	O	9 - n
Call reference	3.5	O	8
Cause indicators	3.9	O	4 - n
Information indicators	3.22	O	4
Network transport parameter	3.24A	O	6 - n
Notification indicator (note 2)	3.24B	O	3
Optional backward call indicators	3.24C	O	3
Redirect status	3.28E	O	3
Redirection number	3.28	O	5 - 12
Remote operations	3.29B	O	n
Service activation	3.29C	O	3- n
Transmission medium used	3.32A	O	3
User-to-user indicators	3.34	O	3
User-to-user information	3.35	O	3 - 131
End of optional parameters	1.8, 3.17	O	1
NOTE 1 - Multiple application transport parameters can be sent in the same message, provided that they belong to different segmentation sequences.			
NOTE 2 - The parameter may be repeated within the message.			

Table 4.6.B - Message Formats - Message type: Circuit Query Response - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Range and status (see note)	3.27	V	2
Circuit state indicator	3.11B	V	2 - 25
NOTE - The status subfield is not present.			

Table 4.6.C - Message Formats - Message type: Circuit Reservation - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Nature of connection indicators	3.24	F	1

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Table 4.6.D - Message Formats - Message type: Circuit Validation Response - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Circuit validation response indicator	3.11C	F	1
Circuit group characteristic indicators	3.10A	F	1
Circuit identification name (sending end)	3.11A	O	28
COMMON LANGUAGE location identification (CLLI) code (sending end)	3.13A	O	13
End of optional parameters	1.8, 3.17	O, 1	

Table 4.7 - Message Formats - Message type: Closed User Group Selection and Validation Request - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.8 - Message Formats - Message type: Closed User Group Selection and Validation Response - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.8.A - Message Formats - Message type: Confusion - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Cause indicators	3.9	V	3- n
End of optional parameters (see note)	1.8, 3.17	O	1
NOTE - End of optional parameters octet indicates that this message can include optional parameters in the future.			

Table 4.9 - Message Formats - Message type: Continuity - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Continuity indicators	3.16	F	1

Table 4.9.A -- Message Formats - Message type: Exit - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Outgoing trunk group number	3.26B	O	3 - 5
End of optional parameters	1.8, 3.17	O	1

Table 4.9.B - Message Formats - Message type: Facility - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Pivot routing indicator	3.26I	O	3
Redirect counter	3.27C	O	3
Redirect status	3.28E	O	3
Redirection number	3.29A	O	5-12
Remote operations	3.29B	O	n
Service activation	3.29C	O	3- n
End of optional parameters	1.8, 3.17	O	1

Table 4.10 - Message Formats - Message type: Facility Information - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.11 - Message Formats - Message type: Facility Reject

(No procedure specified for U.S. networks)

Table 4.12 - Message Formats - Message type: Information - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Information indicators	3.22	F	2
Access transport	3.1A	O	3 - n
Business Group	3.3A	O	9 - n
Call reference	3.5	O	8
Calling party number	3.7	O	5 - 12
Calling party's category	3.8	O	3
Charge number	3.10	O	3 - 12
Connection request	3.15	O	9 - 10
Originating line information	3.26A	O	3
Redirecting number	3.27A	O	5 - 12
Redirection information	3.29	O	4
User-to-user information	3.35	O	3 - 131
End of optional parameters	1.8, 3.17	O	1

Table 4.13 - Message Formats - Message type: Information Request - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Information request indicators	3.23	F	2
Call reference	3.5	O	8
Connection request	3.15	O	9 - 10
Network transport parameter	3.24A	O	6 - n
End of optional parameters	1.8, 3.17	O	1

Table 4.14 - Message Formats - Message type: Initial Address - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Nature of connection indicators	3.24	F	1
Forward call indicators	3.20	F	2
Calling party's category	3.8	F	1
User service information	3.33	V	3 - n
Called party number	3.6	V	2 - 11
Access transport	3.1A	O	3 - n
Application transport (note 1)	3.2	O	5-n
Automatic re-routing	3.2B	O	4
Business Group	3.3A	O	9 - n
Call reference	3.5	O	8
Calling geodetic location	3.6A	O	4-n
Calling party number	3.7	O	5 - 12
Carrier identification	3.8A	O	5
Carrier selection information	3.8B	O	3
Carrier service provider identification (note 2)	3.8C	O	2 - n
Charge number	3.10	O	3 - 12
Circuit assignment map	3.10B	O	6
Connection request	3.15	O	9 - 10
Egress Service	3.16A	O	3 - n
Generic address (note 2)	3.20A	O	6 - 13
Generic digits (note 2)	3.20B	O	4 - n
Generic name	3.20C	O	3-18
Hop counter	3.20D	O	3
Information request indicators	3.23	O	4
Jurisdiction	3.23A	O	2 - 5
Local service provider identification (note 2)	3.23B	O	2 - n
Network management controls	3.24AB	O	3 - n
Network specific facility	3.21D	O	4-n
Network transport	3.24A	O	5 - n
Operator services information	3.24D	O	3 - 8
Optional forward call indicators	3.25	O	3
Original called number	3.26	O	5 - 12
Originating line information	3.26A	O	3
Pivot capability	3.26E	O	3
Precedence	3.26C	O	8
Redirect capability	3.28B	O	3
Redirect counter	3.28C	O	3
Redirect forward information	3.28D	O	4-n

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Parameter	Reference clause	Type	Length (octets)
Redirecting number	3.27A	O	5 - 12
Redirection information	3.29	O	4
Remote operations	3.29B	O	n
Service activation	3.29C	O	3- n
Service code indicator	3.29D	O	3
Special processing request	3.30A	O	3
Transaction request	3.31B	O	8 - n
Transit network selection	3.31C	O	5 - 6
User service information prime	3.33A	O	4 - n
User-to-user information	3.35	O	3 - 131
End of optional parameters	1.8, 3.17	O	1
NOTE 1 - Multiple application transport parameters can be sent in the same message, provided that they belong to different segmentation sequences.			
NOTE 2 - The parameter may be repeated within the message.			

Table 4.14.A - Message Formats - Message type: Release - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Cause indicators	3.9	V	3 - n
Access transport	3.1A	O	3 - n
Automatic congestion level	3.1B	O	3
Automatic re-routing	3.2B	O	4
Call reference	3.5	O	8
Charge number	3.10	O	3-12
Generic address (see note)	3.20A	O	6-13
Redirect backward information	3.28A	O	5-11
Redirect counter	3.28C	O	3
Redirection number	3.29A	O	5-12
Service activation	3.29C	O	3- n
User-to-user information	3.35	O	3 - 131
End of optional parameters	1.8, 3.17	O	1
NOTE - The parameter may be repeated within the message.			

Table 4.15 - Message Formats - Message type: Subsequent Address - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.16 - Message Formats - Message type: Unsuccessful Backward Set-up Information - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.17 - Message Formats - Message type: Forward Transfer - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Call reference	3.5	O	8
End of optional parameters	1.8, 3.17	O	1

Table 4.17.A - Message Formats - Message type: Resume Suspend - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Suspend/resume indicators	3.31A	F	1
Call reference	3.5	O	8
End of optional parameters	1.8, 3.17	O	1

Table 4.17.B - Message Formats - Message type: Delayed Release - ATIS-1000113.2015 – Chapter 3

(No procedure specified for U.S. networks)

Table 4.18 - Message Formats - Message type: See Below - ATIS-1000113.2015 – Chapter 3

Message type: Blocking
Blocking Acknowledgement
Circuit Reservation Acknowledgement
Circuit Validation Test
Continuity Check Request
Loop Back Acknowledgement
Overload (No procedure specified for U.S. networks)
Release Complete
Reset Circuit
Unblocking
Unblocking Acknowledgement
Unequipped Circuit Identification Code

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1

Table 4.19 - Message Formats - Message type: See Below - ATIS-1000113.2015 – Chapter 3

Message type: Call Modification Completed
Call Modification Reject

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Call Modification Request

(No procedure specified for U.S. networks)

Table 4.20 - Message Formats - Message type: See Below - ATIS-1000113.2015 – Chapter 3

Message type: Circuit Group Blocking
 Circuit Group Blocking Acknowledgement
 Circuit Group Unblocking
 Circuit Group Unblocking Acknowledgement

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Circuit group supervision message type indicator	3.11	F	1
Range and status	3.27	V	2-5
NOTE - In these messages the status subfield is not present when the range code is zero.			

Table 4.21 - Message Formats - Message type: See Below - ATIS-1000113.2015 – Chapter 3

Message type: Circuit Group Reset (note 1)
 Circuit Group Reset Acknowledgement (note 2)
 Circuit Query (note 1)

Range and status

Parameter	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Range and status	3.27	V	2-5
Circuit assignment map (note 3)	3.10B	O	6
End of optional parameters	1.8, 3.17	O	1
NOTES - 1. In this message the status subfield is not present. 2. In this message the status subfield is not present when the range code is zero. 3. This parameter can be included only in the circuit group reset and circuit group reset acknowledgement messages.			

Table 4.22 - Message Formats - Message type: See Below - ATIS-1000113.2015 – Chapter 3

Message type: Facility Accepted
 Facility Deactivated
 Facility Request

(No procedure specified for U.S. networks)

Table 4.23 - Message Formats - Message type: Pass Along - ATIS-1000113.2015 – Chapter 3

Parameter	Reference clause	Type	Length (octets)

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Message type	2.1	F	1
Any of the messages defined in Tables 4.5 to 4.22 - ATIS-1000113.2015 – Chapter 3			

Table 4.24 - Message Formats - Message type: Segmentation - ATIS-1000113.2015 – Chapter 3

PARAMETER	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Access transport	3.1A	O	3-n
User-to-user information	3.35	O	3-131
End of optional parameters	1.8, 3.17	O	1

Table 4.25 - Message Formats - Message type: Application Transport - ATIS-1000113.2015 – Chapter 3

PARAMETER	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Application transport (note 1)	3.2	O	5-n
Message compatibility information	3.23C	O	3-n
Parameter compatibility information	3.26D	O	4-n
End of optional parameters	1.8, 3.17	O	1
NOTE 1 - Multiple application transport parameters can be sent in the same message, provided that they belong to different segmentation sequences.			

Table 4.26 - Message Formats - Message type: Pre-Release Information - ATIS-1000113.2015 – Chapter 3

PARAMETER	Reference clause	Type	Length (octets)
Message type	2.1	F	1
Application transport (note 1)	3.2	O	5-n
Message compatibility information	3.23C	O	3-n
Optional backward call indicators (note 2)	3.24C	O	3
Optional forward call indicators (note 2)	3.25	O	3
Parameter compatibility information	3.26D	O	4-n
End of optional parameters	1.8, 3.17	O	1
NOTE 1 - Multiple application transport parameters can be sent in the same message, provided that they belong to different segmentation sequences.			
NOTE 2 - These parameters are required to allow the message to be segmented using the ISUP simple segmentation procedures. They should be mutually exclusive.			

Annex A: Examples of the Use of Location for Busy Conditions

(informative)

This annex gives examples of the location code to be sent in a Cause Indicator parameter for the busy condition. Figure A.1 of ATIS-1000113.2015 – Chapter 3 shows the reference configuration which identifies nodes where a busy condition may occur and therefore a cause should be generated.

Table A.1 of ATIS-1000113.2015 – Chapter 3 shows:

1. The location to be generated at the point where the busy condition occurs; and
2. The location to be delivered to the user (indicated as A) for each location (B - P) where the busy occurs.

As is indicated in the table, the location may be changed in the receiving exchange when the cause value crosses a network boundary.

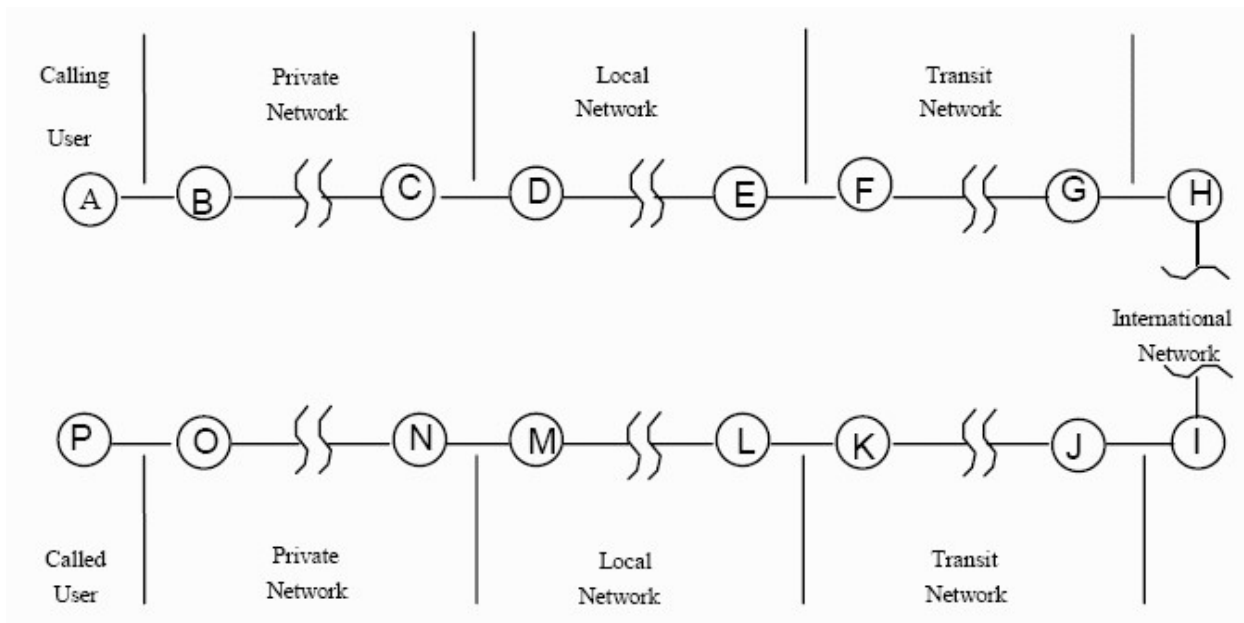


Figure A.1 - Examples of the Use of Location for Busy Condition - ATIS-1000113.2015 – Chapter 3

Table A.1 - Location of Busy Occurrence and Cause Codings - ATIS-1000113.2015 – Chapter 3

Location of busy occurrence		Cause at point of generation	Location at point of generation	Cause and location received by user A	
B	incoming circuit	#34 or #44	LPN	#34 or #44	LPN
B	outgoing circuit	#34	LPN	#34	LPN
C	outgoing circuit	#34	LPN	#34	LPN
D	incoming circuit	#34 or #44	LLN	#34 or #44	LLN
D	outgoing circuit	#34	LLN	#34	LLN
E	outgoing circuit	#34	LLN	#34	LLN
F	outgoing circuit	#34	TN	#34	TN
G	outgoing circuit	#34	TN	#34	TN
H	outgoing circuit	#34	INTL	#34	INTL
I	outgoing circuit	#34	INTL	#34	INTL
J	outgoing circuit	#34	TN	#34	TN
K	outgoing circuit	#34	TN	#34	TN
L	outgoing circuit	#34	LLN	#34	RLN
M	outgoing circuit	#17	LLN	#17	RLN
N	incoming circuit	#34 or #44	LPN	#34 or #44	RPN
N	outgoing circuit	#34	LPN	#34	RPN
O	outgoing circuit	#17	LPN	#17	RPN
P	incoming circuit	#34 or #44	U	#34 or #44	U
P	call control	#17	U	#17	U
LLN: Local local network LPN: Local private network TN: Transit network INTL: International network RLN: Remote local network RPN: Remote private network U: User					

Annex B: National Business Group Identifier Code Assignment and Administration

(informative)

NOTE - Since this Annex is informative, the terms "shall" and "requirements for" used in the following text do not imply that this Annex is a part of this standard. Should the American National Standard referenced in this document be superseded by revisions approved by the American National Standards Institute, Inc., the revisions shall apply.

B.1 Scope, Purpose, & Application

In ATIS-1000611, American National Standard for Telecommunications- *Signaling System 7 (SS7)- Supplementary Services for Non-ISDN Subscribers*, a three-octet Business Group Identifier (BGI) field is specified in the Business Group Parameter of the SS7 protocol to identify Multi-Location Business Group (MBG) customers and Interworking with Private network (IWPEN) customers. The ISDN Multi-level Precedence and Preemption (MLPP) supplementary service has a similar requirement. Business Group Identifiers (BGIs) are uniquely assigned to customers across all networks in which a customer subscribes to a MBG service, MLPP service or an IWPEN Service. Local BGIs are assigned for customers with intra-network MBG or IWPEN service. National BGIs are assigned for customers with inter-network MBG, MLPP, or IWPEN service. The need to delineate the assignment of national BGIs from local BGIs has been accepted by the industry. National BGIs are assigned and administered as specified in this standard. Local BGIs are not addressed in this standard as their use is contained in a single network.

Since the national BGI codes are a limited resource, it is necessary to administer the codes in an efficient manner. The purpose of this document is to coordinate the assignment of national BGIs.

B.2 Related Standards

The following standards are for information only and are not essential for the completion of requirements of this Annex: ATIS-1000611, *Telecommunications - Signaling System 7 (SS7) - Supplementary Services for Non-ISDN Subscribers*, and ATIS-1000619.a, *Integrated Services Digital Network (ISDN) Multi-Level Precedence and Preemption Service Capability*.

B.3 National BGI Code Specifications

B.3.1 Background

As specified in ATIS-1000611, the BGI field contains the identity of an MBG customer or an IWPEN customer. As specified in ATIS-1000619.a, the MLPP service domain code field in the precedence parameter contains the identity of an MLPP customer. In the remainder of this document, "customer" refers to a customer whose MBG service, MLPP service, or IWPEN service involves more than one network.

B.3.2 Assignment Restrictions

Due to the limited number of available codes, national BGIs should be requested on a one-by-one basis. Assignment of a national BGI should be on a first-come-first-served basis. There should be no advance reservation process for national BGI assignment.

B.3.3 Code Restrictions

National BGIs are assigned such that bits 8 and 7 of the first octet are coded '01'. Table B.1 of ATIS-1000113.2015 – Chapter 3 provides the format of the BGI three-octet field, and identifies the codes which are applicable for national assignment.

If the customer subscribes to more than one of MBG, MLPP, or IWPB services, a single code is assigned. This code serves as the IWPB private network identifier, and the MBG and MLPP customer identifier.

If advised by the administrator that the allocation of codes has both reached 70 percent and that the projection for growth will exhaust the codes within two years (see Clause 4.6), ATIS should reevaluate the BGI codes content, and structure and either reaffirm the original plan, expand the plan, or develop a new plan. ATIS shall inform the administrator of their decision.

B.4 National BGI Code Administrator Procedures

B.4.1 Eligibility to Request a National BGI Code Assignment

The administrator (see clause 5) should accept requests from MBG, MLPP, or IWPB service providers and/or customers in the United States (and North America). However, only one request is to be made per service requirement.

B.4.2 Request Procedure

To request the assignment of a national BGI, the organization, company or individual desiring the BGI shall make a written request to the administrator of national BGIs.

When requesting a national Business Group ID, the party must give justification for the assignment of the national BGI.

The requesting organization, company, or individual shall provide its legally recognized name, address, and a contact person with that person's name, title, and full address. The requesting company, organization, or individual shall provide a list of other firms or entities associated with the use of the requested assignment. Exact spelling, capitalization, hyphenation, and other grammatical marks, shall be provided.

The information to be conveyed shall be given in the request for a new code.

B.4.3 Administration of National BGI Code Assignments

National BGI codes shall be assigned for use in the United States' CCS networks. It is assumed that other North American CCS networks will follow the same guidelines as the United States' CCS networks.

When a new BGI code is assigned, it will be assigned the next code in the sequence that has been established by the administrator.

When a new code is assigned, the administrator of the national BGI codes will provide written notification to (1) the requester and (2) ATIS, the standards body responsible for the signaling protocol(s) using the BGI codes.

B.4.4 Assignment Request Response

Within two weeks of receipt of a request for a code assignment, the administrator shall provide written acknowledgement of the requesting entity.

Within 30 to 45 days of the request, the administrator shall assign a code or provide the requesting entity with an explanation. When the administrator is unable to assign a code within three months, the administrator shall provide a written statement to the same party explaining the reason the administrator is not able to assign the code. The administrator shall provide the requesting entity with a monthly status report of the assignment request until the assignment is made or the request is withdrawn.

B.4.5 Reclaiming Assigned National BGI Codes

Assigned national BGIs will remain in effect as long as the service which uses it is in operation. If the appropriate service is no longer in operation, the firms, or entities associated with the assignment agree to relinquish the national BGI in 60 days.

National BGIs are not transferrable from one customer to another. Such Identifiers will be reclaimed and will become available for reassignment after a 6 month transition period (if necessary).

If a number of firms merge, the new consolidated network may choose which national BGI is to be retained for operation. The national BGI(s) which is (are) not retained will be available for reassignment after a 6 month transition period (if necessary).

If a number of firms merge and separate network operations are maintained, the national BGI may be retained by the customer.

Where a national BGI code has been reclaimed, the administrator shall inform all the firms or entities associated with the assignment.

B.4.6 Depletion of National BGI Codes

It is the responsibility of the administrator of the national BGI codes to continually monitor the availability of the codes and the potential for their exhaust. The administrator shall inform ATIS if there is a potential of exhaust and what conservation actions have been put into effect.

When the allocation of codes reaches 70 percent and the projection for growth indicates that the codes will exhaust within two years, ATIS should reevaluate the BGI codes content and structure and either reaffirm the original plan, expand the plan, or develop a new plan. ATIS shall inform the administrator of their decision. The administrator shall advise ATIS and the industry of the impending necessity to increase the supply of available codes.

If the assignment of codes reaches the 90 percent level, the administrator shall notify ATIS and known users of the codes of the impending exhaust. It is hoped that the industry will cooperate by voluntarily releasing unused codes. If the industry does not voluntarily release unused codes, the administrator should request consensus of an appropriate standards body or industry forum/association to reclaim unused codes in order to avoid unnecessary expansion of the signaling protocol.

If (1) the allocation level has reached 90 percent, (2) reclamation has not provided, and is not expected to provide, sufficient available codes and (3) ATIS has not notified the administrator of a new assignment plan or BGI code standard, the administrator shall require written confirmation from the appropriate standards body that there is also consensus that the assignment is of sufficient use to the industry to justify assigning the last few existing codes.

B.4.7 Publication of Codes

At least once per calendar year for any year in which new codes have been assigned, the administrator shall publish, or arrange for publication of, the complete list of assigned national BGI codes in an information source that is available to the industry.

B.5 National BGI Code Administrator

ATIS shall be responsible for contacting, negotiating with, and appointing an administrator (maintenance agent). The appointment of the administrator and the establishment of the administration guidelines are, therefore, contingent upon successful negotiations between ATIS and an administrator. ATIS may be contacted to determine the current administrator.

The administrator shall be given full authority by ATIS and the companies supporting ATIS to implement these guidelines.

Table B.1 - Business Group Identifier Field - ATIS-1000113.2015 – Chapter 3

00000000000000000000000000000000	No indication
00000000000000000000000000000001	Public network
00000000000000000000000000000010	
to	Local BGIs
00111111111111111111111111111111	
01000000000000000000000000000000	
to	National BGIs
01111111111111111111111111111111	
10000000000000000000000000000000	
to	Reserved for future expansion
11111111111111111111111111111111	

Annex C: ANI Information Digits

(informative)

The binary equivalents of the decimal codes used for the ANI information digits (II) are used to code the originating line information parameter field. The following codes are used in the originating line information parameter field based on the ANI information digits assignments as of September, 1999:

00000000	(00)	Plain Old Telephone Service (POTS)
00000001	(01)	Multiparty line (more than 2)
00000010	(02)	ANI failure
00000011	(03)	unassigned
00000100	(04)	unassigned
00000101	(05)	unassigned
00000110	(06)	Station Level Rating
00000111	(07)	special operator handling required
00001000	(08)	unassigned
00001001	(09)	unassigned
00001010	(10)	not assignable - conflict with 10X test code
00001011	(11)	unassigned
00001100	(12)	}
to		not assignable - conflict with international outpulsing code
00010011	(19)	}
00010100	(20)	Automatic Identified Outward Dialing (AIOD)
00010101	(21)	unassigned
00010110	(22)	unassigned
00010111	(23)	coin or non-coin on calls using database access
00011000	(24)	800 service call
00011001	(25)	800 service call from a pay station
00011010	(26)	unassigned
00011011	(27)	coin
00011100	(28)	unassigned
00011101	(29)	prison/inmate service
00011110	(30)	intercept (blank)
00011111	(31)	intercept (trouble)
00100000	(32)	intercept (regular)
00100001	(33)	unassigned
00100010	(34)	telco operator handled call
00100011	(35)	unassigned
00100100	(36)	CPE
00100101	(37)	}
to		unassigned
00100111	(39)	}
00101000	(40)	}
to		unrestricted use - locally determined by carrier
00110001	(49)	}

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00110010	(50)	unassigned
00110011	(51)	unassigned
00110100	(52)	OUTward Wide Area Telecommunications Service (OUTWATS)
00110101	(53)	}
to		unassigned
00111011	(59)	}
00111100	(60)	TRS
00111101	(61)	cellular/wireless PCS (type 1)
00111110	(62)	cellular/wireless PCS (type 2)
00111111	(63)	cellular/wireless PCS (roaming)
01000000	(64)	unassigned
01000001	(65)	unassigned
01000010	(66)	TRS
01000011	(67)	TRS
01000100	(68)	unassigned
01000101	(69)	unassigned
01000110	(70)	private paystations
01000111	(71)	}
to		unassigned
01001111	(79)	}
01010000	(80)	}
to		reserved for future expansion to 3-digit code
01011001	(89)	}
01011010	(90)	}
to		unassigned
01011100	(92)	}
01011101	(93)	access for private virtual network types of service
01011110	(94)	unassigned
01011111	(95)	unassignable - conflict with test codes 958 and 959
01100000	(96)	}
to		unassigned
01100011	(99)	}
01100100	(100)	}
to		reserved for future expansion (no interpretation)
11111111	(255)	}

NOTE - ANI information digits codes are assigned by the North American Numbering Plan (NANP) Administrator. The most current information on these codes can be found in the Telcordia Technologies "Local Exchange Routing Guide".

Annex D: Remote Operations Parameter Format & Encoding of Components

(normative)

This annex provides the format and encoding of Component(s). This is based on the encoding rules provided in ITU-T Recommendation X.209 and is consistent with that Recommendation.

D.1 General Component Structure

Each information element within a component has the same structure. An information element consists of three fields, which always appear in the following order:

1. The Tag distinguishes one type from another and governs the interpretation of the Contents.
2. The Length specifies the length of the Contents.
3. The Contents is the substance of the element, containing the primary information the element is intended to convey.

Figure D.1 of ATIS-1000113.2015 – Chapter 3 shows an overview of a component and an information element.

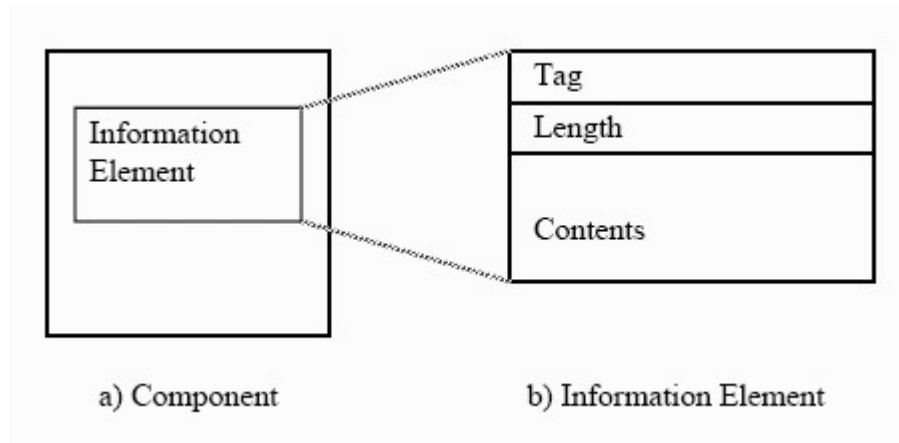


Figure D.1 - Structure of Component and Information Element - ATIS-1000113.2015 – Chapter 3

Each field is coded using one or more octets. Octets are labelled as shown in Figure D.2 of ATIS-1000113.2015 – Chapter 3. The first octet is the first transmitted. Bits in an octet are labelled as shown in Figure D.3 of ATIS-1000113.2015 – Chapter 3 with bit A the least significant and the first transmitted.

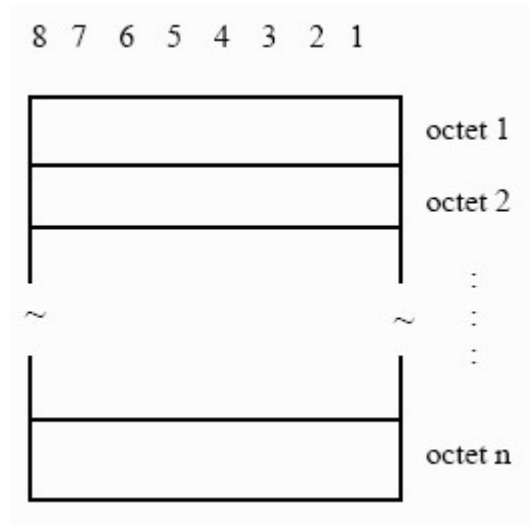


Figure D.2 - Octet Labelling Scheme - ATIS-1000113.2015 – Chapter.3

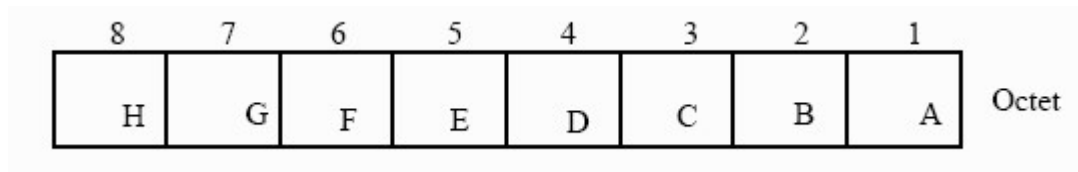


Figure D.3 - Bit Labelling Scheme - ATIS-1000113.2015 – Chapter 3

The contents of each element is either one value (Primitive) or one or more information elements (Constructor), as shown in Figure D.4 of ATIS-1000113.2015 – Chapter 3.

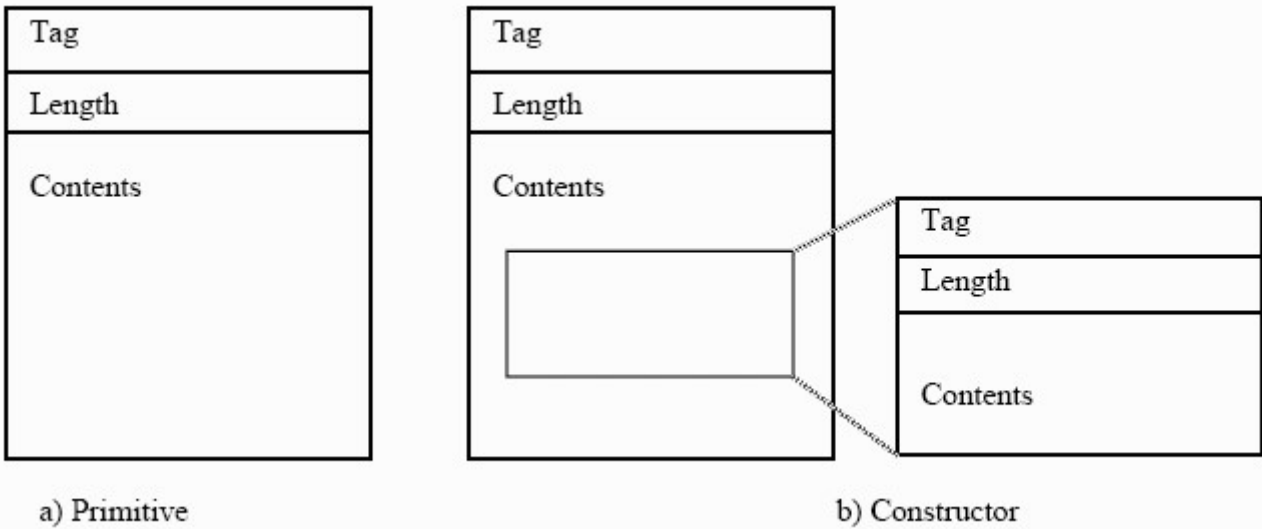
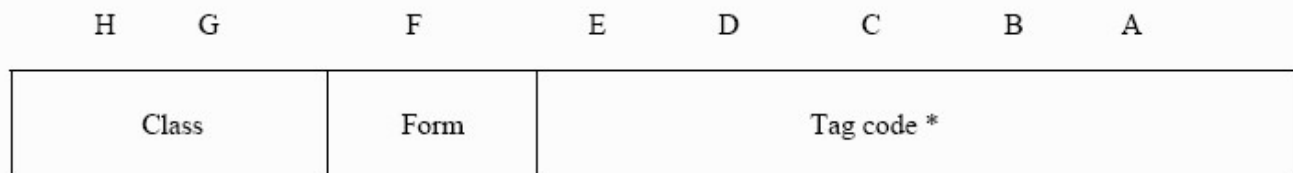


Figure D.4 - Types of Contents - ATIS-1000113.2015 – Chapter 3

D.2 Tags

An information element is first interpreted according to its position within the syntax of the message. The Tag distinguishes one information element from another and governs the interpretation of the Contents. It is one or more octets in length. The Tag is composed of "Class", "Form" and "Tag code", as shown in Figure D.5 of ATIS-1000113.2015 – Chapter 3.



NOTE - The Tag code may be extended to the following octet(s) as discussed in Clause 2.3 of ATIS-1000113.2015 – Chapter 3.

Figure D.5 - Format of Tag - ATIS-1000113.2015 – Chapter 3

D.2.1 Tag Class

All Tags use the two most significant bits (H and G) to indicate the Tag Class. These bits are coded as shown in Table D.1 of ATIS-1000113.2015 – Chapter 3.

Table D.1 - Coding of Tag Class - ATIS-1000113.2015 – Chapter 3

Class	Coding (HG)
Universal	00
Application-wide	01
Context-specific	10
Private use	11

The universal class is used for Tags that are exclusively standardized in ITU-T Recommendation X.209 and are application independent types. Universal Tags may be used anywhere a universal information element type is used. The universal class applies across all ITU-T recommendations (i.e., across ITU-T No. 7 ASEs, X.400 MHS, etc.).

The Application-wide class is used for information elements that are standardized across all applications (ASEs) using ITU-T No. 7 signaling system.

The Context-specific class is used for information elements that are specified within the context of the next higher construction and take into account the sequence of other information elements within the same construction. This class may be used for tags in a construction, and the tags may be re-used in any other construction.

The Private Use class is reserved for information elements specific to a nation, a network, or a private user. Such information elements are beyond the scope of this Recommendation.

D.2.2 Form of the Information Element

Bit F is used to indicate whether the element is "Primitive" or "Constructor", as is shown in Table D.2 of ATIS-1000113.2015 – Chapter 3. A primitive element is one whose structure is atomic (i.e., one value only). A constructor element is one whose content is one or more information elements which may themselves be constructor elements.

Both forms of elements are shown in Figure D.4 of ATIS-1000113.2015 – Chapter 3.

Table D.2 - Coding of Element Form

Element Form	Coding (F)
Primitive	0
Constructor	1

D.2.3 Tag Code

Bits A to E of the first octet of the Tag plus any extension octets represent a Tag code that distinguishes one element type from another of the same class. Tag codes in the range 00000 to 11110 (0 to 30 decimal) are provided in one octet.

The extension mechanism is to code bits A to E of the first octet as 11111. Bit H of the following octet serves as an extension indication. If bit H of the extension octet is set to 0, then no further octets for this tag are used. If bit H is set to 1, the following octet is also used for extension of the Tag code. The resultant Tag consists of bits A to G of each extension octet, with bit G of the first extension octet being most significant and bit A of the last extension octet being least significant. Tag code 31 is encoded as 0011111 in bits G to A of a single extension octet. Higher tag codes continue from this point using the minimum possible number of extension octets.

Figure D.6 – ATIS-1000113 – Chapter 3 shows the detailed format of the Tag code.

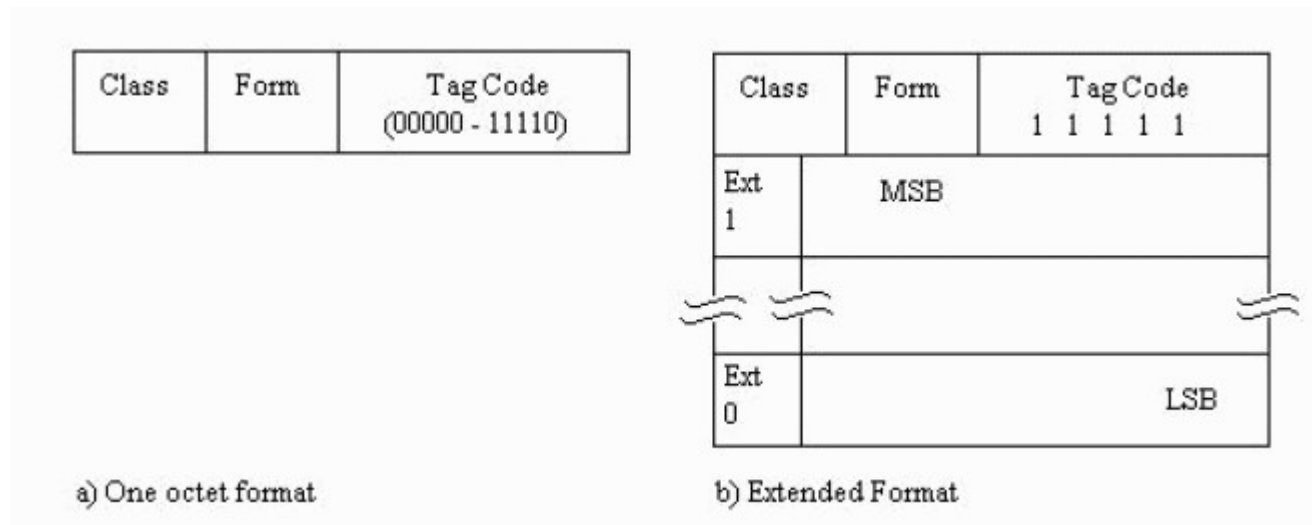


Figure D.6 - Format of the Tag Code - ATIS-1000113.2015 – Chapter 3

D.3 Length of the Contents

The length of the Contents is coded to indicate the number of octets in the Contents. The length does not include the Tag nor the Length of the Contents octets.

The Length of the Contents uses the short, long or indefinite form. If the length is less than 128 octets, the short form is used. In the short form, bit H is coded 0, and the length is encoded as a binary number using bits A to G.

If the length is greater than 127 octets, then the long form of the Length of the Contents is used. The long form Length is from 2 to 127 octets long. Bit H of the first octet is coded 1, and bits A to G of the first octet encode a number one less than the size of the Length in octets as an unsigned binary number whose MSB and LSB are bits G and A, respectively. The length itself is encoded as an unsigned binary number whose MSB and LSB are bit H of the second octet and bit A of the last octet, respectively. This binary number should be encoded in the fewest possible octets, with no leading octets having the value 0.

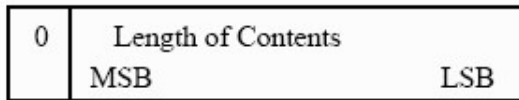
The indefinite form is one octet long and may (but need not) be used in place of the short or long form, whenever the element is a constructor. It has the value 10000000. When this form is employed, a special end-of-contents (EOC) indicator terminates the Contents.

There is no notation for the end-of-contents indicator. Although considered part of the Contents syntactically, the end-of-contents indicator has no semantic significance.

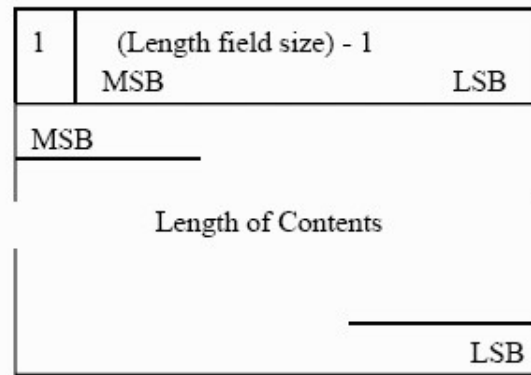
The representation for the end-of-contents indicator is an element whose class is universal, whose form is primitive, whose ID Code has the value 0, and whose Contents is unused and absent:

EOC	Length	Contents
00 (hex)	00 (hex)	Absent

Figure D.7 of ATIS-1000113.2015 – Chapter 3 shows the formats of the Length field described above. The maximum value that may be encoded is constrained by the network message size limitations in the connectionless case.



a) Short form



b) Long Form

Constructor Element Tag
L = 10000000
Tag Length * Contents
: :
: :
Tag Length * Contents
EOC Tag (00000000)
EOC Length (00000000)

c) Indefinite form

*NOTE - The Length may take any of three forms: short, long, and indefinite.

Figure D.7 - Format of Length Field - ATIS-1000113.2015 – Chapter 3

D.4 Contents

The contents are the substance of the element and contains the information the element is intended to convey. Its length is variable, but always an integral number of octets. The contents is interpreted in a type-dependent manner, i.e., according to the tag value.

D.5 Component type

The Components are based on the Remote Operations Service Element (ROSE) of Recommendation X.229. The four components types defined for the Remote Operations parameter are as follows.

D.5.1 Invoke

The invoke component requests that an operation be performed. It may be linked to another operation invocation previously sent by the other end. In this case it is known as a "Linked Invoke".

D.5.2 Return Result

The Return Result component reports successful completion of an operation.

D.5.3 Return Error

The Return Error component reports that an operation has not been successfully completed.

D.5.4 Reject

The Reject component reports the receipt and rejection of an incorrect component, other than a Reject component. The possible causes for rejecting a component are defined by the Problem Codes in clause 11.

D.6 Component Type Tag

Each Component is a sequence of information elements. The Component types have the structure indicated in the following tables.

The information elements for the various Components shown in Table D.3 of ATIS-1000113.2015 – Chapter 3 to Table D.6 of ATIS-1000113.2015 – Chapter 3 are all mandatory except the Linked ID and the parameters. The Parameter Tag shall be any valid ASN.1 tag, depending on the type of the parameter supplied. It can indicate either a primitive or a constructor element and refer to any of the defined tag classes.

When the parameter element is a collection of several information elements, the associated data type shall be derived from the Sequence, SequenceOf, Set, or SetOf types.

Clause 9 and Table D.11 of ATIS-1000113.2015 – Chapter 3 define the Sequence and Set tags.

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Table D.3 - Invoke Component -- ATIS-1000113.2015 – Chapter 3

Invoke Component	Mandatory Indication
Component Type Tag	Mandatory
Component Length	
Invoke ID Tag	
Invoke ID Length	Mandatory
Invoke ID	
Linked ID Tag	
Linked ID Length	Optional
Linked ID	
Operation Code Tag	
Operation Code Length	Mandatory
Operation Code	
Parameters	Optional

Table D.4 - Return Result Components - ATIS-1000113.2015 – Chapter 3

Return Result Component	Mandatory Indication
Component Type Tag	Mandatory
Component Length	
Invoke ID Tag	
Invoke ID Length	Mandatory
Invoke ID	
Sequence Tag	Optional a)
Sequence Length	
Operation Code Tag	Optional a)
Operation Code Length	
Operation Code	
Parameters	Optional a)
a) Omitted when no information elements are included in the parameters.	

Table D.5 - Return Error Component - ATIS-1000113.2015 – Chapter 3

Return Error Component	Mandatory Indication
Component Type Tag	Mandatory
Component Length	
Invoke ID Tag	
Invoke ID Length	Mandatory
Invoke ID	
Error Code Tag	
Error Code Length	Mandatory
Error Code	
Parameters	Optional

Table D.6 - Reject Component - ATIS-1000113.2015 – Chapter 3

Reject Component	Mandatory Indication
Component Type Tag	M
Component Length	
Invoke ID Tag ^{a)}	
Invoke ID Length	M
Invoke ID	
Problem Code Tag	
Problem Code Length	M
Problem Code	
^{a)} If the Invoke ID is not available, Universal Null (Table D.9 of ATIS-1000113.2015 – Chapter 3) with Length = 0 should be used.	

The Component Type Tag is coded context-specific, constructor as indicated in Table D.7 of ATIS-1000113.2015 – Chapter 3.

Table D.7 - Component Type Tag - ATIS-1000113.2015 – Chapter 3

Component Type Tag	H	G	F	E	D	C	B	A
Invoke	1	0	1	0	0	0	0	1
Return Result	1	0	1	0	0	0	1	0
Return Error	1	0	1	0	0	0	1	1
Reject	1	0	1	0	0	1	0	0

D.7 Component ID Tag

The term Component ID refers to the Invoke ID or the Linked ID. An Invoke ID is used as a reference number to identify uniquely a request for an operation. It is present in any reply to an Invoke Component (Return Result, Return Error or Reject), enabling the reply to be correlated with the invoke.

A Linked ID is included in an invoke component by a node when it responds to an operation invocation with a linked operation invocation. The node receiving the Linked ID uses it for correlation purposes, in the same way that it uses the invoke ID in Return Result, Return Error, and Reject components.

The Component ID Tag is coded as shown in Table D.8 of ATIS-1000113.2015 – Chapter 3.

Table D.8 - Coding of Component ID Tag - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Invoke ID	0	0	0	0	0	0	1	0
Linked ID ^{a)}	1	0	0	0	0	0	0	0
^{a)} This tag differs from the Invoke ID, which is coded as a universal INTEGER, in order to distinguish it from the following tag (Operation Code) which is also coded as a universal INTEGER.								

The length of a Component ID is 1 octet.

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An Invoke Component has one or two Component IDs: an Invoke ID, and if it is desired to associate the Invoke with a previous Invoke, then the second or Linked ID is provided in addition to the Invoke ID.

Return Result and Return Error Components have one Component ID, called an Invoke ID which is the reflection of the Invoke ID of the Invoke Component to which they are responding.

The Reject Component uses as its Invoke ID, the Invoke ID in the Component being rejected. If this ID is unavailable (e.g., due to mutilation of the message undetected by lower layers), then the Invoke ID tag is replaced with a universal NULL tag (which always has length = 0) as shown in Table D.9 of ATIS-1000113.2015 – Chapter 3.

Table D.9 - Coding of Null Tag - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
NULL Tag	0	0	0	0	0	1	0	1

If an Invoke containing both Invoke and Linked IDs is being rejected, only the Invoke ID is used in the Reject Component.

D.8 Operation Code Tag

Each operation is assigned a value to identify it. The Operation Code element indicates the precise operation to be invoked, and is present in an invoke component type. It is also present in the Return Result component if the result contains parameters. Operations can be classified as local or global operations.

The actual operation codes, the definition of operations and their associated parameters, are defined in relevant supplementary service specifications.

A local operation code follows an Operation Code Tag and Operation Code length. The Operation Code Tag is coded as shown in Table D.10 of ATIS-1000113.2015 – Chapter 3.

Table D.10 - Coding of Operation Code Tag - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Local Operation Code Tag	0	0	0	0	0	0	1	0
Global Operation Code Tag	0	0	0	0	0	1	1	0

The Global Operation Code is coded as an Object Identifier, which is described in Recommendation X.209.

D.9 Parameter Tag

The Parameter Tag shall be any valid ASN.1 tag, depending on the type of the parameter supplied. It can indicate either a primitive or a constructor element and refer to any of the defined tag classes.

When the parameter element is a collection of several information elements, the associated data type shall be derived from the Sequence, SequenceOf, Set, or SetOf types.

Table D.11 - Coding of Sequence and Set Tag - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Sequence Tag	0	0	1	1	0	0	0	0
Set Tag	0	0	1	1	0	0	0	1

D.10 Error Code Tag

The Error Code element contains the reason why an operation cannot be completed successfully. It is present only in a Return Error component. These errors and associated parameters are defined in relevant supplementary service specifications.

Each error is assigned a value to identify it. Errors can be classified as local or global errors. A local error code follows the Error Code Tag and Error Code Length. The Error Code Tag is coded as shown in Table D.12 of ATIS-1000113.2015 – Chapter 3.

Table D.12 - Coding of Error Code Tag - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Local Error Code Tag	0	0	0	0	0	0	1	0
Global Error Code Tag	0	0	0	0	0	1	1	0

The Global Error Code is coded as an Object Identifier, which is described in Recommendation X.209.

D.11 Problem Code

The Problem code element contains the reason for the rejection of a component, and one such is present in a Reject component. The Problem Code consists of one of the four elements: General Problem, Invoke Problem, Return Result Problem, or Return Error Problem. The tags for these elements are coded as shown in Table D.13 of ATIS-1000113.2015 – Chapter 3. Their values are shown in Table D.14 to Table D.17 of ATIS-1000113.2015 – Chapter 3. The problem codes are described in clauses 11.1 through 11.4.

Table D.13 - Coding of Problem Type Tags - ATIS-1000113.2015 – Chapter 3

Problem Type	H	G	F	E	D	C	B	A
General Problem	1	0	0	0	0	0	0	0
Invoke	1	0	0	0	0	0	0	1
Return Result	1	0	0	0	0	0	1	0
Return Error	1	0	0	0	0	0	1	1

Table D.14 - Coding of General Problem - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Unrecognized Component a)	0	0	0	0	0	0	0	0
Mistyped Component a)	0	0	0	0	0	0	0	1
Badly Structured Component a)	0	0	0	0	0	0	1	0
a) Components are equivalent to ROSE Application Protocol Data Units (APDU).								

Table D.15 - Coding of Invoke Problem - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Duplicate Invoke ID	0	0	0	0	0	0	0	0
Unrecognized Operation	0	0	0	0	0	0	0	1
Mistyped Parameter a)	0	0	0	0	0	0	1	0
Resource Limitation	0	0	0	0	0	0	1	1
Initiating Release b)	0	0	0	0	0	1	0	0
Unrecognized Linked ID	0	0	0	0	0	1	0	1
Linked Response Unexpected	0	0	0	0	0	1	1	0
Unexpected Linked c) Operation	0	0	0	0	0	1	1	1
a) Invoke parameter is equivalent to ROSE Invoke argument. b) ROSE uses "Initiator releasing" as only the initiator of the underlying association may release it. In ISUP, either entity may release the association. c) ROSE refers to a linked operation as a child operation.								

Table D.16 - Coding of Return Result Problem - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Unrecognized Invoke ID	0	0	0	0	0	0	0	0
Return Result Unexpected	0	0	0	0	0	0	0	1
Mistyped Parameter	0	0	0	0	0	0	1	0

Table D.17 - Coding of Return Error Problem - ATIS-1000113.2015 – Chapter 3

	H	G	F	E	D	C	B	A
Unrecognized Invoke ID	0	0	0	0	0	0	0	0
Return Error Unexpected	0	0	0	0	0	0	0	1
Unrecognized Error	0	0	0	0	0	0	1	0
Unexpected Error	0	0	0	0	0	0	1	1
Mistyped Parameter	0	0	0	0	0	1	0	0

D.11.1 General Problem

This element contains one of the problem codes which apply to the components in general, and which do not relate to any specific component type. These are:

D.11.1.1 Unrecognized Component

The component type is not recognized as being one defined in clause 5.

D.11.1.2 Mistyped Component

The elemental structure of a component does not conform to the structure of that component as defined in clause 6.

D.11.1.3 Badly Structured Component

The contents of the component do not conform to the encoding rules defined in clauses 1 through 4.

D.11.2 Invoke Problem

This element contains one of the problem codes which relate only to the invoke component type. They are:

D.11.2.1 Duplicate Invoke ID

The invoke ID is already in use by a previously invoked operation.

D.11.2.2 Unrecognized Operation

The operation code value is not one of those agreed to be used by the ASE.

D.11.2.3 Mistyped Parameter

Signifies that the type of invoke parameter is not that agreed between the users.

D.11.2.4 Resource Limitation

Sufficient resources are not available to perform the operation requested.

D.11.2.5 Initiating Release

The requested operation cannot be invoked because the association is about to be released.

D.11.2.6 Unrecognized Linked ID

The linked ID does not correspond to an active invoke operation.

D.11.2.7 Linked Response Unexpected

The operation referred to by the linked ID is not an operation for which linked invokes are allowed.

D.11.2.8 Unexpected Linked Operation

The operation referred to by the linked ID does not allow this linked operation.

D.11.3 Return Result Problem

This element contains one of the problem codes which relate only to the return result component type. They are:

D.11.3.1 Unrecognized Invoke ID

No operation with the specified invoke ID is in progress.

D.11.3.2 Return Result Unexpected

The invoked operation does not report success.

D.11.3.3 Mistyped Parameter

Signifies that the type of return result parameter is not that agreed between the users.

D.11.4 Return Error Problem

This element contains one of the problem codes which relate only to the return error component type. They are:

D.11.4.1 Unrecognized Invoke ID

No operation with the specified invoke ID is in progress.

D.11.4.2 Return Error Unexpected

The invoked operation does not report failure.

D.11.4.3 Unrecognized Error

The reported error is not one of those defined for the invoked operation.

D.11.4.4 Unexpected Error

The received error is not one of those that the invoked operation may report.

D.11.4.5 Mistyped Parameter

Signifies that the type of error parameter is not that agreed between the users.

D.12 Specification of Components in ASN.1

ISUPRemoteOperations {iso(1) memberbody(2) USA(840) ATIS-1000113(10027)} DEFINITIONS ::=

BEGIN

EXPORTS OPERATION, ERROR;

Component	::= CHOICE{	invoke	[1]	IMPLICIT	Invoke,
		returnResult	[2]	IMPLICIT	ReturnResult,
		returnError	[3]	IMPLICIT	ReturnError,
		reject	[4]	IMPLICIT Reject}	

--The Components are sequences of data elements.

Invoke	::= SEQUENCE	{	invokeID		IMPLICIT	INTEGER	INTEGER,
			linkedID[0]				OPTIONAL,
			operationCode				OPERATION,
			parameter	ANY	DEFINED	BY	operationCode
			-- ANY is filled by the single ASN.1 data type following the key				OPTIONAL}
			-- word PARAMETER in the type definition of a particular				
			-- operation.				

ReturnResult	::= SEQUENCE	{	invokeID			INTEGER,
			SEQUENCE{		operationCode	OPERATION,
			parameters	ANY	DEFINED	BY
			-- ANY is filled by the single ASN.1 data type			
			-- following the key word RESULT in the type			
			-- definition of a particular			
			}OPTIONAL}			

ReturnError	::= SEQUENCE	{	invokeID			INTEGER,
			errorCode			ERROR,
			parameter	ANY	DEFINED	BY
			-- ANY is filled by the single ASN.1 data type following the key			
			-- word PARAMETER in the type definition of a particular			
			-- error.			

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Reject	::= SEQUENCE	{invokeID problem CHOICE{	CHOICE{INTEGER,NULL},
		[0]	IMPLICIT
		[1]	IMPLICIT
		[2]	IMPLICIT
		[3]	IMPLICIT
			GeneralProblem, InvokeProblem, ReturnResultProblem, ReturnErrorProblem}}

-- OPERATIONS.

-- Operations are specified with the OPERATION MACRO. When an operation is specified,
-- the valid parameter set, results, and errors for that operation are indicated.
-- Default values and optional parameters are permitted.

OPERATION MACRO ::= BEGIN

TYPE NOTATION	::=	Parameter	Result	Errors	LinkedOperation
VALUE NOTATION	::=		value(VALUE		CHOICE{
		localValue			INTEGER,
		globalValue	OBJECT IDENTIFIER}}		

Parameter ::= "PARAMETER"NamedType | empty

Result ::= "RESULT"ResultType | empty

Errors ::= "ERRORS" "{"ErrorNames"}" | empty

LinkedOperations ::= "LINKED" "{"LinkedOperationNames"}" | empty

ResultType ::= NamedType | empty

ErrorNames ::= ErrorList | empty

ErrorList ::= Error | ErrorList"," Error

Error ::= value (ERROR) -- shall reference an error value
| type -- shall reference an error type if no error value is specified

LinkedOperationNames ::= OperationList | empty

OperationList ::= Operation | OperationList"," Operation

Operation ::= value (OPERATION) -- shall reference an Operation value
| type -- shall reference an Operation type if no Operation value is specified

NamedType ::= identifier type | type

END --end of Operation Macro

--ERRORS

--Errors are specified with the ERROR MACRO. When an error is specified, the valid parameters for that
--error are indicated. Default values and optional parameters are permitted.

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--Definition of Error Macro follows

```

ERROR MACRO      ::=
BEGIN

TYPE NOTATION    ::=
VALUE NOTATION   ::=                                value(VALUE
                                                    localValue
                                                    globalValue OBJECT IDENTIFIER})

Parameter        ::= "PARAMETER"NamedType | empty

NamedType        ::= identifier type | type

END --end of Error Macro

--PROBLEMS.

GeneralProblem   ::= INTEGER { unrecognizedComponent (0),
                               mistypedComponent (1),
                               badlyStructuredComponent (2)}

InvokeProblem    ::= INTEGER { duplicateInvokeID (0),
                               unrecognizedOperation (1),
                               mistypedParameter (2),
                               resourceLimitation (3),
                               initiatingRelease (4),
                               unrecognizedLinkedID (5),
                               linkedResponseUnexpected (6),
                               unexpectedLinkedOperation (7)}

ReturnResultProblem ::= INTEGER { unrecognizedInvokeID (0),
                                  returnResultUnexpected (1),
                                  mistypedParameter (2)}

ReturnErrorProblem  ::= INTEGER { unrecognizedInvokeID (0),
                                  returnErrorUnexpected (1),
                                  unrecognizedError (2),
                                  unexpectedError (3),
                                  mistypedparameter (4)}

END --end of ISUPRemoteOperations Module

```

**Signaling System No. 7 (SS7) --
Integrated Services Digital Network (ISDN) User Part**

Chapter 4

Signaling Procedures

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American National Standard on –

Signaling System No.7 (SS7) – Integrated Services Digital Network (ISDN) User Part

Chapter 4: Signaling Procedures

1 Scope, Purpose, & Application

1.1 Relationship with other Signaling System 7 Specifications

This chapter describes the basic signaling procedures for the set-up and clear-down of national and international ISDN and non-ISDN connections. The messages and signals are defined in ATIS-1000113.2015 – Chapter 2 and their format and content are given in ATIS-1000113.2015 – Chapter 3. This chapter also includes generic procedures for supplementary services. Service-specific procedures for supplementary services are contained in separate American National Standards (see Clause 2.2 of ATIS-1000113.2015 – Chapter 1).

This chapter may contain requirements that reference other American National Standards. If so, when the American National Standards referenced in the requirements are superseded by revisions approved by the American National Standards Institute, Inc, the revisions shall apply.

1.2 Numbering

The procedures described assume that the ISDN uses the international numbering plan defined for the ISDN and thus provides a basic circuit service between ISDN terminals and telephony terminals that may be interconnected via the existing international telephony network.

1.3 Address Signaling

In general, the call set-up procedure described is standard for both voice and non-voice connections using en bloc address signaling for calls between ISDN terminals and non-ISDN terminals.

1.4 Basic Procedures

The basic call control procedure is divided into three phases: call set-up, the data/conversation phase, and call clear-down. Messages on the signaling link are used to establish and terminate the different phases of a call. Standard inband supervisory tones or recorded announcements or both are returned to the caller on speech and 3.1 kHz connections to provide information on call progress. Calls originating from ISDN terminals may be supplied with more detailed call progress information by means of additional messages in the access protocol supported by a range of messages in the network.

1.4A Signaling methods

Two signaling methods are used in this chapter:

- Link-by-link;
- End-to-end.

The link-by-link method is primarily used for messages that need to be examined at each exchange (see clause 2). The end-to-end methods are used for messages of end point significance (see clause 3).

The link-by-link method may be used for messages of end point significance. (However, the messages may be affected by processing delays.)

1.5 Layout of ATIS-1000113.2015 – Chapter 4

The procedures specified in clause 2 of this chapter relate to basic calls (i.e., calls not involving supplementary services). Clause 3 of this chapter specifies the procedures relating to end-to-end signaling connections. Generic procedures for supplementary services are specified in clause 4A of this chapter. The additional requirements to be met in the case of calls involving supplementary services and network utilities are specified in separate American National Standards. The state transition diagrams for the ISDN User Part (ISUP) are presented in ATIS-1000113.2015 – Chapter 6.

1.6 Interworking with Other Signaling Systems or User Parts

Only some examples are included in this chapter and should not be used as a definitive interworking guide.

2 Basic Call Control & Signaling Procedures

2.1 Successful Call Set-up

Figure 4.1 to Figure 4.8A of ATIS-1000113.2015 – Chapter 4 show the call set-up and release sequence which are described below.

2.1.1 Forward Address Signaling - En Bloc Operation

2.1.1.1 Actions Required At Originating Exchange

1) **Circuit selection:** When the originating exchange has received the complete selection information from the calling party, and has determined that the call is to be routed to another exchange, selection of a suitable, idle, inter-exchange circuit takes place and an Initial Address Message (IAM) is sent to the succeeding exchange. Appropriate routing information is either stored at the originating exchange or at a remote database to which a request may be made.

The selection of the route will depend on the transit network selection (if applicable), called party number and the network signaling capability required. This selection process may be performed at the exchange or with the assistance of the remote database.

In addition, in the case of a subscriber with ISDN access, the set-up message contains bearer capability information which is analyzed by the originating exchange to determine the correct network signaling capability. In the case of non-ISDN access, the appropriate bearer capability information shall be determined by the originating

exchange. The bearer capability information shall be coded into the User Service Information parameter of the Initial Address Message.¹

The network signaling capabilities allowed (as coded in the Forward Call Indicators parameter) are for:

- ISDN user-part preferred;
- ISDN user-part required;
- ISDN user-part not required (any signaling system).

The information used to determine the routing of the call by the originating exchange will be included in the Initial Address Message to permit correct routing at intermediate exchanges. The Initial Address Message conveys implicitly the meaning that the indicated circuit has been seized.

2) Address information sending sequence: The sending sequence of address information on international calls will be the country code (not sent to an incoming international exchange) followed by the national (significant) number. On national connections, the address information may be the local number or the national (significant) number as required by the Administration concerned. For calls to international operator positions (Code 11 and Code 12) refer to ITU-T Recommendation Q.107². For calls to national operator positions, by operators, existing standard digit codes will be used.³

3) Initial Address Message: The Initial Address Message in principle contains all the information that is required to route the call to the destination exchange and connect the call to the called party.

All Initial Address Messages shall include a Protocol Control Indicator (in the Forward Call Indicators parameter). The originating exchange shall set the parameters in the Protocol Control Indicator and in the ISDN User Part Preference Indicator to indicate:

- The type of end-to-end signaling that can be accommodated (see Clause 3);
- The availability of Signaling System 7 signaling;
- The use of the ISDN User Part;
- Whether further information is available (being sent in a subsequent unsolicited Information Message);
- Network signaling capability required (e.g., ISDN User Part required all the way).

The ISDN User Part Preference Indicator is set according to the bearer service and supplementary service(s) requested. The exact setting depends on the service demand conditions and may be different depending on individual cases. In principle, if the service demand requires ISDN-UP to be essential then the indicator is set to "required", if the service required is optional but preferred it is set to "preferred", otherwise it is set to "not required". The indicator is set to either "required", "preferred", or "not required", according to the most stringent condition required by one or more of the parameters in the Initial Address Message. In addition, if end-to-end signaling is essential to provide the requested service, the indicator should always be set to "required" (see ITU-T Recommendation E.172).

The Nature of Connection Indicators are set appropriately based on the characteristics of the selected outgoing circuit.

¹ Transmission Medium Requirement parameter in ITU-T Recommendation Q.764 is not specified for U.S. networks.

² ITU-T (formerly, CCITT) Recommendations mentioned in this chapter are available from the International Telecommunications Union at < <http://www.itu.int/ITU-T/> >.

³ ST signal in ITU-T Recommendation Q.764 is not specified for U.S. networks.

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The originating exchange may also include in the Initial Address Message:

- A call reference (including the point code of the originating exchange) to enable the destination exchange to establish an end-to-end connection (see Clause 3);
- The calling party number, which shall be made available to other networks, if available. If a user-provided calling party number is available and has passed screening, it is sent in the Calling Party Number parameter. If a user-provided calling party number is available but failed screening or was not screened, it is sent in the Generic Address parameter. In the latter case and when no user-provided number is available, a network-provided calling party number is sent in the Calling Party Number parameter;
- An SCCP Connection Request parameter;
- Other information related to supplementary services and network utilities.

The Initial Address Message can contain an Access Transport parameter.

If subaddress information is received from the calling access, this information is passed unchanged to the destination exchange in the Access Transport parameter of the Initial Address Message.

High Probability of Completion calls, Multi-level Precedence and Preemption calls, and calls dialed as “911” shall use the higher of the two Initial Address Message priorities as specified in ATIS-1000111.

4) Transfer of information not included in the Initial Address Message: As an alternative to the inclusion of call set-up supplementary service information in the Initial Address Message, any call set-up supplementary service information not included in the IAM and which can be requested from the destination exchange, may be transported between the originating and destination exchange. The method of transportation for this information can be by using the unsolicited Information Message (see Clause 2.1.4B) or via the end-to-end methods (see Clause 3).

5) Completion of transmission path: For a speech, 3.1 kHz audio, or unrestricted digital information with tones and announcements (UDI-TA) call, through connection of the transmission path in the backward direction shall be completed at the originating exchange no later than at receipt of an Address Complete Message (see Clause 2.1.4.3).

For any call, through connection in both directions shall be completed no later than at receipt of an interworking or answer indication (see Clause 2.1.4.3).

6) Network protection timer: When the originating exchange or the controlling exchange has sent the Initial Address Message the awaiting address complete timer (T_7) is started. If timer T_7 expires, the connection shall be released and an indication returned to the calling subscriber.

7) Number portability: The originating exchange using the Call Completion to a Portable Number (CCPN) network capability and acting as the initiating switch may, in addition to existing ISUP optional parameters, include in the Initial Address Message (IAM) a Generic Address Parameter (GAP) containing the ported number dialed by the calling party (that is, the Type of Address of the GAP is coded with “ported number”) when the number dialed by the calling party is translated to a different routing number. The translated number is populated in the Called Party Number parameter and the Forward Call Indicators parameter shall be set to “number translated”.

If the number dialed by the calling party is not translated to a different routing number, the originating exchange acting as an initiating switch shall set the Forward Call Indicators parameter to “number translated”. The Called Party Number parameter shall remain unchanged and the “ported number” GAP will not be included in the IAM.

8) Transport of dialed number: The originating exchange may, in addition to existing ISUP optional parameters, include in the Initial Address Message (IAM) a Generic Address Parameter (GAP) containing the number dialed by the calling party (that is, the Type of Address of the GAP is coded with “dialed number”) when the number dialed by the calling party is translated to a different number.

2.1.1.2 Actions Required at an Intermediate Exchange

1) Circuit selection: An intermediate exchange, on receipt of an Initial Address Message, shall analyze the called party number, the Protocol Control Indicator (see Clause 2.1.1.1(3)), the ISDN User Part Preference Indicator, the bearer capability specified in the User Service Information parameter, and any other routing information (see Clause 2.1.1.1(1)) to determine the routing of the call.

When no echo control device or nature-of-circuit indication is received from a preceding exchange using a signaling system with fewer facilities, the indicators shall be considered as received "no" unless positive knowledge is available.

If the ISDN User Part Preference Indicator is set to:

- "ISDN User Part not required all the way", then the call is set up no matter what the outgoing signaling system is (ISDN User Part, Telephone User Part, MF, etc.);
- "ISDN User Part preferred all the way" and it is not possible to find a circuit using the ISDN User Part, the call is still set up;
- "ISDN User Part required all the way" and there is no available ISDN User Part circuit, the call is rejected and appropriate information is sent in the backward direction.

If the call is still permitted, the intermediate exchange then seizes an idle inter-exchange circuit and sends an Initial Address Message to the succeeding exchange.

2) Parameters in the Initial Address Message: An intermediate exchange may modify signaling information received from the preceding exchange according to the capabilities used on the outgoing route. Signaling information that may be changed are Nature of Connection Indicators or End-to-End Method Indicator; the most significant digits in the called party number may be amended or omitted (see Clause 2.1.1.1(2)). A change of the end-to-end method used may also alter parameters (see Clause 3). The satellite indicator in the Nature of Connection Indicators parameter should be incremented if the selected outgoing circuit is a satellite circuit. Otherwise, the indicator is passed on unchanged. Other signaling information is passed on transparently (e.g., the Access Transport parameter, User Service Information, etc.⁴)

3) Completion of transmission path: For a speech, 3.1 kHz audio, or UDI-TA call, through connection of the transmission path in the backward direction shall be completed at an intermediate exchange no later than at receipt of an Address Complete Message (see Clause 2.1.4.2).

For any call, through connection in both directions shall be completed no later than at receipt of an interworking or answer indication (see Clause 2.1.4.2).

4) Congestion: In the case of congestion at an intermediate exchange, the exchange may send a Release Message (including Automatic Congestion Level parameter) to the preceding exchange indicating congestion and initiating release of the call at that exchange. The Release Message shall include the cause indicators parameter with Cause Value 42 (switching equipment congestion). Refer to Clause 2.11 for automatic congestion control procedures.

5) Number portability: The actions at an intermediate exchange acting as an initiating switch are the same as an originating exchange acting as an initiating switch. Otherwise, no action is required at an intermediate exchange. In particular, an intermediate exchange that receives an IAM with the Forward Call Indicators parameter set to "number translated" shall not act as the initiating switch.

6) Transport of dialed number: The intermediate exchange may, in addition to existing ISUP optional parameters, include in the Initial Address Message (IAM) a Generic Address Parameter (GAP) containing the

⁴ Other signaling information may be passed on to other networks based on bilateral agreements.

number dialed by the calling party (i.e., the Type of Address of the GAP is coded with “dialed number”) when the number dialed by the calling party is translated to a different called number.

If the IAM received for a call at the intermediate exchange contains a “dialed number” GAP, the intermediate exchange shall not modify the “dialed number” GAP but shall pass the parameter as received.

2.1.1.3 Actions Required at the Destination Exchange

1) Selection of called party: Upon receipt of an Initial Address Message, the destination exchange shall analyze the called party number to determine to which party the call should be connected. It shall also check the called party's line condition and perform various checks to verify whether or not the connection is allowed. These checks shall include correspondence of compatibility checks (e.g., checks associated with supplementary services).

At this point, certain call set-up information may need to be obtained from an originating or controlling exchange. Examination of the Protocol Control Indicator shows whether an unsolicited Information Message is expected due to Initial Address Message segmentation. Also, examination of the Protocol Control Indicator shows whether the SCCP or Pass Along methods (see Clause 3) can be used for exchange of information between the involved exchanges.

In the case where the connection is allowed, the destination exchange shall set up a connection to the called party. If a continuity check has to be performed on one or more of the circuits involved in a connection, setting up of the connection to the called party must be prevented until the continuity of such circuits has been verified.

2) Connection not allowed: If the call cannot be connected due to, for instance, the called party being busy, a Release Message indicating the reason is sent to the preceding exchange (see Clause 2.2).

3) Number portability: Upon receipt of an IAM, the destination exchange shall analyze the IAM for the presence of Call Completion to a Portable Number (CCPN) network capability specific information. When the “ported number” GAP is present and the Forward Call Indicators parameter is set to “number translated”, the ported number contained in the GAP shall be used to connect the call to the called party and be used for services that need the ported number. If no “ported number” GAP is present, the Called Party Number shall be used to connect the call to the called party and be used for services that need the ported number.

In the event that the destination exchange cannot determine an end user's ported number based on the Called Party Number parameter and possibly a “ported number” GAP, it will do the following:

- If the IAM does not contain a “ported number” GAP, the exchange shall either release the call or provide a suitable tone or announcement using one of the existing cause values for unidentified users.
- If the IAM contains a “ported number” GAP, the exchange shall release the call using ANSI Cause Value 26, “Misrouted to a ported number”.

4) Transport of the dialed number: Upon receipt of the IAM with a “dialed number” GAP, the destination exchange may use this information for supplementary services.

5) Congestion: In the case of congestion at the destination exchange, the exchange may send a Release Message (including Automatic Congestion Level parameter) to the preceding exchange indicating congestion and initiating release of the call at that exchange. The Release Message shall include the cause indicators parameter with Cause Value 42 (switching equipment congestion). Refer to Clause 2.11 for automatic congestion control procedures.

2.1.2 Forward Address Signaling - Overlap Operation

(No procedure specified for U.S. networks.)

2.1.3 Calling Party Number

The calling party number can either be included in the Initial Address Message (see Clause 2.1.1.1(3)) or requested by the destination exchange (see Clause 2.1.4B). If the calling party number is required at the destination exchange but is not included in the Initial Address Message, the destination exchange shall analyze the Protocol Control Indicator to determine if the request and response should be conducted by end-to-end procedures (see Clause 3) or link-by-link procedures (see Clause 2.1.4B). It may be necessary to withhold the sending of the Address Complete Message until the calling party number has been successfully delivered.

2.1.3A Exit Message

2.1.3A.1 Actions at a Gateway Exchange

The Exit Message may be generated at an outgoing gateway exchange in a network and sent backward to notify preceding exchanges that a call connection has been completed into a succeeding network. When an Initial Address Message is sent from the gateway exchange for the outgoing circuit, a timer ($T_{\text{EXM,d}}$) should be set. The timer value is network dependent. The Exit Message should be returned for the incoming circuit at the expiration of this timer.

The message shall consist of the Message Type, and optionally, an Outgoing Trunk Group Number parameter. When included, the Outgoing Trunk Group Number parameter should carry the number of the trunk group used to complete the connection from the exchange originating the Exit Message.

2.1.3A.2 Actions at Intermediate Exchange

Upon receipt of the Exit Message, an intermediate, non-gateway exchange may send the corresponding Exit Message to the preceding exchange.

2.1.3A.3 Actions at an Originating or Gateway Exchange

Receipt of the Exit Message may be used to generate timing indications at the originating exchange. Upon receipt of the Exit Message at an originating or gateway exchange, no Exit Message is generated to preceding points, as the Exit Message is only used within a network.

2.1.3B Circuit Reservation

The following signaling procedure using a Circuit Reservation Message and a Circuit Reservation Acknowledgment Message is an optional procedure for call setup between exchanges in different networks. The procedure may be initiated by an intermediate exchange only when the incoming circuit uses Exchange Access Signaling as specified in ATIS-1000104 and the outgoing circuit is SS7 supported and connected to an exchange in another network.

2.1.3B.1 Actions at the Intermediate Exchange Initiating Circuit Reservation

1) Sending a Circuit Reservation Message: The intermediate exchange sends a Circuit Reservation Message to the succeeding exchange. The Circuit Reservation Message contains the Nature of Connection Indicators coded as for an Initial Address Message. In particular, any required continuity check on the outgoing circuit is requested in the Circuit Reservation Message. On sending the Circuit Reservation Message, the exchange sets a timer (T_{CRM}) awaiting an on-hook indication on the incoming circuit or a Circuit Reservation Acknowledgment Message for the outgoing circuit. If the Circuit Reservation Message requests a continuity check and if this check is successful, the intermediate exchange should also send forward a Continuity Message with a "continuity check

successful" indication. This Continuity Message may precede or follow receipt of the expected Circuit Reservation Acknowledgment Message.

2) Receipt of Circuit Reservation Acknowledgment Message: On receipt of a Circuit Reservation Acknowledgment Message the intermediate exchange cancels timer (T_{CRM}). After both the receipt of a Circuit Reservation Acknowledgment Message and the successful completion of any required continuity check on the outgoing circuit, the intermediate exchange returns an off-hook wink on the incoming circuit. This wink will prompt the preceding exchange to send routing information, on receipt of which the intermediate exchange formulates and sends an Initial Address Message for the outgoing circuit (see Clause 2.1.1.1(3)) and returns an acknowledgment wink to the preceding exchange. The Continuity Check Indicator within the Nature of Connection parameter is coded "continuity check not required."

3) Abnormal conditions:

- If the Circuit Reservation Message requests a continuity check and the check fails, and the Circuit Reservation Message is the first message sent for the call, then the exchange cancels timer T_{CRM} if active, sends forward a Continuity Message with a "continuity check failed" indication, and selects a second outgoing circuit and sends a Circuit Reservation Message for this circuit;
- If a continuity check requested in a Circuit Reservation Message for a reattempted call fails, the call is not reattempted again. Off-hook is returned on the incoming circuit and reorder tone or an announcement is provided to the calling party;
- If timer T_{CRM} expires a first time for a call, the exchange should release the outgoing circuit following the normal release procedures (see Clause 2.3.3). The exchange should then again select an outgoing circuit and send a Circuit Reservation Message for this circuit, again setting timer T_{CRM} . If timer T_{CRM} expires a second time, the exchange returns off-hook on the incoming circuit and provides reorder tone or an announcement to the calling party;
- If an on-hook is received on the incoming circuit while timer T_{CRM} is active, the timer is canceled and the outgoing circuit is released.

2.1.3B.2 Actions at the Exchange Receiving a Circuit Reservation Message

1) Return of Circuit Reservation Acknowledgment Message: An exchange receiving a Circuit Reservation Message marks the circuit busy and returns a Circuit Reservation Acknowledgment Message. If the Circuit Reservation Message indicates that a continuity check is being performed, the exchange need not wait for receipt of a Continuity Message before returning the Circuit Reservation Acknowledgment Message. However, the exchange sets a timer (T_8) awaiting receipt of the Continuity Message. On receipt of this Continuity Message, timer (T_8) is canceled. If the Continuity Message contains a successful indication, the exchange uses this information to encode the Continuity Message sent for the outgoing circuit connection. If the Continuity Message is received with a failed indication, the exchange proceeds with incoming continuity recheck procedures (i.e., sets a timer awaiting receipt of a Continuity Check Request Message, etc.).

2) Receipt of subsequent messages: After returning the Circuit Reservation Acknowledgment Message, the exchange sets a timer T_{CRA} , awaiting receipt of an Initial Address Message or a Release Message. On receipt of either message, timer T_{CRA} is canceled.

If a Release Message is received, the exchange follows the usual procedure of idling the circuit (see Clause 2.3) and returning a Release Complete Message.

If an Initial Address Message is received, the exchange proceeds with normal call processing and, as appropriate, routes the call forward. If the call is routed forward on an SS7 supported circuit the Continuity Check Indicator within the Nature of Connection Indicator in the Initial Address Message sent for this outgoing circuit is coded to reflect any continuity check performed as indicated in the Circuit Reservation Message. Other information carried in the Nature of Connection Indicator of the received Initial Address Message should also be used to code the Nature of Connection Indicator in the outgoing Initial Address Message.

3) Abnormal conditions: If timer T_8 or timer T_{CRA} expires before the receipt of an appropriate message, the exchange proceeds with release procedures for the incoming circuit, i.e., sends a Release Message, sets a timer awaiting receipt of a Release Complete Message, etc.

An example of the interworking between Exchange Access Signaling and SS7 using the circuit reservation procedure is shown in Figure 4.11A of ATIS-1000113.2015 – Chapter 4.

2.1.3B.3 Interworking of Answer Indication

When interworking between Exchange Access Signaling and SS7 occurs at an intermediate exchange and the circuit reservation procedure (see clause 2.1.3B.1) is used, it is possible that an Answer Message is received at the intermediate exchange for the outgoing circuit before the acknowledgment wink (third wink) from the intermediate exchange to the preceding exchange has been completed. If this occurs, the intermediate exchange should delay the sending of the off-hook answer indication on the incoming circuit until the acknowledgment wink to the preceding office is completed.

2.1.3B.4 Interworking with Facility/Service Selective Signaling

If Facility/Service Selective Signaling as specified in T1.104 is used on the incoming circuit at an intermediate exchange and a Facility Code has been dialed for the call, then the first stage of outpulsing from the preceding exchange to the intermediate exchange includes the Facility Code.

When interworking between such signaling and SS7 occurs at the intermediate exchange and the circuit reservation procedure (see clause 2.1.3B.1) is used, the intermediate exchange uses the Facility Code along with the other information it receives in the first stage of outpulsing to select a suitable circuit to the succeeding network. The Facility Code is not included in the Circuit Reservation Message but may be indicated in the Initial Address Message for the call.

An example of the interworking between Facility/Service Selective Signaling and SS7 using the circuit reservation procedure is shown in Figure 4.11B of ATIS-1000113.2015 – Chapter 4.

2.1.4 Address Complete Message⁵

2.1.4.1 Return of Address Complete Message from Destination Exchange

An Address Complete Message shall be sent from the destination exchange to indicate that the path through the network is complete and to convey indications such as called party status or interworking. In the case that the continuity check is performed the destination exchange shall withhold sending the Address Complete Message until a successful continuity indication has been received (see Clause 2.1.7).

Address Complete Message is sent from the destination exchange in the following conditions:

- 1) In the case where the terminating access is non-ISDN, the following action takes place at the destination exchange:
 - a) In all cases an Address Complete Message is sent as soon as it has been determined that the complete called party number has been received and the destination exchange has established that the subscriber is free. Indicators in the Address Complete Message shall be set to indicate:
 - Called Party's Status Indicator = "subscriber free";
 - ISDN Access Indicator = "non-ISDN".
 - b) When the status of the subscriber cannot be determined (e.g., in the case of a PBX), an Address Complete Message is sent as soon as it has been determined that the called party number has been received. Indicators in the Address Complete Message shall be set to indicate:

⁵ Connect Message in ITU-T Recommendation Q.764 is not specified for U.S. networks.

- Called Party's Status Indicator = "no indication";
- ISDN Access Indicator = "non-ISDN".

2) In the case where the terminating access is ISDN, the following conditions can apply:

a) If the called party responds with a progress indication, the indicators in the Address Complete Message shall be set to indicate:

- Called Party's Status Indicator = "no indication";
- ISDN Access Indicator = "ISDN".

The Access Transport parameter shall contain the progress indication from the access protocol.

NOTE - In this case the indication that the destination user is being alerted is transferred in a Call Progress Message (see Clause 2.1.4A.1).

b) The destination exchange concludes from the receipt of an alerting indication from the ISDN access that the complete called party number has been received. In this case the indicators in the Address Complete Message shall be set to indicate:

- a) Called Party's Status Indicator = "subscriber free";
- b) ISDN Access Indicator = "ISDN".

3) As a network option, a timer may be run in call control monitoring the delay in response from the called party. If call control indicates timer expiration, the Address Complete Message shall be sent with the indications:

- Called Party's Status Indicator = "excessive delay";
- ISDN Access Indicator = "ISDN".

2.1.4.2 Receipt of Address Complete Message at an Intermediate Exchange

Upon receipt of an Address Complete Message, an intermediate exchange shall send the corresponding Address Complete Message to the preceding exchange with the same parameters as received, with the possible exception of the End-to-End Method Indicator and the Echo Control Device Indicator in the Backward Call Indicators parameter which may have to be adjusted to reflect conditions for the incoming circuit. However, if the intermediate exchange has already sent an Address Complete Message to the preceding exchange, the procedures in clause 4A.4 apply.

For a speech, 3.1 kHz audio, or UDI-TA call, the intermediate exchange shall through connect the transmission path in the backward direction, if not already connected. If the Address Complete Message indicates that interworking has occurred, the intermediate exchange shall through connect the transmission path in both directions, if not already connected.

2.1.4.3 Receipt of Address Complete Message at the Originating Exchange

When the originating exchange receives an Address Complete Message, the appropriate exchange functions take place and the awaiting address complete timer (T_7) is stopped⁶.

If the interworking indicator is set to "interworking encountered", the corresponding progress indication should be sent to the calling party, if possible.

If the interworking indicator is set to "no interworking encountered", then:

⁶ Awaiting answer timer (T_9) in ITU-T Recommendation Q.764 is not specified for U.S. networks.

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- If the Called Party's Status Indicator is set to "subscriber free", an alerting indication should be sent to the calling party, if possible;
- If the Called Party's Status Indicator is set to "excessive delay", the corresponding progress indication should be sent to the calling party, if possible;
- If the Called Party's Status Indicator is set to "no indication" and the Optional Backward Call Indicators parameter is present with the Inband Information Indicator set to "inband information or an appropriate pattern is now available", the corresponding progress indication should be sent to the calling party, if possible, including cause information, if available.

If the Called Party's Status Indicator is set to "subscriber free" an alerting indication is passed to the calling party, if possible. For other codings of the Address Complete Message, the appropriate indication is passed to the calling party, if possible. For a speech, 3.1 kHz audio, or UDI-TA call, the originating exchange shall through connect the transmission path in the backward direction, if not already connected. If the Address Complete Message indicates that interworking has occurred, the originating exchange shall through connect the transmission path in both directions, if not already connected.

2.1.4.4 Through connection & Awaiting Answer Indication at the Destination Exchange

The sending of the awaiting answer indication (e.g., ring tone) at the destination exchange depends on the type of call. On speech, 3.1 kHz, and UDI-TA calls and calls to a non-ISDN called party the awaiting answer indication is applied to the transmission path to the calling party from the destination exchange on receipt of an alerting indication from the called party or from information contained within the destination exchange that the called party will not or is prohibited from providing inband tone. It may optionally be provided based on timer expiry in networks supporting the call delay indication (see Clause 2.1.4.1(3)).

Regardless of whether tones are to be provided or not, the destination exchange shall through connect after the reception of the connection indication from the called party and before sending the Answer Message to the preceding exchange.

If the destination exchange does not send the awaiting answer indication because the destination user provides for the sending of tones, then the destination exchange shall through connect the transmission path in the backwards direction on receipt of the progress indication.

The complete through connection of the transmission path at answer is covered in Clause 2.1.5.

2.1.4.5 Address Complete Message with Charging Information

The Address Complete Message carries a charge indicator.

2.1.4.6 Address Complete Message with Other Information

Additional information can be included in the Address Complete Message (e.g., related to supplementary services).

2.1.4.7 Return of Address Complete Message in Interworking Situations

An Address Complete Message indicating "interworking encountered" shall not be sent until the cross-office check is made (see Clause 2.1.8) and the Continuity Message is received, if applicable.

If the succeeding exchange does not provide electrical called-party's-line-condition indications, the last Signaling System 7 exchange shall originate and send an Address Complete Message if:

- 1) The complete address has been received; and
- 2) An outgoing circuit is successfully seized (e.g., a seize signal has been sent and acknowledged).

If in normal operation, a delay in the receipt of an address complete signal from the succeeding exchange is expected, the last common channel signaling exchange shall originate and send an Address Complete Message 15 to 20 seconds (T_{11}), after receiving the Initial Address Message. The time-out condition is an upper limit considering the clauses of 2.9.8.3 (20 to 30 seconds waiting for Address Complete Message timer (T_7) for outgoing exchanges in abnormal release conditions).

2.1.4A Call Progress Message

The Call Progress Message is sent from an exchange in either direction indicating that an event has occurred which should be relayed to the user.

For the basic call, a Call Progress Message can be sent only after the Address Complete Message from an exchange in the backward direction. A Call Progress message can be sent in either direction after receipt of an Answer message, if required by a supplementary service.

If a Call Progress Message is received before an Address Complete Message, it should not cause change of call state. In this case, the Call Progress Message is used by the supplementary service to report occurrence of the event. It has no effect to the basic call flow, since the Call Progress Message is not considered as the first backward basic call message.

A Call Progress Message shall not be sent in the forward direction until an Address Complete Message has been received in the backward direction. While continuity-check is still in progress, on receipt of a Call Progress Message in the forward direction, the exchange receiving Call Progress message shall start circuit reset sending sequence which shall result in a Reset Circuit Message being sent in the backward direction. In addition, the exchange shall send a Release Message with Cause Value 41 signifying temporary failure to the succeeding exchange to release the call.

2.1.4A.1 Return of Call Progress Message from the destination exchange

The Call Progress Message is sent from the destination exchange if the Address Complete Message has been sent⁷ and, subsequently

- An indication is received that the called party is being alerted, the Call Progress Message contains an event indicator that is set to "alerting";
- A progress indication is received from the called party, the Call Progress Message contains an event indicator that is set to "progress".

If the indication received from the called party contains a "progress indication", this is carried by the Call Progress Message in the Access Transport parameter (transported unchanged across the network).

In both cases, the Event Presentation Restricted Indicator shall be set to "no indication".

⁷ The destination exchange may send a Call Progress Message before an Address Complete Message if required by a supplementary service.

The destination exchange may on receipt of the indication from the called party that contains an appropriate progress indicator, through connect the speech path (see Clause 2.1.4.4).

In the case of call failure and the connection of a tone or announcement being returned before the Address Complete Message has been returned, see Clause 2.2.4.

2.1.4A.2 Receipt of Call Progress Message at an Intermediate Exchange

On receipt of a Call Progress Message, an intermediate exchange shall send the corresponding Call Progress Message to the preceding exchange with the same parameters as received, with the possible exception of the End-to-End Method Indicator and the Echo Control Device Indicator in the Backward Call Indicators parameter which may have to be adjusted to reflect conditions for the incoming circuit.

While waiting for continuity reports, on receipt of a Call Progress Message in the backward direction, the exchange shall start circuit reset sending sequence which shall result in a Reset Circuit Message being sent. In addition, the exchange shall send a Release Message with Cause Value 41 signifying temporary failure to the preceding exchange to release the call.

2.1.4A.3 Receipt of Call Progress Message at the Originating Exchange

On receipt of a Call Progress Message at the originating exchange, no state change shall occur (i.e., the awaiting address complete timer is not stopped) and the appropriate indication shall be sent to the calling party. If the Call Progress Message contains information carried in the Access Transport parameter, it is transferred unaltered into the indication returned to the calling party. If the event indicator is set to:

- "alerting", an alerting indication should be sent to the calling party, if possible;
- "progress", an appropriate progress indication should be sent to the calling party, if possible. If the Call Progress Message contains the Backward Call Indicators parameter indicating "interworking encountered" or "excessive delay", the corresponding progress indication should be sent. Otherwise, the progress indication in the Access Transport parameter should be sent;
- "inband information or appropriate pattern is now available", the corresponding progress indication should be sent to the calling party, if possible.

While waiting for continuity reports, on receipt of a Call Progress Message in the backward direction, the exchange shall start circuit reset sending sequence which shall result in a Reset Circuit Message being returned.

2.1.4B Information Messages

2.1.4B.1 Requesting Information

See Clause 4A.1.1.

2.1.4B.2 Sending Solicited Information

See Clause 4A.1.2.

2.1.4B.3 Sending Unsolicited Information

Information that is available at an exchange and that does not correspond to information which can be or has been requested by an Information Request Message, can be sent in the Information Message with the solicited information indicator set to signify that the message has been sent unsolicited.

The unsolicited Information Message can be used only if the ISDN User Part has been used all the way.

It can be sent in any direction in any call state (except in the waiting release complete state).

Solicited and unsolicited information shall not be sent in the same Information Message; if unsolicited information is to be sent at the same time together with solicited information, this shall be done in a separate message with the solicited information indicator set to "unsolicited".

2.1.4B.4 Receiving a Solicited Information Message

See Clause 4A.1.3.

2.1.4B.5 Simple Segmentation

The Segmentation Message is used to convey an additional segment of an overlength message. Any message containing either the optional forward or optional backward call indicators can be segmented using this method. This procedure provides a mechanism for the transfer of certain messages with contents longer than 272 octets but not longer than 544 octets.

The procedure for segmentation is as follows:

- 1) The sending exchange, on detecting that the message to be sent exceeds the 272 octet limit of the Message Transfer Part, can reduce the message length by sending some parameters subsequently in a Segmentation Message sent immediately following the message containing the first segment;

NOTE - The threshold for the initiation of the simple segmentation procedure may alternatively depend on network characteristics. The value of this threshold may vary per traffic relation depending on the typical network configuration and interconnection agreements.
- 2) The parameters that may be sent in the second segment using the Segmentation Message are the User-to-User Information and Access Transport parameters. If the User-to-User Information and Access Transport parameters cannot be carried in the original message and the two together do not fit in the Segmentation Message, the User-to-User Information parameter is discarded.
- 3) The sending exchange sets the Simple segmentation indicator in the Optional Forward Call Indicators parameter or Optional Backward Indicators parameter to indicate that additional information is being sent;
- 4) When a message is received at an exchange doing reassembly with the Simple segmentation indicator set to indicate that additional information is being sent, the exchange should start a timer (T_{36}) awaiting the Segmentation Message;
- 5) When the Segmentation Message is received, the timer (T_{36}) is stopped and the call continues. In the case of a segmented Initial Address Message, the Address Complete Message is not returned until the Segmentation Message has been received. Should parameters other than User-to-User Information or Access Transport be received, the exchange may discard the information and continue the call;
- 6) If the timer (T_{36}) expires, the call should be continued if possible and a subsequently received Segmentation Message is discarded. If it is not possible to continue the call, the call shall be released.
- 7) In case any other message except the ones listed below is received before the Segmentation Message the exchange should react as if the second segment is lost (i.e., the timer (T_{36}) is stopped and the call continues). The messages are: Continuity, Blocking, Blocking acknowledgment, Circuit group blocking, Circuit group blocking acknowledgment, Unblocking, Unblocking acknowledgment, Circuit group unblocking, Circuit group unblocking acknowledgment, Circuit group query, Circuit group query response.

This procedure requires all exchanges to recognize the Segmentation Message as reasonable signaling information when received after an Initial Address Message. Intermediate exchanges not doing reassembly are also required to pass the Simple segmentation indicator without change. When a segmented call attempt is received at a destination exchange or at an originating exchange which does not support reassembly (i.e., an earlier version ISDN User Part), the call continues based on the information in the first segment message alone.

NOTE - Based on the set of services supported (e.g., ISDN end-to-end information, Call Diversion, User-to-user, etc.) and the set of APM applications (e.g., Bearer Independent Call Control), the exchange performing the segmentation is able to calculate the maximum length of the first segment, to leave enough space in a message for use by any subsequent exchange. This maximum length may vary per traffic relation depending on the typical network configuration and interconnection agreements.

2.1.5 Answer Message

2.1.5.1 Return of Answer Message from Destination Exchange

When the called party answers, the destination exchange connects through the transmission path and the ringing tone is removed if applicable. Immediately following connection of the transmission path, the destination exchange sends an Answer Message to the preceding exchange.

2.1.5.2 Receipt of Answer Message at Intermediate Exchange

Upon receipt of an Answer Message, an intermediate exchange through connects the transmission path in both directions if not already connected, sends the corresponding Answer Message to the preceding exchange with the same parameters as received, with the possible exception of the End-to-End Method Indicator and the Echo Control Device Indicator in the Backward Call Indicators parameter which may have to be adjusted to reflect conditions for the incoming circuit. If the exchange is a controlling node, charging may begin.

2.1.5.3 Receipt of Answer Message at Originating Exchange

When the originating exchange receives an Answer Message indicating the required connection has been completed, the transmission path is connected through in both directions, if not already connected, charging, if applicable, may begin, and a connect indication is passed to the calling terminal in accordance with the applicable interface protocol.

2.1.5.4 Return of Answer from Automatic Terminals⁸

When connections are set-up to terminals having an automatic answer feature, the alerting indication may not be received from the called party. If a destination exchange receives a connect indication, an Answer Message is sent as soon as the transmission path is completed.

If an Address Complete Message has not yet been sent by the destination exchange, the Answer Message signifies both address complete and answer conditions. In this case, the indicators in the Answer Message shall indicate:

- Called Party's Status Indicator = "subscriber free";
- ISDN Access Indicator = "ISDN".

⁸ This incorporates ITU-T Recommendation Q.764, Clause 2.1.7.7.

2.1.5.5 Answer with Charging Information

When the called party is designated as a free call (Official Number), the destination exchange shall indicate "no charge" in the Backward Call Indicators parameter in the Answer Message. In all other cases, if the Backward Call Indicators parameter is included in the Answer Message, the charge indicator is set to "no indication".

2.1.6 Continuity-check

Because the signaling in Signaling System 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, a per-call or a statistical continuity check may be needed on fully digital circuits when circuits or bundles of circuits in primary multiplex groups are dropped or 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 (see ITU-T Recommendation Q.33).

For analog circuits with pilot supervision it is sufficient to perform the continuity-check on a statistical basis or by test calls (see B.1.5 of Annex B of ATIS-1000113.2015 – Chapter 4⁹). For analog circuits not using pilot supervision a continuity check should be performed on a per-call basis. For mixed circuit groups (i.e., analog and digital circuits), a continuity-check should be performed on a statistical basis or per-call basis. Within mixed connections (i.e., connections composed of circuits with and without continuity check on a statistical or 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. For circuit groups comprised of all digital circuits, in normal operation, the continuity check will not be performed. However, the continuity check should be permitted on digital circuits as well as analog circuits as part of the circuit turn-up procedures in an identical manner as on analog circuits. Continuity check transmission and timing requirements are specified in Annex B of ATIS-1000113.2015 – Chapter 4. Circuit administrative errors as well as circuit identity misunderstanding between Signaling System 7 exchanges should be resolved with the circuit validation test (see Annex C of ATIS-1000113.2015 – Chapter 4).

2.1.6.1 Continuity Check at Sending Exchange¹⁰

The decision on whether continuity-check should be performed or not on a given circuit should be made according to the criteria described in 2.1.6. An exchange shall indicate whether continuity-check is required or not by the continuity-check indicator in the Initial Address Message. If it is required, the exchange shall connect a transceiver to the circuit when it sends an Initial Address Message. If a Release message with either Cause Value 41 or 42 is received while the sending exchange is awaiting completion of continuity check, the sending exchange shall follow the procedures in accordance with the receipt of a Release message and release the call. This should not be regarded as continuity-check failure. If continuity-check is not required either on the incoming circuit or on the outgoing circuit, the exchange can switch-through the transmission path immediately after having sent the Initial Address Message.

⁹ Text from ITU-T Recommendation Q.724, Clauses 7 and 8 is contained in Annex B of ATIS-1000113 – Chapter 4.

¹⁰ This clause corresponds to ITU-T Recommendation Q.724, Clause 7.3. Note, ITU-T Recommendation Q.764 does not contain this clause.

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The exchange shall send forward the Continuity Message with successful indication after completion of all the following actions:

- 1) The continuity-check performed on the outgoing circuit is completed;
- 2) The transmission path across the exchange has been checked and found correct (see Clause 2.1.8);
- 3) If the continuity-check indicator in the received Initial Address Message indicates that continuity-check is being (has been) performed on previous circuit(s), receipt of a Continuity Message with successful indication from the preceding exchange.

The transmission path may be switched through at the exchange and the transceiver disconnected after the continuity-check of the circuit has been successfully completed. However, the switching through of the transmission 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, by using the check-tone receiver to test for the removal of the check-tone, or other appropriate means.

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

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

On failure of the outgoing circuit to satisfy the continuity-check:

- 1) The continuity-check transceiver shall be removed and an automatic repeat attempt will be made on another circuit;
- 2) A Continuity Message with failed indication shall be sent to the succeeding exchange.

A repeat of the continuity-check shall be made on the failed outgoing circuit within 1-10 seconds (T_{25}) of detection of the continuity-check failure, in the case the initiation of the procedure has been made by an Initial Address Message.

The second continuity-check shall be initiated by the exchange detecting the failure by sending a Continuity Check Request Message, connecting a transceiver to the circuit, and starting timer T_{CCR} awaiting acknowledgment that a continuity-check loop has been inserted by the far-end exchange. On receipt of a Loop Back Acknowledgment Message, the timer is stopped, and the check tone may be sent.

If the repeated check passes, the circuit shall be returned to idle with a Release/Release Complete Message sequence. If the repeated check fails, the maintenance staff shall be alerted that a failure has occurred and the check shall be repeated at intervals of 1-3 minutes (T_{26}). The repeated continuity-check will only be finished when continuity is detected or manual intervention occurs.

According to transmission maintenance requirements, Signaling System 7 may provide for:

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

- A log 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).

2.1.6.2 Continuity Check at Receiving Exchange

When an Initial Address Message is received with a request for continuity-check (either on the incoming circuit or on a previous circuit), timer T_8 is started. If continuity-check is requested on the incoming circuit, a continuity-check loop is connected to the circuit. On receipt of a Continuity Message or a Release Message, timer T_8 is stopped and the continuity-check loop is removed if inserted. When an Initial Address Message or a Circuit Reservation Message is received with an indication of continuity check is required and no check-loop (if 4-wire circuit) or transponder (if 2-wire circuit) is available, the receiving exchange shall return a Release message. The cause value to be included in the Release message is as follows: (1) Cause 41, "temporary failure", if it is a 4-wire connection at receiving exchange, or (2) Cause Value 42, "switching equipment congested", if it is a 2-wire connection at receiving exchange.

If a Continuity Message with successful indication is received, any digits of the national number that were withheld may be released (see Clause 2.1.7.2). If this exchange is the last common channel signaling exchange, the Address Complete Message is not returned until the loop is disconnected.

If a Continuity Message with failed indication, a 20-second timer ($T_{CCR,r}$) is started awaiting a continuity recheck request. On receipt of a Continuity Check Request Message, the timer is stopped.

On receipt of a Continuity Check Request Message, a continuity-check loop is connected to the incoming circuit, a Loop Back Acknowledgment Message is returned to the far-end exchange, and timer T_{34} is started. On receipt of a Release Message, timer T_{34} is stopped, the continuity-check loop is removed, a Release Complete Message is returned to the far-end exchange, and the circuit is returned to idle.

If, instead, a Continuity Message with failed indication is received, timer T_{34} is stopped, the continuity-check loop is removed, and timer T_{27} is started awaiting a continuity recheck request. On receipt of a Continuity Check Request Message, timer T_{27} is stopped and the continuity recheck procedure is repeated.

If, instead, a Release Message or Initial Address Message is received timer T_{27} is stopped and the received message is processed in the normal manner.

2.1.6.3 Expiration of Continuity-Check Timers

The expiration of timer T_8 is covered in Clause 2.9.8.3.

If timer T_{CCR} , $T_{CCR,r}$, T_{34} , or T_{27} expires, the transceiver or continuity-check loop is disconnected if attached, a Reset Circuit Message is sent to the far-end exchange, and timers T_{16} and T_{17} are started. On receipt of a Release Complete Message, the timers are stopped and the circuit is returned to idle. (The expiration of timers T_{16} and T_{17} is covered in Clause 2.9.3.1.)

2.1.7 Special Procedures at an Interworking Point

2.1.7.1 Completion of Transmission Path at an Interworking Exchange

In general, completion of the transmission path at an interworking point should occur as soon as possible during the call set-up phase. The actual point of switch-through will vary depending on the interworking signaling system (e.g., whether in-band or out-of-band signaling is used or whether a continuity check procedure is applied).

When interworking with other internationally specified signaling systems, the rules on switch-through given in Table 4.1 of ATIS-1000113.2015 – Chapter 4 should be applied.

When a continuity check is made on the outgoing circuit, and early connection is made, there is a possibility that the calling party has its go and return paths temporarily looped (from the instant of through connection to the instant of loop removal of the incoming end of the circuit). This problem can be prevented by using the optional single report continuity check procedure given in Clause 2.1.6.

2.1.7.2 Alerting of Called Party

If in an interworking situation a continuity-check has to be performed on one or more of the circuits involved in the connection preceding the interworking point, appropriate measures must be taken to prevent alerting of the called party until the continuity of such circuits has been verified. Interworking situations which could be discriminated are:

- 1) Signaling System 7 ----> any non Signaling System 7.
- 2) International Signaling System No. 7 ----> national Signaling System 7 not performing continuity-check.

For (1) the last digit(s) of the national number have to be withheld in any (interworking) intermediate exchange or destination exchange in case of DDI (direct dialing in) or the alerting of the called party is postponed in the destination exchange in case of non-DDI.

For (2) either the last digits(s) of the national number are withheld in the incoming international exchange, an intermediate exchange in the national network or the destination exchange in case of DDI (direct dialing in) or the setting up of the connection to the called party is postponed in the destination exchange in case of non-DDI.

2.1.7.3 Number Portability

Using SS7 signaling, additional call related information can be transported during call setup. For a portable user/address, routing through the network(s) is done based on the routing information received in the IAM. If the call encounters a route that is inband signaling, the end user's public address will be signaled for routing to the subsequent switch via the inband signaling. This converts the routing information for call setup back to the form expected for inband signaling interface.

2.1.8 Cross Office Check

For digital exchanges, the requirements mentioned in ITU-T Recommendation Q.543 shall be met. For other exchanges, Administrations shall ensure the reliability of a connection through a switching machine (cross-office check) either on a per call basis or by a statistical method. With either method, the probability of the connection being established with an unacceptable speech path transmission quality should not exceed 0.00001 as the long-term average.

2.1.9 Charging Procedures

2.1.9.1 Basic Call Charging

Charging shall normally begin when the exchange(s) controlling charging receive(s) the Answer Message from the network. Other charging methods are for further study.

2.1.9.2 Network Charging Messages

When the charging exchange does not have the capability to determine the charge rate for a particular call, charge information may be received during call set-up.

2.1.9.3 Charging for Transfer of User-to-User Data

(Deleted. Refer to Clause 1.2 of ATIS-1000113.2015 – Chapter 1.)

2.1.9.3A Charge information¹¹

When an exchange wishes to forward charge information to the next exchange in an Initial Address Message, it shall include the Originating Line Information parameter and possibly the Charge Number parameter.

The Charge Number parameter shall be included, unless the charge number digits agree with those in the calling party number and the calling party number is in the Initial Address Message. In the case in which the charge number digits agree with those in the Calling Party Number parameter in the same Initial Address Message, the Charge Number parameter may be omitted.

If the Charge Number parameter is included in the Initial Address Message and if the Nature of Address field in the Charge Number parameter is coded "ANI of the called party: no number present" the Numbering Plan octet and the Address Digits octets in the Charge Number parameter shall be omitted. This coding of the Charge Number parameter would be used only if the charge number digits are the same as those in the Called Party Number parameter in the Initial Address Message.

An exchange receiving an Initial Address Message with an Originating Line Information parameter and no Charge Number parameter will identify the calling party address digits as the charge number digits. An exchange receiving a Charge Number parameter with a Nature of Address coded "ANI of the called party: no number present" and no charge number digits will recognize the called party address digits as the charge number digits.

2.1.10 Forward Transfer Message

The Forward Transfer Message may be sent in telephony semi-automatic working in either of the following two cases:

- Following a call switched automatically to a subscriber, or following a call established via a special operator, the controlling operator wishes to call in an assistance operator. On receipt of the Forward Transfer Message at the incoming international exchange, an assistance operator is called in;
- Following a call via codes 11 and 12, the controlling operator wishes to recall the incoming international exchange. Receipt of the Forward Transfer Message at the incoming international exchange recalls the incoming operator on calls completed via the operator positions at the exchange.

Equivalent procedures, using standard digit operator codes, are available on national calls between operators.

¹¹ Procedures are given only for the case when charge information is included in the Initial Address Message. Possible extension of the procedures to allow the charge information to be sent in an Information Message in response to a request is for further study.

2.1.10A Transit Network Selection

If transit network selection information is included in the set-up information from the calling party or is provided on a subscription basis, this information is carried in the Transit Network Selection parameter, and is used for routing the call (e.g., to a specific carrier). The Transit Network Selection parameter is removed before the call is passed to the indicated transit network.

2.1.10B Carrier Identification

A network completing a call to a transit network may optionally include a Carrier Identification parameter in the Initial Address Message. This parameter contains the carrier identification code which identifies the transit network and is derived from the setup information provided by the calling party or is provided on a subscription basis. This information is not used for routing the call.

2.1.10C Jurisdiction Information

An originating exchange may optionally include the Jurisdiction Information parameter¹² in the Initial Address Message. If included, the Jurisdiction Information parameter shall contain six digits representing the geographic location (NPA-NXX) of the call origination.

Intermediate exchanges shall pass a Jurisdiction Information parameter unchanged from an incoming Initial Address Message to an outgoing Initial Address Message. If an intermediate exchange receives an Initial Address Message without a Jurisdiction Information parameter, and if the exchange is provisioned such that (for calls received on the incoming trunk group) a Jurisdiction Information parameter may be optionally included in the outgoing Initial Address Message. The exchange shall populate a Jurisdiction Information parameter with an NPA-NXX associated with incoming trunk group. When an intermediate exchange receives a call over a trunk group with inband signaling, the exchange may optionally include a Jurisdiction Information parameter in the outgoing Initial Address Message. The exchange shall populate a Jurisdiction Information parameter with an NPA-NXX associated with incoming trunk group.

2.1.10D Egress Service

If an exchange receives a call set-up from a preceding network and is routing the call to a succeeding network, the exchange may optionally include the Egress Service parameter in the Initial Address Message so that the succeeding network can accurately attribute and rate the call.

2.1.11 Storage & Release of IAM Information¹³

Each exchange of the connection shall store during the call set-up the information contained in the Initial Address Message sent (the originating exchange) or received (intermediate or destination exchange). The information to be stored includes all parameters in the Initial Address Message. The contents of the Initial Address Message information shall be updated, if the values of parameters change during the call set-up.

The Initial Address Message information can be released from memory:

¹² Although the Jurisdiction Information parameter is an optional parameter in ISDN-UP, the parameter will always be included in the IAM. Service standards will determine how the contents of the parameter are to be used.

¹³ This clause corresponds to ITU-T Recommendation Q.764, Clause 2.3.4.

- In the originating exchange when the Address Complete Message (or the Answer Message instead of the Address Complete Message) has been received and the calling party does not subscribe to a supplementary service which would cause a new call set-up (e.g., call transfer). The release of the information when the calling party does subscribe to a supplementary service is covered in separate service-specific American National Standards (see Clause 1.2 of ATIS-1000113.2015 – Chapter 1);
- In the intermediate exchange when the Address Complete Message (or the Answer Message instead of the Address Complete Message) has been received;
- In the destination exchange when the Address Complete Message (or the Answer Message instead of the Address Complete Message) has been sent and the called party does not subscribe to a supplementary service which would cause a new call set-up (e.g., call transfer). The release of the information when the called party does subscribe to a supplementary service is covered in separate service-specific American National Standards;
- When the call is released earlier and no automatic repeat attempt is to be attempted.

2.2 Unsuccessful Call Set-up

If at any time in the call set-up the connection cannot be completed, a Release Message is returned. This message contains the reason.

When an exchange cannot handle the specified bearer capability (e.g., data call on analog switch), Cause Value 65 shall be used to signify bearer capability not implemented.

If "ISUP is Required" for a call, but there are no ISUP circuits provisioned, Cause Value 65 shall be used to signify bearer capability not implemented.

When a destination exchange can handle the specified bearer capability but the end user is not an authorized subscriber, Cause Value 57 shall be used to signify bearer capability not authorized.

When a destination exchange can handle the specified bearer capability but:

- End user's terminal cannot handle it, Cause Value 88 shall be used to signify incompatible destination;
- Private network cannot handle it, Cause Value 65 shall be used to signify bearer capability not implemented.

When a destination exchange determines that the reason for call clearing is under normal circumstances but cannot decide which available cause value to use for the particular event, Cause Value 31 (Normal Unspecified) shall be used and the call can be cleared normally.

2.2.1 Actions at Exchange Initiating a Release Message

The initiating exchange immediately starts the release of the switched path (if established). The initiating exchange sends a Release Message to the preceding exchange and timers T_1 and T_5 shall be started to ensure that a Release Complete Message is received from the preceding exchange. (Expiration of these timers is covered in Clause 2.9.6.)

2.2.2 Actions at Intermediate Exchange

On receipt of a Release Message from the succeeding exchange, an intermediate exchange shall:

- 1) Immediately start the release of the switched path. When the path has been fully disconnected, a Release Complete Message is returned to the succeeding exchange;

- 2) At the same time as the start of the release of the switched path, a Release Message is sent to the preceding exchange and timers T_1 and T_5 are started to ensure that a Release Complete Message is received from the preceding exchange. (Expiration of these timers is covered in Clause 2.9.6.)

2.2.3 Actions at the Controlling Exchange

On receipt of a Release Message from the succeeding exchange, the controlling exchange starts the release of the switched path.

When the path has been fully disconnected at the controlling exchange, a Release Complete Message is sent to the succeeding exchange.

In addition, the controlling exchange shall (if applicable) do one of the following:

- Return an indication (in-band or out-of-band) to the calling subscriber. An indication is carried in the Call Progress Message or Address Complete Message indicating inband information is available (see Clause 2.2.4);
- Attempt to re-route the call set-up;
- Initiate release procedures to the preceding exchange (see Clause 2.2.2).

2.2.4 Tones & Announcements

Tones and announcements are applicable for the following bearer services:

- speech
- 3.1 kHz audio, and
- 64 kbit/s unrestricted digital information with tone and announcement (UDI-TA).

If a call set-up fails and no in-band tone or announcement has to be returned to the calling party from an exchange succeeding the controlling exchange, this exchange sends a Release message to the controlling exchange. The cause value should reflect the reason of the call failure in the same way as the in-band tone or announcement to be applied by the controlling exchange.

If a call set-up fails and an in-band tone or announcement has to be returned to the calling party from an exchange or called party, the exchange or user concerned connects the in-band tone to the transmission path. If a time-out period is associated with the in-band indication and this period is exceeded, the connection is released and a Release message is sent to the preceding exchange. The cause value should not be that associated with the call failure but rather specify normal clearing. That is, the exchange sends a Release message to the preceding exchange with Cause Value 31 (normal unspecified).

If an Address Complete Message has been returned to the preceding exchange a Call Progress Message indicating that in-band information is available along with the Cause Indicators parameter, is returned to the preceding exchange (see Clause 2.1.4A). The cause value should reflect the reason of call failure in the same way as the in-band tone or announcement to be applied.

If an Address Complete Message has not been returned to the preceding exchange already, an Address Complete Message, with the appropriate cause value and the In-band Information Indicator set in the Optional Backward Call Indicators parameter, shall be returned to the originating exchange. The cause value should reflect the reason of call failure in the same way as the in-band tone or announcement to be applied.

In case a special tone or announcement has to be applied due to an event only known by a certain exchange and not covered by a cause value, no Cause indicators parameter is included in either the Address Complete Message or Call Progress message. The Answer message must not be sent in this case.

For the preceding exchanges the inclusion of the Cause indicators parameter in the Address Complete Message or Call Progress message implies an unsuccessful call set-up. The Cause indicators parameter shall not be included for unsuccessful call set-up when interworking has occurred and the in-band tone or announcement is returned from the exchange beyond the interworking point.

2.2.5 Actions at the Number Portability Initiating Exchange

When the exchange acting as an initiating switch receives a Release message with an ANSI Cause Value 26 in the backward direction, the procedure to be taken by the exchange is one of the following:

- The exchange, as an option, plays tone or announcement and sends an ACM or CPG message containing the ANSI Cause Value 26 towards the originating User-Network Interface according to Clause 2.2.4.
- The exchange does not play tone or announcement but sends a Release message with ANSI Cause Value 26, "Misrouted call to a ported number", toward the originating User-Network Interface.

In either case, the originating User-Network Interface will interpret the received ANSI Cause Value 26 as a Cause Value 31 (Normal Unspecified) and use existing procedures to provide interworking with DSS1.

2.3 Normal Call Release

The release procedures are based on a two message approach whereby the Release Message initiates release of the circuit switched connection. The same procedures are used in the network irrespective of whether they are initiated by the calling party, the called party, or the network.

2.3.1 Release Initiated by a Calling Party

1) Actions at originating exchange: On receipt of a request to release the call from the calling party, the originating exchange immediately starts the release of the switched path and, at the same time, sends a Release Message to the succeeding exchange. Timers T_1 and T_5 are started to ensure that a Release Complete Message is received from the succeeding exchange. (Expiration of these timers is covered in Clause 2.9.6.)

2) Actions at an intermediate exchange: On receipt of the Release Message from the preceding exchange, an intermediate exchange shall:

- a) Immediately start the release of the switched path. When the path has been fully disconnected, a Release Complete Message is returned to the preceding exchange;
- b) At the same time, send a Release Message to the succeeding exchange. Timers T_1 and T_5 are started to ensure that a Release Complete Message is received from the succeeding exchange. (Expiration of these timers is covered in Clause 2.9.6.)

3) Actions at destination exchange: On receipt of a Release Message from the preceding exchange, the destination exchange shall immediately start the release of the switched path. When the path has been fully disconnected, a Release Complete Message shall be returned to the preceding exchange.

4) Charging: Charging shall be stopped upon receipt of the Release Message at the charging exchange(s) or on receipt of a request to release the call from the calling party when the charging exchange is the originating exchange.

5) Collision of Release Messages: In the case when two points in the connection both initiate the release of a call, a Release Message may be received at an exchange from a succeeding or preceding exchange after the release of the switched path is initiated and after sending a Release Message to the adjacent exchange. In this case, the exchange shall return a Release Complete Message to the exchange from which the concerned Release Message was received. The exchange shall make the path available for new calls after both a Release

Complete Message response is received (for any previously sent Release Message) and a Release Complete Message is sent (for any previously received Release Message).

2.3.2 Release Initiated by a Called Party

The procedures in Clause 2.3.1 apply, except that the functions at the originating and destination exchanges and the designation of succeeding and preceding exchanges are transposed.

2.3.3 Release Initiated by the Network

The procedures in Clause 2.3.1 apply, except that they can be initiated at any exchange (originating, destination, or intermediate).

2.3.4 Release of Address & Routing Information

See Clause 2.1.11.

2.4 Transfer of User-to-User Information

(Deleted. Refer to Clause 2.2 of ATIS-1000113.2015 – Chapter 1.)

2.4A Transfer of Access Signaling Information

Certain signaling information in ATIS-1000607 (Digital Subscriber Signaling System No. 1) has only significance to the user/network interfaces or users. This signaling information should be transported by the ISDN User Part without interpretation in the Access Transport parameter. (Note that this signaling information does not include user-to-user information which is unstructured data having significance only to the users.)

As each information element in ATIS-1000607 (DSS1) has an identifier and length indicator, multiple information elements from DSS1 with access significance can be serially placed after one another in the Access Transport parameter. On receipt of the ISDN User Part message, the information in the Access Transport parameter shall be passed directly to the access side of the exchange without further ISDN User Part action.

2.4B Transfer of Network Signaling Information

2.4B.1 Actions at the Exchange which Initiates Message with Network Transport Parameter

When an originating or destination exchange initiates an ISDN User Part message, it may optionally include parameters which are only of relevance to the destination or originating exchange, respectively, in the Network Transport parameter. The intent of the Network Transport parameter is to provide a graceful evolution to new protocol elements. The messages that may carry the Network Transport parameter are Initial Address Message, Address Complete Message, Call Progress Message, Answer Message, Information Request Message and Information Message. Other messages are for further study.

2.4B.2 Actions at an Intermediate Exchange

Upon receiving the ISDN User Part message containing the optional Network Transport parameter, the intermediate exchange should not make any changes to the content of the Network Transport parameter and include the same into the outgoing message to the succeeding (preceding) exchange. A gateway exchange may screen the contents and take the actions based on the bilateral agreement.

2.4B.3 Actions at the Exchange which Terminates Message with Network Transport Parameter

Upon receiving the ISDN User Part message containing the optional Network Transport parameter, the exchange which terminates the message shall process all the parameters enclosed by the Network Transport parameter and take the appropriate actions based on the content of the parameters. If the Network Transport parameter received within a message contains unreasonable signaling information or unrecognized signaling information, that unreasonable or unrecognized information should be discarded while the message should be processed as normal. A gateway exchange may screen the contents and take the actions based on the bilateral agreement.

2.5 Suspend, Resume

2.5.1 Suspend

The Suspend Message indicates a temporary cessation of communication without releasing the call. It can only be accepted during the connection/data phase. A Suspend Message is generated by the network in response to a clearback indication from an interworking node or an on-hook condition from a non-ISDN called party.

2.5.1.1 Suspend Initiated by a Calling Party

(No procedures specified for U.S. networks.)

2.5.1.2 Suspend Initiated by a Called Party

(No procedures specified for U.S. networks.)

2.5.1.3 Suspend Initiated by the Network

A Suspend (network) Message may be generated by the network in response to a clearback indication from an interworking node or an on-hook condition from a non-ISDN called party.

- 1) Action at destination exchange or interworking exchange:** On receipt of an on-hook condition at the destination exchange or a clearback signal at the interworking exchange, the exchange shall send a Suspend (network) Message to the preceding exchange;
- 2) Action at an intermediate exchange:** On receipt of the Suspend (network) Message, the exchange shall send a Suspend (network) Message to the preceding exchange;
- 3) Action at the controlling exchange:** On receipt of the on-hook condition, clearback indication, or Suspend (network) Message, the controlling exchange starts a timer¹⁴ (T₆) to ensure that an off-hook condition, a re-

¹⁴ The value of this timer is taken from ITU-T Recommendation Q.118.

answer indication, a Resume (network) Message or a Release Message is received. If the timer expires, the procedures in Clause 2.5.3 apply.

2.5.2 Resume

A Resume Message indicates a request to recommence communication. A request to release the call received from the calling party shall override the suspend/resume sequence and the procedures given in clause 2.3 shall be followed.

2.5.2.1 Resume Initiated by a Calling Party

(No procedures specified for U.S. networks.)

2.5.2.2 Resume Initiated by a Calling Party

(No procedures specified for U.S. networks.)

2.5.2.2 Resume Initiated by the Network

A Resume (network) Message is initiated by the network, if a Suspend (network) Message had previously been sent, in response to a re-answer indication from an interworking node or an off-hook condition from a non-ISDN called party.

- 1) Action at destination exchange or interworking exchange:** On receipt of a re-answer indication at the interworking exchange or off-hook condition in the destination exchange, the exchange shall send a Resume (network) Message to the preceding exchange if a Suspend (network) Message had previously been sent;
- 2) Actions at an intermediate exchange:** On receipt of a Resume (network) Message, the exchange shall send a Resume (network) Message to the preceding exchange;
- 3) Action at the controlling exchange:** On receipt of the off-hook condition, re-answer signal, Release Message or Resume (network) Message, the controlling exchange stops timer (T_6).

2.5.3 Expiration of Timer T_6

If a request for reconnection or a Resume Message is not received within time T_6 then the controlling exchange shall initiate the release procedure outlined in Clause 2.3.3.

2.6 Delayed Release

(Deleted. No procedures specified for U.S. networks.)

2.7 In Call Modification

(Deleted. Refer to Clause 2.2 of ATIS-1000113.2015 – Chapter 1.)

2.7A Echo Control Procedure¹⁵

2.7A.1 General

The echo control procedure is used on a per call basis to convey information between exchange nodes about the demand and ability to insert echo control devices.

The procedure is invoked when a call is to be routed on a connection for which echo control is necessary. It could be initiated at the originating exchange or at an intermediate exchange.

2.7A.2 Forward Direction

2.7A.2.1 Actions at the Originating Exchange

If an originating exchange has sufficient information to determine that echo control is necessary for the outgoing circuit then:

- 1) An outgoing half echo control device is enabled;
- 2) The Echo Control Device Indicator of the Nature of Connection Indicators parameter in the Initial Address Message is set.

2.7A.2.2 Actions at an Intermediate Exchange

If an intermediate exchange has sufficient information to determine that echo control is required for the outgoing circuit then one of the following actions can occur:

- 1) When the Nature of Connection Indicators parameter in the Initial Address Message indicates that an echo control device is already included:
 - a) No change to the Nature of Connection Indicators parameter in the Initial Address Message is made;
 - b) An incoming half echo control device is reserved;
 - c) Any outgoing half echo control device is disabled.
- 2) When the Nature of Connection Indicators parameter in the Initial Address Message does not indicate that an echo control device is already included:
 - a. An outgoing half echo control device is enabled;
 - b. The Echo Control Device Indicator in the Nature of Connection Indicators parameter is set.

If an intermediate exchange has sufficient information to determine that echo control is not required for the outgoing circuit then one of the following actions can occur:

- 1) When the Nature of Connection Indicators parameter in the Initial Address Message indicates that an echo control device is already included:
 - a. No change to the Nature of Connection Indicators parameter in the Initial Address Message is made;
 - b. An incoming half echo control device is reserved.
- 2) When the Nature of Connection Indicators parameter in the Initial Address Message does not indicate that an echo control device is already included, no additional action is required.

¹⁵ Based on the echo control signaling procedures of ITU-T Recommendation Q.115. Dynamic echo control procedures of ITU-T Recommendation Q.764 are not specified for U.S. networks.

2.7A.2.3 Actions at the Destination Exchange

See Clause 2.7A.3.1.

2.7A.3 Backward Direction

2.7A.3.1 Actions at the Destination Exchange

Upon receipt of an Initial Address Message with the indication "outgoing half echo control device included" in the Nature of Connection Indicators parameter, the following action is taken:

- 1) An incoming half echo control device is enabled;
- 2) The Echo Control Device Indicator in the Backward Call Indicators parameter in the first backward message (i.e., Address Complete, Answer, or Call Progress) is set.

If the destination exchange is unable to include an incoming half echo control device, this information is conveyed to the preceding exchange by the Echo Control Device Indicator in the Backward Call Indicators parameter not being set in the first backward message.

2.7A.3.2 Actions at an Intermediate Exchange

Upon receipt of the first backward message (i.e., Address Complete, Answer, or Call Progress Message) in response to an Initial Address Message with echo control indication, then one of the following actions can occur:

- 1) When the Backward Call Indicators parameter indicates that an incoming half echo control device is not already included:
 - a. The reserved incoming half echo control device is enabled;
 - b. The Echo Control Device Indicator in the Backward Call Indicators parameter is set.
- 2) When the Backward Call Indicators parameter indicates that an incoming half echo control device is already included:
 - a. The reserved incoming half echo control device is released;
 - b. No change to the Backward Call Indicators parameter in the backward message is made.

2.7A.3.3 Actions at the Originating Exchange

No additional action is required.

2.8 Network Features

2.8.1 Automatic Repeat Attempt

Automatic repeat attempt, as defined in ITU-T Recommendation Q.12, is provided in Signaling System 7. An automatic repeat attempt shall be made (up to the point when the Initial Address Message information is released according to Clause 2.3.4)

- On detection of dual seizure (at the non-control exchange) (see Clause 2.9.1.4);

- On receipt of a Blocking or Circuit Group Message after sending an Initial Address Message or Circuit Reservation Message and before an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, has been received (see Clause 2.8.2.1);
- On receipt of a Reset Circuit Message after sending an Initial Address Message or Circuit Reservation Message and before an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, has been received (see Clause 2.9.3.1);
- On failure of the continuity check when a continuity check is performed;
- On receipt of an unreasonable message during call set-up (see Clause 2.9.5);
- On receipt of an Unequipped Circuit Identification Code Message on a first attempt.

2.8.2 Blocking & Unblocking of Circuits & Circuit Groups

The Blocking (Unblocking) Message and the Circuit Group Blocking (Unblocking) Message are provided to permit the switching equipment or maintenance system to remove from (and return to) traffic the distant terminal(s) of a circuit or group of circuits because of a fault or to permit testing.

Since the circuits served by ISDN User Part have both way capability, the Blocking Message or Circuit Group Blocking Message can be originated by either exchange. The circuit(s) shall be removed from service (blocked) on transmission of the Blocking Message or Circuit Group Blocking Message at one exchange and on receipt of the Blocking Message or Circuit Group Blocking Message at the other exchange. The receipt of a Blocking Message or Circuit Group Blocking Message shall have the effect of prohibiting non-test calls on the relevant circuit(s) outgoing from the exchange until an Unblocking

Message, an appropriate Circuit Group Unblocking Message, or a non-test Initial Address Message (see Clause 2.8.2.3(14)) is received, but shall not prohibit test calls incoming to that exchange. Test calls generated in the outgoing direction from the exchange that sent the Blocking Message or Circuit Group Blocking Message shall not be prohibited.

An acknowledgment sequence is always required for the Blocking and Unblocking Messages as well as for the Circuit Group Blocking and Circuit Group Unblocking Messages using the Blocking Acknowledgment Message, the Unblocking Acknowledgment Message, the appropriate Circuit Group Blocking Acknowledgment Message, and the appropriate Circuit Group Unblocking Acknowledgment Message, respectively. The acknowledgment is not sent until the appropriate action, either blocking or unblocking has been taken.

The Release Message should not override the blocked condition and return circuits to service which might be faulty. The blocked circuit(s) shall be returned to service (unblocked) on transmission of the Unblocking Acknowledgment Message or the appropriate Circuit Group Unblocking Acknowledgment Message at one exchange and on receipt of the Unblocking Acknowledgment Message or the appropriate Circuit Group Unblocking Acknowledgment Message at the other exchange.

The exchange that has sent Blocking and Circuit Group Blocking Messages must not send the corresponding Unblocking and Circuit Group Unblocking Messages for the circuit until all the blocking reasons for the circuit are cleared.

Notification should be provided to maintenance personnel when circuits are blocked or unblocked. The procedures for such notification are implementation-specific.

2.8.2.1 Blocking & Unblocking Messages

On sending of the Blocking Message, the indicated circuit is removed from service (blocked), any automatic continuity repeat testing is terminated, and timers T_{12} and T_{13} are started awaiting a Blocking Acknowledgment Message. (Expiration of these timers is covered in Clause 2.9.4.)

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If a Blocking Message is sent and subsequently an Initial Address Message or Circuit Reservation Message is received in the opposite direction, the following action is taken:

- For test calls, the call should be accepted, if possible. In the case where the test call cannot be accepted, the Blocking Message must be returned;
- For calls other than test calls, the Blocking Message shall be returned and the Initial Address Message or Circuit Reservation Message discarded.

On receipt of a Blocking Message, the indicated circuit is removed from service (blocked), any automatic continuity repeat testing is terminated, and a Blocking Acknowledgment Message is returned. The fact that the circuit is engaged on a call shall not delay transmission of the Blocking Acknowledgment Message.

In the event of a Blocking Message being received:

- After an Initial Address Message or Circuit Reservation Message has been sent for the circuit in the opposite direction; and
- Before an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, relating to that call has been received; an automatic repeat attempt shall be made on another circuit. The exchange receiving the Blocking Message should release the original attempt in the normal manner (see Clause 2.3.3) after sending the Blocking Acknowledgment Message and shall not seize the circuit for subsequent calls.

If the Blocking Message is received:

- After an Initial Address Message or Circuit Reservation Message has been sent for the circuit in the opposite direction, and after an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, relating to that call has been received; or
- After an Initial Address Message or Circuit Reservation Message has been received for that circuit beforehand; the exchange shall proceed with the existing call but shall not seize that circuit for subsequent calls.

On sending of the Unblocking Message, timers T_{14} and T_{15} are started awaiting receipt of an Unblocking Acknowledgment Message. On receipt of the acknowledgment, the circuit is returned to service (unblocked). (Expiration of these timers is covered in Clause 2.9.4.)

On receipt of an Unblocking Message, the indicated circuit is returned to service (unblocked) and an Unblocking Acknowledgment Message is returned. The fact that the circuit is engaged on a call shall not delay transmission of the Unblocking Acknowledgment Message.

2.8.2.2 Circuit Group Blocking & Unblocking Messages

Two circuit group blocking procedures are defined:

- **Circuit group blocking without release of circuits:**¹⁶ In this procedure, the receiving exchange immediately marks the specified circuits as "remotely blocked", but does not release circuits until any calls in progress have completed;

¹⁶ This is the maintenance oriented and software generated group blocking procedures as in 2.8.2.2 of T1.113-1988.

- **Circuit group blocking with immediate release of all circuits and related calls:**¹⁷ In this procedure, the receiving exchange immediately marks the specified circuits as "remotely blocked", and releases any interconnected circuits, using the appropriate messages.

The two procedures are distinguished in the Circuit Group Blocking Message by the Circuit Group Supervision Message Type Indicator.¹⁸

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

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

The same rule applies on the acknowledgments.

The maximum number of circuits to be blocked (unblocked) with one Circuit Group Blocking (Unblocking) Message is limited to 24.

A circuit is controlled by the ISDN User Part if it can be used by the ISDN User Part as a circuit switched bearer. Hence, time slots in a digital path that are used for synchronization or as signaling channels are not circuits whose control is allocated to the ISDN User Part. Some of the circuit identification code values covered by the range field of a Circuit Group Blocking (Unblocking) (Acknowledgment) Message may not be allocated to any circuit under ISDN User Part control. Then the corresponding status bits in the status field are set to 0.

Each Circuit Group Blocking Message has to be transmitted twice within five seconds.¹⁹ On sending of the Circuit Group Blocking Message, the indicated circuits are removed from service (blocked), any automatic continuity repeat testing on those circuits is terminated, and timers T_{18} and T_{19} are started awaiting a Circuit Group Blocking Acknowledgment Message. (Expiration of these timers is covered in Clause 2.9.4.) A received Circuit Group Blocking Acknowledgment Message has to match in the parameter value of the Circuit Identification Code, the Circuit Group Supervision Message Type Indicator, and the Range field with the previously sent Circuit Group Blocking Message in order to be considered a valid acknowledgment.

If a Circuit Group Blocking Message is sent and subsequently an Initial Address Message or Circuit Reservation Message is received in the opposite direction, the same actions have to be taken as described in Clause 2.8.2.1.

A Circuit Group Unblocking Message which is sent to unblock members of a circuit group must have the same circuit group blocking type as the Circuit Group Blocking Message sent previously to block the circuits or, optionally, two Circuit Group Unblocking Messages must be sent, one with the circuit group blocking type set to "without release" and the other with the circuit group blocking type set to "with immediate release." On sending of the Circuit Group Unblocking Message(s), timers T_{20} and T_{21} are started awaiting (a) Circuit Group Unblocking Acknowledgment Message(s). (Expiration of these timers is covered in Clause 2.9.4.) A received Circuit Group Unblocking Acknowledgment Message has to match in the parameter value of the Circuit Identification Code, the Circuit Group Supervision Message Type Indicator, and the Range field with the previously sent Circuit Group Unblocking Message in order to be considered a valid acknowledgment.

On receipt of a Circuit Group Blocking Message, as an implementation option, the receiving exchange may take either of the following actions:

- Take independent action on every Circuit Group Blocking Message received;

¹⁷ This is the hardware failure oriented group blocking procedures as in 2.8.2.2 of T1.113-1988.

¹⁸ Interpretation of circuit group blocking type "10" as "without release" or "with immediate release" is by bilateral agreement.

¹⁹ This is required for compatibility with exchanges conforming to T1.113-1988.

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- Take action on the first Circuit Group Blocking Message received and start timer T_{CGB} [5 seconds] awaiting the second Circuit Group Blocking Message. If a Circuit Group Blocking Message is received within time T_{CGB} then the timer is stopped. If the second message matches the first message in both Range and Status fields then it is discarded. Otherwise, the receiving exchange treats the message as a new request and takes the appropriate action. If a Circuit Group Unblocking Message is received during time T_{CGB} then the timer is stopped and the message is processed in the normal manner. If timer T_{CGB} is stopped or expires, any subsequent Circuit Group Blocking Message is treated as a new request.

On acceptance of the circuit group blocking request, the indicated circuits are removed from service (blocked) and a Circuit Group Blocking Acknowledgment Message is returned. The fact that a circuit is engaged on a call shall not delay transmission of the Circuit Group Blocking Acknowledgment Message.

In the event of a Circuit Group Blocking Message being received after an Initial Address Message or Circuit Reservation Message has been sent for any of the indicated circuits, and before an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, relating to any of those calls has been received, an automatic repeat attempt shall be made on another circuit. The exchange receiving the Circuit Group Blocking Message releases the original attempt(s) in the normal manner (see Clause 2.3.3) after sending the Circuit Group Blocking Acknowledgment Message and shall not seize the circuit(s) for subsequent calls.

In addition, in the case of blocking without immediate release, if the Circuit Group Blocking Message is received after sending or receiving an Initial Address Message or Circuit Reservation Message for any of the indicated circuit(s), the same conditions apply and the same actions have to be taken as described in Clause 2.8.2.1.

The Circuit Group Unblocking Message only has to be received once. On receipt of a Circuit Group Unblocking Message, the indicated circuits are returned to service (unblocked) and a Circuit Group Unblocking Acknowledgment Message is returned. The fact that a circuit is engaged on a call shall not delay transmission of the Circuit Group Unblocking Acknowledgment Message.

A received Circuit Group Unblocking Message unblocks members of a circuit group regardless of whether the blocking procedure used was immediate release or no release.

Circuits which have been blocked by the receipt of a Circuit Group Blocking Message may be unblocked by the receipt of an Unblocking Message with the appropriate circuit identification code. Similarly, circuits which have been blocked by the receipt of a Blocking Message may be unblocked by the receipt of a Circuit Group Unblocking Message with the appropriate range and status.

For circuits blocked using the immediate release procedure, the following additional actions shall be taken:

- 1) All interconnected circuits have to be released by the appropriate signals;
- 2) The affected circuits are set to the blocked state without any exchange of clearing messages.

2.8.2.2A Receipt of an Initial Address Message on a Remotely Blocked Circuit

See Clause 2.8.2.3.

2.8.2.3 Abnormal Blocking & Circuit Group Blocking Procedures

The following procedures are designed to cover abnormal cases which may occur in the circuit group blocking/unblocking procedures:

- 1) If a Circuit Group Blocking Message is received relating to remotely blocked circuits then blocking acknowledgment indications for those circuits are given in the status field of the corresponding Circuit Group Blocking Acknowledgment Message which shall be sent in response;

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- 2) If a Circuit Group Unblocking Message is received relating to circuits which are not in the state remotely blocked then unblocking acknowledgment indications for those circuits are given in the Status field of the corresponding Circuit Group Unblocking Acknowledgment Message which shall be sent in response;
- 3) When an exchange upon receipt of a Circuit Group Blocking Message is not able to give an appropriate blocking acknowledgment indication for each Circuit Identification Code (e.g., because that (those) Circuit Identification Code(s) is (are) not allocated to any circuit under ISDN User Part control at the receiving exchange) for which also a blocking indication is given in the status field of the received Circuit Group Blocking Message, then no blocking acknowledgment indication relating to that/those Circuit Identification Code(s) shall be given in the Status field of the corresponding Circuit Group Blocking Acknowledgment Message which shall be sent in response. In addition, an Unequipped Circuit Identification Code Message may be sent for such Circuit Identification Codes as specified in Clause 2.9.8.3A;
- 3A) When an exchange upon receipt of a Circuit Group Unblocking Message is not able to give an appropriate unblocking acknowledgment indication for each Circuit Identification Code (e.g., because that (those) Circuit Identification Code(s) is (are) not allocated to any circuit under ISDN User Part control at the receiving exchange) for which also a unblocking indication is given in the status field of the received Circuit Group Unblocking Message, then no unblocking acknowledgment indication relating to that/those Circuit Identification Code(s) shall be given in the Status field of the corresponding Circuit Group Unblocking Acknowledgment Message which shall be sent in response. In addition, an Unequipped Circuit Identification Code Message may be sent for such Circuit Identification Codes as specified in Clause 2.9.8.3A;
- 4) If a Circuit Group Blocking Acknowledgment Message in response to a Circuit Group Blocking Message is received containing in the status field the indications no blocking acknowledgment for some or all of the circuits which are to be blocked due to the previously sent Circuit Group Blocking Message, then the maintenance personnel should be notified for the circuits concerned;
- 4A) If a Circuit Group Unblocking Acknowledgment Message in response to a Circuit Group Unblocking Message is received containing in the status field the indications no unblocking acknowledgment for some or all of the circuits which are to be unblocked due to the previously sent Circuit Group Unblocking Message, then the maintenance personnel should be notified for the circuits concerned;
- 5) If a Circuit Group Blocking Acknowledgment Message in response to a Circuit Group Blocking Message is received containing in the status field blocking acknowledgment indications for the circuits which are not to be blocked due to the previously sent Circuit Group Blocking Message and are not marked locally blocked, then the maintenance personnel should be notified for the circuits concerned;
- 6) If a Circuit Group Unblocking Acknowledgment Message in response to a Circuit Group Unblocking Message is received containing in the Status field unblocking acknowledgment indications for the circuits which are not to be unblocked due to the previously sent Circuit Group Unblocking Message and have to remain marked locally blocked, then the maintenance personnel should be notified for the circuits concerned;
- 7) If a Circuit Group Blocking Acknowledgment Message which is not expected as an acknowledgment for any Circuit Group Blocking Message is received:
 - Relating to circuits which all are in the status locally blocked, then the received Circuit Group Blocking Acknowledgment Message shall be discarded;
 - Related to circuits part or all of which are not in the status locally blocked, then a Circuit Group Unblocking Message shall be sent for the relevant circuits.
- 8) If a Circuit Group Unblocking Acknowledgment Message which is not expected as an acknowledgment for any Circuit Group Unblocking Message is received:
 - Relating to circuits none of which is in the status locally blocked, then the Circuit Group Unblocking Acknowledgment Message shall be discarded;
 - Relating to circuits part or all of which are locally blocked, then a Circuit Group Blocking Message shall be sent for the relevant circuits.
- 9) If a Circuit Group Blocking (Unblocking) Message or a Circuit Group Blocking (Unblocking) Acknowledgment Message refers to status changes for more than 24 circuits the receiving exchange shall discard that message;

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- 10) If a Blocking Message is received for a remotely blocked circuit, a Blocking Acknowledgment Message shall be sent;
- 11) If a Unblocking Message is received for a circuit which is not remotely blocked, an Unblocking Acknowledgment Message shall be sent;
- 11A) If a Blocking Message is received for a circuit which the receiving exchange is not able to block, no Blocking Acknowledgment Message shall be sent;
- 11B) If an Unblocking Message is received for a circuit which the receiving exchange is not able to unblock, no Unblocking Acknowledgment Message shall be sent;
- 12) If a Blocking Acknowledgment Message, which is not expected as an acknowledgment for a Blocking Message, is received:
 - Relating to a circuit which is locally blocked, then the Blocking Acknowledgment Message is discarded;
 - Relating to a circuit which is not locally blocked, then an Unblocking Message shall be sent.
- 13) If an Unblocking Acknowledgment Message, which is not an expected response to an Unblocking Message is received:
 - Relating to a circuit which is not locally blocked, the received Unblocking Acknowledgment Message is discarded;
 - Relating to a circuit which is locally blocked then a Blocking Message shall be sent.
- 14) If a non-test Initial Address Message or Circuit Reservation Message is received on a remotely blocked circuit, the remotely blocked state of the circuit is removed and the Initial Address Message or Circuit Reservation Message is processed normally unless the circuit is also locally blocked in which case a Blocking Message is returned and the Initial Address Message or Circuit Reservation Message is discarded (see Clause 2.8.2.1). This applies to any blocking states. However, it should not be the preferred method of unblocking a circuit.

2.8.2A Circuit Query

2.8.2A.1 General

The circuit query test allows an exchange to audit the circuit states of circuits on a demand or routine basis.

This test is necessary in order:

- To ensure that the circuits are not incorrectly put in maintenance states thereby denying them from service;
- To coordinate a circuit turn-up procedure.

The value N of the range field of the Circuit Query Message, including N=0 for a single circuit, indicates the range of circuits to be tested. The maximum value of N is 23. If that value is exceeded, the Circuit Query Message is discarded.

2.8.2A.2 Interpretation of Circuit States

For the purposes of circuit query procedure, there are fourteen non-overlapping circuit states, which are classified into six major categories, as follows:

- Unequipped;
- Transient;
- Active;

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- Remotely Blocked;
- Locally Blocked;
- Locally Blocked And Remotely Blocked.

Each of the last four of the above categories can be subdivided into three call-processing categories:

- Idle;
- Incoming circuit busy;
- Outgoing circuit busy;

thus creating a total of fourteen states.

A circuit is "unequipped" if the circuit is not activated for call processing or maintenance or it is not an ISDN User Part circuit. This is a unique state and will not overlap with any of the other states.

The "transient" state refers to any transient call processing or maintenance states.

Call processing is in a transient state:

- After Having Sent An Initial Address Message Or Circuit Reservation Message And Waiting For An Address Complete/Answer Or Circuit Reservation Acknowledgment Message, Respectively (Whether A Suspended Call Is In A Transient State In The Context Of Circuit Group Query Is For Further Study);
- After Having Sent A Release Message And Waiting For The Release Complete Message.

Transient maintenance states are those, where the exchange after having sent a(n) (Circuit Group) (Un)Blocking Message is awaiting the proper (Circuit Group) (Un)Blocking Acknowledgment Message from the remote exchange.

The circuit state is also considered transient as long as a (Circuit Group) Reset (Circuit) Message has not been acknowledged.

The "active" state refers to an operationally available state, that is, equipped and a nonmaintenance state. A circuit in an active state may be further qualified as being "idle", "incoming circuit busy", or "outgoing circuit busy".

The "remotely blocked" state refers to the state marked by the exchange when the far-end exchange initiated blocking. This state can co-exist with "idle", "incoming circuit busy", or "outgoing circuit busy".

The "locally blocked" state refers to the state marked by the exchange when it initiated blocking to the far-end exchange. This state can co-exist with "idle", "incoming circuit busy", or "outgoing circuit busy".

The "idle" state is a call-processing state of an equipped, nonbusy circuit. The "incoming circuit busy" or "outgoing circuit busy" refers to a stable call-processing state.

To initiate the circuit query procedure, the sending exchange sends a Circuit Query Message indicating in the routing label and range field those circuits to be audited. If no response to the Circuit Query Message is received before timer T₂₈ expires, maintenance systems should be informed.

The receiving exchange shall process the Circuit Query Message and return a Circuit Query Response Message setting the circuit state indicators to the state of the circuits being audited.

2.8.2A.3 Auditing Procedure

The circuit query test is designed for each end to audit circuit states using the data maintained by the near-end as well as the far-end exchange. The circuit query shall not be allowed to the exchange that does not support the circuit query process. The routine of circuit query shall be set up in each exchange in a manner to minimize glare if possible.

The basic circuit state discrepancies and the required corrective actions are listed below.

2.8.2A.3.1 Error in Call-Processing States

1. If the near-end shows the circuit is outgoing circuit busy or incoming circuit busy and the far-end shows the circuit is unequipped, idle circuit and release any interconnected circuit;
2. If the near-end shows the circuit is unequipped and the far-end shows the circuit is outgoing circuit busy or incoming circuit busy, send a Release Message to idle the circuit at the far-end (the cause indicator should be coded "protocol error, unspecified");
3. If the near-end shows the circuit is idle and the far-end shows the circuit is incoming circuit busy or outgoing circuit busy, send a Release Message to idle the circuit at the far-end (the cause indicator should be coded "protocol error, unspecified");
4. The near-end shows the circuit is outgoing circuit busy or incoming circuit busy and the far-end shows the circuit is idle, idle circuit and release any interconnected circuit;
5. If both ends are incoming circuit busy or outgoing circuit busy:
 - a. Send a Release Message to idle circuit at the far-end (the cause indicator should be coded "protocol error, unspecified");
 - b. Idle circuit after Release Complete Message is received.

2.8.2A.3.2 Error in Maintenance States

- 1) If the near-end shows the circuit is unequipped and the far-end shows the circuit is active, initiate a Blocking Message (if the circuit identification code exists) to establish remote blocking, thereby preventing the circuit from being seized for call processing or maintenance testing;
- 2) If the near-end shows the circuit is not locally blocked and the far-end shows the circuit is unequipped:
 - a. Mark the circuit as locally blocked and withhold sending any Blocking Message to the far-end²⁰
 - b. Print a message to maintenance.
- 3) If the near-end shows the circuit is remotely blocked and the far-end shows the circuit is not locally blocked:
 - a. Remove the remote blocking state;
 - b. Print a message to maintenance.
- 4) If the near-end shows the circuit is locally blocked and the far-end shows the circuit is not remotely blocked, send a Blocking Message to establish the far-end remote blocking;
- 5) If the near-end shows the circuit is not locally blocked and the far-end shows the circuit is remotely blocked, send an Unblocking Message;
- 6) If the near-end shows the circuit is not remotely blocked and the far-end shows the circuit is locally blocked:
 - a. Mark the circuit as remotely blocked;

²⁰ As an option, the circuit may instead be marked as remotely blocked.

- b. Print a message to maintenance.

All of the actions involved are given in Table 4.2 of ATIS-1000113.2015 – Chapter 4.

2.9 Abnormal Conditions

2.9.1 Dual Seizure

Because Signaling System 7 circuits have the capability of bothway operation, it is possible that the two exchanges will attempt to seize the same circuit at approximately the same time.

2.9.1.1 Unguarded Interval

The exchange shall detect dual seizure and take action as defined in Clause 2.9.1.4.

2.9.1.2 Detection of Dual Seizure

A dual seizure is detected by an exchange from the fact that it receives an Initial Address Message or Circuit Reservation Message for a circuit for which it has sent an Initial Address Message or Circuit Reservation Message, but before it receives an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively.

2.9.1.3 Preventive Action

Different methods for circuit selection can be envisaged to minimize the occurrence of dual seizure. In the following, two methods are described:

- **Method 1:** An opposite order of selection is used at each terminal exchange of a bothway circuit group;
- **Method 2:** (No procedure specified for U.S. networks).

Further study is required to determine the field of application of each method and to ensure that the two methods do interwork satisfactorily.

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

For call control purposes, a bothway circuit group can be subdivided into subgroups in an exchange.

It is necessary to take preventive action in cases where Signaling System 7 uses a signaling data link with long propagation time.

2.9.1.4 Action to be Taken on Detection of Dual Seizure

On detection of a dual seizure, the call being processed by the control exchange for that circuit shall be completed and the received Initial Address Message or Circuit Reservation Message shall be disregarded.

Under these conditions, the call being processed by the control exchange shall be allowed to mature. The call being processed by the non-control exchange shall be backed off and the switch-path released. A Release Message shall not be sent. The non-control exchange shall make an automatic repeat on the same or on an alternative route.

For the purpose of resolution of dual seizure on bothway circuits, a predesignated method shall be used to assign control of the circuits. A dual seizure control indicator for each circuit group shall indicate which method is to be applied. For any given circuit group both exchanges shall apply the same method. However, different circuit groups may be controlled using different methods.

One of the following methods shall be applied to assign control of the circuits:

- The exchange with the higher signaling point code shall control all even-numbered circuits (circuit identification code); and the other exchange, the odd-numbered circuits;
- One exchange shall control all the circuits in a circuit group while the other exchange shall control none of the circuits in that same circuit group.

For one-way circuits, the exchange at the outgoing end of a circuit group shall control all of the circuits in the circuit group while the exchange at the incoming end shall control none of the circuits in that same circuit group.

The designation of control may also be used for maintenance control purposes.

2.9.2 Transmission Alarm Handling on Digital Interexchange Circuits

When fully digital circuits are provided between two exchanges, which have some inherent fault-indication feature giving an indication to the switching system when faults on transmission systems are detected, the switching system should inhibit selection of the circuits concerned for the period the fault conditions persist.

2.9.3 Reset of Circuits & 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 shall 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 Messages or a Circuit Group Reset Message should be sent as appropriate for the affected circuits.

2.9.3.1 Reset Circuit Message

If only a few circuits are concerned, a Reset Circuit Message should be sent for each affected circuit. On sending of a Reset Circuit Message, timers T_{16} and T_{17} are started awaiting a Release Complete Message.

On receiving a Reset Circuit Message, the receiving (unaffected) exchange shall take the following action:

- 1) If the circuit is in any call state or in the idle state, the exchange should regard the Reset Circuit Message as a Release Message. That is, the exchange should idle the circuit (if in a call state) and, in any case, send a Release Complete Message for the circuit. If an Initial Address Message or a Circuit Reservation Message for an outgoing call has been sent and no Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, has yet been received for that call, the exchange should make an automatic repeat attempt on another circuit if appropriate;
- 2) If the exchange has previously sent a Blocking Message for the circuit, or if it is for some reason unable to release the circuit as described in (1), it should send a Blocking Message before sending the Release Complete Message indicated above. The unaffected exchange should await the receipt of a Blocking Acknowledgment Message from the affected exchange. If such an acknowledgment is not received, the repetitive process indicated in 2.9.4 should be followed. (The exchange should not wait for the Blocking Acknowledgment before sending the Release Complete Message, however);
- 3) If a Blocking Message has been previously received for the circuit, the unaffected exchange should remove the remotely blocked condition before sending the Release Complete Message indicated in (1);

- 4) If the exchange receives a Reset Circuit Message after sending a Reset Circuit Message, it should send a Release Complete Message to the far-end exchange as indicated in (1). After receipt of the appropriate acknowledgment message, the circuit should be made available for service;
- 5) Except in the case of an automatic repeat attempt indicated in (1), the unaffected exchange should release any interconnected circuit. The cause value in the Release Message should be coded for "temporary failure";
- 6) If the receiving exchange has initiated a continuity recheck procedure on the affected circuit, the check procedure is stopped and the circuit returned to the idle state.

The affected exchange should reconstruct its memory according to the response(s) to the Reset Circuit and respond to the message(s) in the normal way (i.e., Blocking Acknowledgment Message in response to a Blocking Message).

If no Release Complete Message is received in acknowledgment to the Reset Circuit Message within 4-15 seconds (T_{16}), the Reset Circuit Message should be repeated. If an acknowledgment for the message is not received within one minute (T_{17}) after the initial Reset Circuit Message, maintenance personnel should be notified. Repeated Reset Circuit Messages should be sent at one-minute intervals until maintenance intervention occurs or an expected response is received.

2.9.3.2 Circuit Group Reset Message

If a considerable number of circuits or all circuits are affected by the memory mutilation, a Circuit Group Reset Message(s) should be used to make them available for new traffic.

The maximum number of circuits to be reset with a Circuit Group Reset Message is limited to 24. Upon sending a Circuit Group Reset Message, the affected exchange shall clear all blocking and call processing conditions, start timer T_{22} and T_{23} and mark each circuit state as "transient" until a Circuit Group Reset Acknowledgment Message is received.

Each Circuit Group Reset Message has to be sent twice within five seconds.²¹

As an implementation option, the receiving exchange may take either of the following actions on receipt of a Circuit Group Reset Message:

- Take independent action on every Circuit Group Reset Message received;
- Take action on the first Circuit Group Reset Message received and start a timer (T_{GRS}) [5 seconds] awaiting the second Circuit Group Reset Message. If a Circuit Group Reset Message is received within time T_{GRS} then the timer is stopped. If the second message matches the first message in Range field then it is discarded. Otherwise, the receiving exchange treats the message as a new request and takes the appropriate action. If timer T_{GRS} is stopped or expires, any subsequent Circuit Group Reset Message is treated as a new request.

On receipt of a Circuit Group Reset Message the receiving (unaffected) exchange shall take the following actions:

- 1) Independent from the coding of the range field the following actions should take place:
 - a. (Deleted);

²¹ This is required for compatibility with exchanges conforming to T1.113-1988.

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- b. If it had previously received (a) Blocking Message(s) or (a) Circuit Group Blocking Message(s) for one or more of the circuit(s) involved, the remotely blocked condition shall be removed and the circuits shall be made available for service;
 - c. Restore the circuits involved to the idle state;
 - d. If a Circuit Group Reset Message is received after having sent a Circuit Group Reset Message or (a) Reset Circuit Message(s), the circuits involved in both the sent and received messages are made available for service after receipt of the appropriate acknowledgment message;
 - e. If an Initial Address Message or a Circuit Reservation Message has been sent for any of the affected circuits and no Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, has yet been received, the exchange should make an automatic repeat attempt on another circuit if appropriate. Otherwise, appropriate signals should be sent on interconnected circuits to release them. The Cause Indicator in the Release Message should be coded as "temporary failure";
 - f. If the receiving exchange has initiated a continuity recheck procedure on any of the affected circuits, the check procedure is stopped and the circuit(s) returned to the idle state.
- 2) If the range field is not coded all zero, respond by a Circuit Group Reset Acknowledgment Message in which the status indicator bits of the circuits available for service are coded 0, and the status indicator bits of all circuits locally blocked are set to 1;
- 3) If the range field is coded all zero:
 - a. Send the appropriate Circuit Group Blocking Message or Blocking Message(s) if it had previously sent a Circuit Group Blocking or individual Blocking Message(s) for any of the circuits in the predetermined range;
 - b. Respond by a Circuit Group Reset Acknowledgment Message in which the range field is coded all zero indicating that the restoration of the predetermined circuits has been completed.

The affected exchange shall then reconstruct its memory according to the possibly received (Circuit Group) Blocking Messages, the received Circuit Group Reset Acknowledgment Message and from local status information. It shall respond to the possibly received (Circuit Group) Blocking Messages in the normal way.

If no acknowledgment to a Circuit Group Reset Message is received before 4-15 seconds (T_{22}), the Circuit Group Reset Message should be retransmitted twice. If an acknowledgment for the message is not received within one minute (T_{23}) after sending the initial Circuit Group Reset Message, the maintenance personnel should be notified to permit manual restoration procedures. However, the sending of the Circuit Group Reset Message should continue at *one-minute* intervals until maintenance intervention occurs.

A correct acknowledgment should match the original Circuit Group Reset Message in Range and Circuit Identification Code indicated in the routing label. The Circuit Identification Code in the routing label of both Circuit Group Reset Messages and Circuit Group Reset Acknowledgment Messages should belong to a circuit whose control is allocated to the ISDN User Part.

2.9.3.3 Abnormal Circuit Group Reset Message Procedures

- 1) If a Circuit Group Reset Message is received indicating reset of more circuits than allowed by the receiving exchange, it is discarded;
- 2) If a Circuit Group Reset Acknowledgment Message is received which is not a correct response to a sent Circuit Group Reset Message, it is discarded;
- 3) If a Circuit Group Reset Message is received requesting reset of circuits that are not controlled by the ISDN User Part, or a Circuit Group Reset Acknowledgment Message that contains Circuit Identification Codes that are not controlled by the ISDN user part, the message is discarded (see Clause 2.9.8.3A).

2.9.4 Failure in the Blocking/Unblocking Sequence

An exchange shall repeat the Blocking (Unblocking) Message or the Circuit Group Blocking (Unblocking) Messages on failure to receive the appropriate acknowledgment in response to one of these messages before 4-15 seconds (T_{12} , T_{14} , T_{18} , T_{20} appropriately).

If an appropriate acknowledgment is not received within a period of one minute (T_{13} , T_{15} , T_{19} , T_{21} appropriately) after sending the initial Blocking (Unblocking) Message or Circuit Group Blocking (Unblocking) Message, maintenance personnel should be alerted. The repetition of the Blocking (Unblocking) Message or Circuit Group Blocking (Unblocking) Message should be continued at one minute intervals until maintenance intervention occurs and the circuit(s) are taken out of (returned to) service as appropriate.

2.9.5 Receipt of Unreasonable Signaling Information

The Message Transfer Part of the signaling system shall avoid missequencing, or double delivery (see ATIS-1000111 – Chapter 6). However, undetected errors at the signaling link level and exchange malfunctions may produce signaling information messages that are either ambiguous or inappropriate.

Unreasonable or unexpected signaling information may also be received at an exchange due to different levels of signaling protocol enhancements at different exchanges within a network; an exchange using a more enhanced version of the protocol may send information to a less enhanced exchange.

NOTE - The procedures listed below are not applicable to the blocking, circuit group blocking and the circuit group reset maintenance procedures.

The following are considered message format errors:

1. The message length is less than the number of octets required for the mandatory fixed part, the mandatory variable pointers and the start of optional parameter pointer.
2. A mandatory variable or start of optional parameter's pointer points beyond the message length.
3. A mandatory variable or optional parameter's length indicator causes the overall message length to be exceeded.

When a message format error is detected the message shall be discarded.

NOTE - A format error can only be detected when the message is recognized.

For the purposes of format error detection, the message length may be interpreted as either:

1. Received message length, or
2. Maximum message length (272 octets).

Interpretation of 1) is preferred as it will detect errors which may not be found by interpretation; 2). However MTP does not provide the length information for the signaling information that is passed to its users by the MTP.

2.9.5.1 Handling of Unexpected Messages²²

An unexpected message is one which is recognized and valid but has been received in the wrong phase of the call.

²² Blocking-related messages are now covered in Clause 2.8.2.3.

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In order to resolve some possible ambiguities in the state of a circuit when unexpected messages are received the following shall apply:

- 1) If a Release Message is received relating to an idle circuit, it shall be acknowledged with a Release Complete Message;
- 2) If a Release Complete Message is received relating to an idle circuit, it shall be discarded;
- 3) If a Release Complete Message is received relating to a busy circuit for which a Release Message has not been sent, the circuit shall be released and a Release Message shall be sent;
- 4) If other unexpected messages are received when the circuit is idle, the Reset Circuit Message is sent;
- 5) If other unexpected messages are received for a circuit seized by a call (that is, an Initial Address Message has been sent or received), after receipt of an Address Complete/Answer message required for the call set-up, the unreasonable signaling information is discarded;
- 6) If other unexpected messages are received for a circuit seized by a call (i.e., a Circuit Reservation Message has been sent or received), after receipt of Circuit Reservation Acknowledgment Message, required for the call set-up, the unreasonable signaling information is discarded.
- 7) If other unexpected message is received for a circuit seized by a call, before receipt of a backward signal required for the call set-up, the Reset Circuit Message is sent. If the circuit is seized by an incoming call, the call shall be released. If the circuit is seized by an outgoing call, an automatic repeat attempt is provided on another circuit.
- 8) If unreasonable signaling information caused by conflicting code point values in the Protocol Control Indicator as specified in ATIS-1000113.2015 – Chapter 3 is received in a backwards call set-up message, and if the conflicting conditions can be reconciled by assuming lower network capability in the affected parameter, the call should be allowed to continue if the service requirements for the call can be satisfied.
- 9) If an Address Complete Message (or Answer Message in lieu of Address Complete Message) is received for the same incoming circuit for which an Address Complete Message (or Answer message) has been sent, the Reset Circuit Message should be sent, the received ACM (or ANM) should be discarded, and the maintenance personnel should be notified for the circuit concerned.

Except in certain cases (see Clause 2.9.1, dual seizure) any other unexpected messages information received shall be discarded. If the discarding of the signaling information prevents a call from being completed, that call shall eventually be released by the expiry of a time out.

2.9.5.2 General Requirements on Receipt of Unrecognized Signaling Information Messages & Parameters

Normally an exchange knows the signaling system or version of a signaling system to be used to its adjacent exchanges. However, in certain circumstances (e.g., upgrading of a signaling system in the network) it may happen that an exchange receives unrecognized information (i.e., messages or parameters or parameter values). No distinction is being made between unrecognized and unimplemented functions.

It may happen that an exchange receives unrecognized signaling information (i.e., messages, parameter types or parameter values). This can typically be caused by the upgrading of the signaling system used by other exchanges in the network. In these cases the following compatibility procedures are invoked to ensure the predictable network behavior.

The procedures to be used on receipt of unrecognized information make use of:

- Compatibility information received in the same message as the unrecognized information,
- The Confusion message;
- The Release message;

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- The Release Complete message;
- The Facility Reject message; or
- The Cause Indicators parameter; the following cause values are used:
 - (#97)message type non-existent or not implemented, discarded
 - (#99)parameter non-existent or not implemented, discarded
 - (#103) parameter non-existent or not implemented, passed on
 - (#110) message with unrecognized parameter, discarded

For all the above cause values a diagnostic field is included containing, dependent on the cause value either, the unrecognized parameter name(s), the message type code, or the message type code and the unrecognized parameter name(s).

It should be noted that the use of the Confusion Message is mainly to facilitate interworking with different implementations of the ISDN User Part protocol. In these cases, use of the Confusion Message is a switch settable option (per circuit group).

These procedures are based on the following assumptions:

- Signaling for a facility completely provided between the originating and destination local exchanges could utilize one of the end-to-end methods defined in clause 3, i.e., such facilities do not have to be supported by intermediate exchanges;
- If an exchange receives a Confusion, a Release, a Release Complete or Facility Reject Message indicating an unrecognized message, it assumes interworking with an exchange at a different functional level.
- The forward compatibility information contains different instructions for different exchanges. There are two types of exchanges, type A and type B exchanges. The classification of type A and B exchanges to the functional type an exchange may perform is listed below. It is determined on a per call basis. The classification of an exchange to the functional type can change during a call, (e.g., due to supplementary services):
 - Type A - Originating exchange, Destination exchange, Interworking exchange.
 - Type B - Intermediate exchange.
- As a minimum, all implementations must recognize all messages and all parameters specified in ATIS-1000113.2015.
- All unrecognized messages that can be received only contain parameters coded as optional parameters, no new messages (beyond the messages defined in ATIS-1000113.2015) will contain mandatory fixed or mandatory variable parameters.

As a minimum, all implementations must recognize all messages and all parameters specified in ATIS-1000113.2015.

All unrecognized messages that can be received only contain parameters coded as optional parameters, no new messages (beyond the messages defined in ATIS-1000113.2015) will contain mandatory fixed or mandatory variable parameters.

If messages are received without compatibility information and are not recognized, they are discarded, and the Confusion message is sent.

NOTE - This is the action taken by ATIS-1000113.2015.

When an unrecognized parameter or message is received, the exchange should find some corresponding instructions contained in the parameter compatibility information or message compatibility information parameters

respectively. The parameter compatibility information parameter may contain compatibility instructions for more than one parameter. The message compatibility information parameter contains the instructions specific for the handling of the complete message.

If the exchange does not find instructions in an appropriate compatibility parameter or if the compatibility parameter is not found in the message, the actions default to a basic action. Details of this are found in Clause 2.9.5.3.

The instruction indicators are a set of Boolean indicators. The following general rules apply to the examination of these instruction indicators:

- Depending on the role of the exchange in the call, i.e., type A or type B, and the settings of the instructions, only a subset of the indicators are examined; others are ignored.
 - Only type B exchanges examine the 'Transit at Intermediate Exchange indicator'. If it is set to 'Transit Interpretation', the other indicators are ignored. If it is set to 'End Node Interpretation', the actions in accordance with the setting of the remaining indicators are performed.
 - Type A exchanges always interpret the remaining indicators, i.e., all indicators except the 'Transit at Intermediate Exchange indicator'.
 - Consequently, 'End Node Interpretation' means that all kinds of exchanges, i.e., type A and type B, have to interpret the instruction indicators.
- Instruction indicators marked as 'spare' are not examined. They may be used by future versions of the ISDN-UP; in this case the future version of the ISDN-UP will set the currently defined instruction indicators to a reasonable value for current version. This rule ensures that more types of instruction indicators can be defined in the future without creating a backward compatibility problem.
- An exchange must decide what exchange type it is for before performing compatibility actions.
- At a type B exchange the unrecognized information should be passed on unchanged, if the 'Transit Intermediate Exchange indicator' is set to 'Transit Interpretation'.
- At a type B exchange that has not been instructed to pass on the unrecognized information, if the 'Release Call indicator' is set to 'Release Call', the call is released.
- At a type A exchange, the call is released if 'Release Call indicator' is set to 'Release Call'.
- At a type B exchange that has not been instructed to pass on the unrecognized information or at a type A exchange, in any case the following is applicable if the 'Release Call indicator' is set to 'Do not Release Call':
 - If the 'Discard Message indicator', or the 'Discard Parameter indicator' is set to 'Discard Message/Discard Parameter', the message or parameter is discarded, as instructed.
 - And then, if the 'Send Notification indicator' is set to 'Send Notification', a Confusion message is sent towards the exchange that sent the unrecognized information.
- For the case of an unrecognized parameter it is possible for the instruction to require that either the unrecognized parameter or the whole message is discarded. This provides for the case where the sending exchange determines that it is not acceptable for the message to continue being processed without this parameter.
- In case a parameter is included more than once in the same message, the instruction indicator of the Parameter Compatibility Information parameter is set according to the most stringent combination of the possible codings (i.e., the coding '1' of a bit in the instruction indicator is dominant).
- In case a message is used for more than one procedure related to the same call and the codings of the instruction indicator of the Message Compatibility Information parameter described in the corresponding texts are different, the instruction indicator is set according to the most stringent combination of the possible codings (i.e., the coding '1' of a bit in the instruction indicator is dominant).
- At a type A exchange where 'pass on' has been specified for a message or parameter and pass on is not possible, then the 'possible on not possible indicator' and 'send notification indicator' are checked.

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- In case of, for example, a repeat attempt, if a Confusion message is sent or passed on with the indication that a parameter of an IAM is discarded, this parameter shall not be sent in a new IAM.
- If unrecognized information is received at a broadband/narrowband Interworking point, the Broadband/Narrowband Interworking indicator is checked.
- The following tables clarify the handling of the received compatibility information:

Message Compatibility
Information parameter
Instruction indicator

B	C	D	Required action
0	X	0	Pass on message (note 1)(note 2)
0	0	1	Discard message
0	1	1	Discard message and send notification
1	X	X	Release call

X means don't care.

The format and coding of the Message Compatibility Information parameter is given in Clause 3.23C of ATIS-1000113.2015 – Chapter 3.

NOTE 1 - Applicable to type B exchanges. Other exchanges (e.g., originating exchange, destination exchange, interworking exchange) check bit E to determine the required action.

NOTE 2 - In case of passing on a message, no notification is sent, bit C is ignored. If pass on is set (bit D=0) but not possible, then bits C and E are checked.

Parameter Compatibility Information
parameter Instruction indicator

B	C	D	E	Required action
0	X	0	0	Pass on parameter (note 1)(note 2)
0	0	0	1	Discard parameter
0	0	1	0	Discard message
0	0	1	1	Discard message
0	1	0	1	Discard parameter and send notification
0	1	1	0	Discard message and send notification
0	1	1	1	Discard message and send notification
1	X	X	X	Release call

X means don't care.

The format and coding of the Parameter Compatibility Information parameter is given in Clause 3.26D of ATIS-1000113.2015 – Chapter 3.

NOTE 1 - Applicable to type B exchanges. Other exchanges (e.g., originating exchange, destination exchange, interworking exchange) check bits G and F to determine the required action.

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NOTE 2 - In case of passing on a message, no notification is sent, bit C is ignored. If pass on is set (bit D=0 and bit E=0) but not possible, then bits C, F and G are checked.

Action taken on receipt of the Confusion Message will depend on the call state and the affected service (see Clause 2.9.5.4). The default action taken on receipt of a Confusion Message is to discard the message without disrupting normal call processing.

If within the requirements in ATIS-1000113.2015 – Chapter 3 or ATIS-1000113.2015 – Chapter 4, specific actions or interpretations are described that are to be taken for receipt of unrecognized signaling information within the offending message or parameter, then those actions or interpretations shall be applied. Otherwise:

1. If the message is a Release Message, then the message shall be treated as if the unrecognized information was not present. If release of the circuit is possible, the Release Message shall be forwarded onto any associated circuits. When there is no signaling system interworking, the message can be transferred transparently. In other cases, the unrecognized information shall be deleted;
2. If the message is a circuit supervision message (Circuit Validation Test, Circuit Validation Response, Release Complete, Continuity Check Request, Reset Circuit, Loop-Back Acknowledgment, Blocking, Unblocking, Blocking Acknowledgment, Unblocking Acknowledgment, Suspend, Resume, or Unequipped Circuit Identification Code) or circuit group supervision message (Circuit Group Blocking, Circuit Group Unblocking, Circuit Group Blocking Acknowledgment, Circuit Group Unblocking Acknowledgment, Circuit Group Reset, Circuit Group Reset Acknowledgment, Circuit Query, or Circuit Query Response), then the message shall be discarded, and no other action shall be taken;
3. If an Initial Address Message is received with invalid information needed to route the call, the message shall be discarded and the circuit shall be released along with any associated circuits;
4. For all other cases, the procedures specified in Clause 2.9.5.3 apply.

2.9.5.3 Procedures for the Handling of the Unrecognized Messages or Parameters

A Confusion Message shall not be sent in response to a received Confusion, Facility Reject, Release, or Release Complete Message. Any unrecognized parameters received in a Confusion, Facility Reject, Release, or Release Complete message are discarded. Any unrecognized mandatory parameter value received in a Confusion or Facility Reject message will result in the message being discarded.

2.9.5.3.1 Unrecognized Messages

A) Actions at type A exchanges:

- Compatibility information parameter received:
Depending on the instructions received in the Message Compatibility Information parameter, a type A exchange receiving an unrecognized message will either:
 - Transfer the message transparently (see Note),
 - Discard the message,
 - Discard the message and send Confusion, or
 - Release the call.

NOTE- The transparent passing of a message is only applicable when the ISUP signaling is in accordance with ATIS-1000113.2015 or a latter version.

A Release or a Confusion Message shall include the Cause Value #97 "message type non-existent or not implemented" followed by a diagnostic field containing the message type code. For multiple occurrences of unrecognized messages, a Confusion Message should be sent for each occurrence.

- Compatibility information parameter not received:

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If an unrecognized message is received without Message Compatibility Information parameter at an exchange, the message shall be discarded and a Confusion Message returned. The Confusion Message shall include the Cause Value #97 "message type non-existent or not implemented" followed by a diagnostic field containing the message type code. For multiple occurrences of unrecognized messages, a Confusion Message should be sent for each occurrence.

NOTE - As a minimum all implementations must recognize all messages specified in ATIS-1000113.2015.

B) Actions at type B exchanges:

- Compatibility information parameter received:

Depending on the instructions received in the Message Compatibility Information parameter, a type B exchange receiving an unrecognized message will either:

- Transfer the message transparently,
- Discard the message,
- Discard the message and send Confusion, or
- Release the call.

A Release or a Confusion Message shall include the Cause Value #97 "message type non-existent or not implemented - discarded" followed by a diagnostic field containing the message type code.

- Compatibility information parameter not received:

If an unrecognized message is received without Message Compatibility Information parameter at an exchange, the message shall be discarded and a Confusion Message returned. The Confusion Message shall include the Cause Value #97 "message type non-existent or not implemented - discarded" followed by a diagnostic field containing the message type code.

NOTE - As a minimum all implementations must recognize all messages specified in ATIS-1000113.2015.

2.9.5.3.2 Unrecognized Parameters

Receipt of unrecognized parameters can only refer to optional parameters since mandatory parameters will always be recognized by their location in a message.

An unrecognized parameter is one with a parameter name that is not included in Table 4.4 of ATIS-1000113.2015 – Chapter 3, is included in Table 4.4 of ATIS-1000113.2015 – Chapter 3 but is marked as "deleted" or "no procedure specified for U.S. networks", or is included in Table 4.4 of ATIS-1000113.2015 – Chapter 3 but is not included in the relevant table corresponding to the particular message in which it is received. This last case is to cover the possibility of receiving a parameter in the "wrong" message. New parameters that are added to a later version cannot be recognized at an exchange which has not upgraded to that later version; thereby are detected as unrecognized.

A) Actions at type A exchanges:

- Compatibility information parameter received:

Depending on the instructions received in the Parameter Compatibility Information parameter, a type A exchange receiving an unrecognized message will either:

- Transfer the parameter transparently (Note),
- Discard the parameter,
- Discard the message,
- Discard the parameter and send Confusion,
- Discard the message and send Confusion, or
- Release the call.

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NOTE- The transparent passing of a parameter is only applicable when the ISUP signaling is in accordance with ATIS-1000113 or a latter version.

A Confusion Message shall include the Cause Value #99 "parameter non-existent or not implemented - discarded" followed by a diagnostic field containing the parameter name code, or Cause Value #110 "message with unrecognized parameter - discarded" followed by a diagnostic field containing the message type code and the name of the first detected parameter which caused the message to be discarded. A Confusion message may refer to multiple unrecognized parameters.

A Release Message shall include the Cause Value #99 "parameter non-existent or not implemented - discarded" followed by a diagnostic field containing the parameter name code.

If an unrecognized parameter is received in a Facility Request message, the parameter is handled like unrecognized parameters as in other messages.

If a Release message is received containing an unrecognized parameter, depending on the instructions received in the compatibility information parameter, type A exchange will either:

- Discard the parameter, or
- Discard the parameter and send a Cause 99 'Parameter non-existent or not implemented - discarded', in the Release Complete message.
- Compatibility information parameter not received:

If an exchange receives and detects an unrecognized parameter without Parameter Compatibility Information parameter, the actions taken will be dependent on whether the unrecognized parameter is passed on or discarded. If the unrecognized parameter is discarded, a Confusion Message is sent to the exchange from which the unrecognized parameter was received. The Confusion Message shall include the Cause Value #99 "parameter non-existent or not implemented - discarded" followed by a diagnostic field containing the parameter name code. A Confusion message may refer to multiple unrecognized parameters. If the unrecognized parameter is passed on unmodified, no subsequent actions are necessary.

If a Facility Request message is received with unrecognized parameters, the message is discarded and a Facility Reject message is returned including the Cause Value #99 'parameter non-existent or not implemented - discarded', followed by the parameter name code in the diagnostic field.

If a Release message containing an unrecognized parameter is received at a type A exchange, a Release Complete message is returned including the Cause Value #99 'parameter non-existent or not implemented - discarded'.

(B) Actions at type B exchanges:

- Compatibility information parameter received:

Depending on the instructions received in the Parameter Compatibility Information parameter, a type B exchange receiving an unrecognized message will either:

 - Transfer the parameter transparently,
 - Discard the parameter,
 - Discard the message,
 - Discard the parameter and send Confusion,
 - Discard the message and send Confusion, or
 - Release the call.

A Confusion Message shall include the Cause Value #99 "parameter non-existent or not implemented - discarded" followed by a diagnostic field containing the parameter name code, or Cause Value #110 "message with unrecognized parameter - discarded" followed by a diagnostic field containing the message type code and the name of the first detected parameter which caused the message to be discarded. A Confusion message may refer to multiple unrecognized parameters. If the unrecognized parameter is passed on unmodified, no subsequent actions are necessary.

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A Release Message shall include the Cause Value #99 "parameter non-existent or not implemented - discarded" followed by a diagnostic field containing the parameter name code.

If an unrecognized parameter is received in a Facility Request message, the parameter is handled like unrecognized parameters as in other messages.

If a Release message is received containing an unrecognized parameter, depending on the instructions received in the compatibility information parameter, a type B exchange will either:

- Transfer the parameter transparently,
 - Discard the parameter, or
 - Discard the parameter and send a Cause 99 'Parameter non-existent or not implemented - discarded', in the Release Complete message.
- Compatibility information parameter not received:

If an exchange receives and detects an unrecognized parameter without a Parameter Compatibility Information parameter, the actions taken will be dependent on whether the unrecognized parameter is passed on or discarded. If the unrecognized parameter is discarded, a Confusion Message is sent to the exchange from which the unrecognized parameter was received. The Confusion Message shall include the Cause Value #99 "parameter non-existent or not implemented - discarded" followed by a diagnostic field containing the parameter name code. A Confusion message may refer to multiple unrecognized parameters. If the unrecognized parameter is passed on unmodified, no subsequent actions are necessary.

If a Facility Request message is received with unrecognized parameters, the message is discarded and a Facility Reject message is returned including the Cause Value #99 'parameter non-existent or not implemented - discarded', followed by the parameter name code in the diagnostic field.

If a Release message containing an unrecognized parameter that cannot be passed on is received at a type B exchange, a Release Complete message is returned including the Cause Value #99 'parameter non-existent or not implemented - discarded'.

2.9.5.3.3 Unrecognized Parameter Values

Any parameter value marked as "spare", "reserved", or "no procedures specified for U.S. networks" in ATIS-1000113.2015 – Chapter 3 shall be regarded as an unrecognized parameter value.

All parameter fields considered essential for basic call processing are marked in ATIS-1000113.2015 – Chapter 3 as either having a default value or as uninterpretable if received with an unrecognized value.

If an exchange receives a recognized parameter which contains any value considered unrecognized, the exchange proceeds as follows:

- a) If there exists a default value for the parameter field (as marked in ATIS-1000113.2015 – Chapter 3) then this default value shall be used for any processing of that parameter field. The unrecognized parameter value, however, shall be passed on if the parameter is to be passed on, except if the value is in a network-specific range, in which case the value may be optionally replaced by the default value;
- b) If the parameter field is uninterpretable (as marked in ATIS-1000113.2015 – Chapter 3), the call shall be released with an appropriate cause value. In case no specific cause value can be identified, a Cause Indicators parameter coded as follows should be used:
 - Coding standard: "ITU-T standard";
 - Location: "local interface controlled by this signaling link";
 - Cause value: "protocol error, unspecified".

- c) If there is no default value and the parameter field is not marked as interpretable, the unrecognized parameter value shall be passed on or shall be processed in accordance with supplementary service procedures, if applicable.

2.9.5.4 Procedures for the Handling of Responses Indicating Unrecognized Information has Been Sent

2.9.5.4.1 Type A Exchange

Action taken on receipt of these messages at an originating exchange or destination exchange will depend on the call state and affected service.

The definition of any procedure that is outside the basic call set-up protocol should include procedures for handling responses indicating that another exchange has received, but not recognized, information belonging to that procedure. The procedure receiving this response should take the appropriate actions.

The default action taken on receipt of a Confusion message is to discard the message without disrupting normal call processing.

2.9.5.4.2 Type B Exchange

- a) Confusion with Cause 'message type non-existent or not implemented - discarded':

An exchange receiving Confusion with Cause 'message type non-existent or not implemented - discarded' has to determine the appropriate subsequent actions as described for type A exchanges above.

- b) Confusion with Cause 'parameter non-existent or not implemented - discarded, or pass on':

The actions taken at a type B exchange, on receipt of a Confusion message will depend on whether the exchange has the functionality to generate the parameter identified in the diagnostic field:

- a) If the exchange does not have the functionality to generate the parameter the decision on what action should be taken is deferred to an exchange that does contain this functionality. This is achieved by passing the Confusion message transparently through the type B exchange.
- b) If the exchange does have the functionality to generate the parameter, the procedural element that creates or modifies the information should determine any subsequent actions, as described for type A exchange above.

- Facility Reject:

If a type B exchange does not have the capability to take action on receipt of Facility Reject, it should pass the message transparently to the preceding or succeeding exchange.

- Release and Release Complete:

Action to be taken on receipt of a Release or Release Complete message with Cause indicating unrecognized information is as for the normal procedures of these messages.

The above actions are summarized in the following table:

Handling of responses indicating unrecognized information has been sent

	Exchange has the functionality to generate the information			
	Cause			
Message	parameter discarded	parameter passed on	message discarded	message passed on
Confusion	(procedure dependent action)			

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Facility Reject	Normal procedures	Procedure dependent action	Not applicable	Not applicable
Release	Normal procedures	Not applicable	Not applicable	Not applicable
Release Complete	Normal procedures	Normal procedures	Not applicable	Not applicable

Handling of responses indicating unrecognized information has been sent

	Exchange does not have the functionality to generate the information			
	Cause			
Message	parameter discarded	parameter passed on	message discarded	message passed on
Confusion	Defer action (transit Confusion message)			
Facility Reject	Defer action (transit the message)			
Release	Normal procedures	Not applicable	Not applicable	Not applicable
Release Complete	Normal procedures	Normal procedures	Not applicable	Not applicable

2.9.5A Receipt of Unrecognized Signaling Information

(Refer to Clause 2.9.5.)

2.9.6 Failure to Receive a Release Complete Message - Time T_1 & T_5

If a Release Complete Message is not received in response to a Release Message before 4-15 seconds (T_1), the exchange shall retransmit a Release Message.

On transmitting the initial Release Message, a one minute timer (T_5) is started. If after repeating the Release Message for this period of one minute, a Release Complete Message is not received the exchange shall:

1. Send a Reset Circuit Message;
2. Alert the maintenance system;
3. Cease sending the Release Message.

The sending of the Reset Circuit Message shall continue at *one-minute* intervals until maintenance action occurs or an expected response is received.

2.9.7 Failure to Receive a Response to an Information Request Message

If a response is not received in response to an Information Request Message before timer T_{33} expires, the exchange shall release the connection and the maintenance system may be informed.

2.9.8 Other Failure Conditions

2.9.8.1 Inability to release in response to a Release Message

If an exchange is unable to return the circuit to the idle condition in response to a Release Message, it should immediately remove the circuit from service (mark locally blocked), alert the maintenance system, and send the Blocking Message. Upon receipt of the Blocking Acknowledgment Message, the Release Complete Message is sent in acknowledgment of the Release Message.

2.9.8.2 Call Failure

The "temporary failure" Cause Value 41 is sent in a Release Message (see Clause 2.2) whenever a call attempt fails and other specific signals do not apply.

Reception of the Release Message at any Signaling System 7 exchange shall cause the Release Message to be sent to the preceding exchange. If the signaling system does not permit the Release Message to be sent, the appropriate signal, tone, or announcement shall be sent to the preceding exchange.

2.9.8.3 Abnormal Release Conditions

If the conditions for normal release as covered in clause 2.3 are not fulfilled, release shall take place under the following conditions:

- 1) **Outgoing international or national controlling exchange:** The exchange shall:
 - a) Release all equipment and the connection on failure to meet the conditions for normal release of address and routing information before 20-30 seconds (T_7) after sending the Initial Address Message;
 - b) At an outgoing international gateway exchange, release all equipment and release the connection on failure to receive an Answer Message within time T_9 specified in ITU-T Recommendation Q.118 after the receipt of the Address Complete Message.
- 2) **Incoming international exchange:** An incoming international exchange shall release all equipment and the connection into the national network and send back a Release Message in the following cases:
 - a) On failure to receive a Continuity Message if applicable before 10-15 seconds (T_8) after receipt of the Initial Address Message;
 - b) On failure to receive a backward message from a national network (where expected) before 20-30 seconds (T_7) after receipt of the Initial Address Message;
 - c) On receipt of a Release Message after an Address Complete Message has been generated.
- 3) **Intermediate exchange:** The exchange shall release all equipment and the connection and send back a Release Message in the following cases:
 - a) On failure to receive a Continuity Message if applicable, before 10-15 seconds (T_8) after receipt of the Initial Address Message;
 - b) On failure to meet the conditions for normal release as covered in 2.3 before 20-30 seconds (T_7) after sending the Initial Address Message.

The procedures for Release Messages are detailed in Clause 2.2.2.

2.9.8.3A Unequipped Circuit Identification Code Message

An Unequipped Circuit Identification Code Message is sent by an exchange in response to the reception of an Initial Address, Circuit Reservation, Continuity Check Request, Release, Reset Circuit, Blocking, Unblocking, Circuit Group Blocking, Circuit Group Unblocking, or Circuit Group Reset Message, and optionally any other message except a Circuit Query, Circuit Query Response, Circuit Validation Test, or Circuit Validation Response Message, on which it is unable to act as a consequence of its inability to perform a circuit identification code translation.

If an Unequipped Circuit Identification Code Message is received for a Signaling System 7 circuit, the receiving exchange shall:

- 1) Remove the indicated circuit from service and report the circuit to maintenance for maintenance action;
- 2) If the circuit has been seized and an Initial Address Message or Circuit Reservation Message transmitted, but the set-up sequence has not as yet resulted in the receipt of an Address Complete/Answer or Circuit Reservation Acknowledgment Message, respectively, reattempt the call on another circuit providing the rejected attempt was a first attempt. If the rejected attempt was a second attempt, either a Release Message should be returned (if the incoming circuit uses Signaling System 7) or a recorded announcement should be connected (if the incoming circuit uses in-band signaling);
- 3) Except in the case of a reattempt indicated in (2), send appropriate signals on any interconnected circuits to release them. As an option, stable calls may not be released.

An exchange receiving a Circuit Group Blocking, Circuit Group Unblocking, or Circuit Group Reset Message where the circuit identification code in the routing label is equipped but one or more of the circuits indicated by the range (and status) field is unequipped may optionally send an Unequipped Circuit Identification Code Message for each of these unequipped circuits. Otherwise, the unequipped state of the circuit(s) will be recovered when an Initial Address Message, a Circuit Reservation Message, a Continuity Check Request Message, or a Circuit Query Message is received for the affected circuit(s).

An exchange receiving an Unequipped Circuit Identification Code Message after having transmitted a Circuit Group Blocking, Circuit Group Unblocking, or Circuit Group Reset Message, assumes the regular acknowledgment message shall not be received and treats the other circuits as though the responding exchange had not taken the action on the affected circuits indicated in the initial message.

If messages are lost during an end-to-end transfer, appropriate actions shall be taken according to the type of end-to-end technique being used.

For calls involving the SCCP, expiration of the call supervision timer (concerned with Initial Address Message call setup) will result in the SCCP being notified of an error condition.

2.9.9 Temporary Trunk Blocking (TTB)

(No procedure specified for U. S. networks).

2.9A Multilevel Precedence & Preemption

(Deleted.)

2.9B Nx64 Multi-Rate Connection Type²³

An Nx64 (N is from 2 to 24) multi-rate connection type (also known as an NxDSO connection type) consists of N DS0 trunks within a DS1. An Nx64 connection exists only for the duration of an Nx64 call. An Nx64 call (also known as an Nx64 kbit/s bearer service) is an unrestricted circuit-mode bearer service requiring N times 64 kbit/s bandwidth. For reference purpose, a call on a single DS0 circuit (also known as a trunk) is referred to as a single-64 call.

The normal call control procedures supporting the Nx64 multi-rate connection type use the existing single-64 kbit/s protocol procedures as the basis. In particular, the basic call set-up and normal clearing procedures for a single-64 kbit/s unrestricted circuit-mode connection apply. When a maintenance message, such as a reset or blocking message, is received during an Nx64 call, in addition to applying the existing single-DS0 procedures to the affected circuit, the new procedures are to release the unaffected circuits and to release the Nx64 call. The procedures are applicable to a fixed starting point contiguous, a flexible starting point contiguous and a non-contiguous channel allocation. In the fixed starting point allocation, the N circuits used are contiguous and the lowest member circuit is pre-specified. The circuits used in the flexible starting point contiguous allocation are contiguous and the lowest member circuit could be any circuit as long as the allocated N circuits are within the DS1. The non-contiguous allocation allows the circuits to be derived from any circuit within the DS1. Switches shall provide either contiguous allocation or non-contiguous allocation, or both. For interworking between exchanges providing contiguous and non-contiguous circuit selection capabilities, an exchange providing the non-contiguous circuit selection option shall be able to support, on a per trunk group basis, the contiguous circuit selection protocol and procedures.

The use of contiguous or non-contiguous circuit selection capability between two networks will be mutually agreed upon.

2.9B.1 Call Control Procedures

2.9B.1.1 Successful Call Set-Up

2.9B.1.1.1 Circuit Identification Code

The following messages are relevant to the Nx64 call control: Initial Address Message, Exit, Continuity, Address Complete Message, Answer Message, Call Progress, Release, and Release Complete. All other messages are considered non-call control messages. For Nx64 calls, the call control messages must be sent and received with the CIC coded indicating the lowest member DS0 trunk of an Nx64 connection.

The value of N is specified by the transfer rate multiplier in the User Service Information parameter of an incoming IAM. The lowest member trunk of an Nx64 connection is designated the controlling trunk for an Nx64 call. Each of the other N-1 DS0 trunks is designated a non-controlling trunk.

The CIC codes shall be allocated in sequence without gaps with the lowest CIC code being the lowest DS0 trunk within a DS1.

The action to be taken when a subsequent call control message is received with the CIC coded to indicate a non-controlling trunk is provided in the "Call control message received on a non-controlling trunk" section.

NOTE - The circuit reservation procedure as specified in clause 2.1.3B is not applicable.

2.9B.1.1.2 Circuit Selection

The originating exchange determines whether it is an Nx64 call by analyzing the bearer capability information contained in the set-up message. When the originating exchange selects an Nx64 connection and routes an

²³ This clause corresponds to ITU-T Recommendation Q.764, Clause 2.1.13.

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Nx64 call to the network, the following parameters, indicators, and code values that are specific to Nx64 call control are conveyed in an Initial Address Message:

Parameter	Indicator	code value	meaning
User Service Information	Information transfer capability	01000	unrestricted digital information
	Information transfer rate	11000	Nx64 kbit/s
	Transfer rate multiplier	(binary encoding)	value of N
Forward Call Indicators	ISDN-up preference indicator	10	ISDN user part required all the way
Calling Party's Category		00001010	ordinary calling subscriber
Circuit Assignment Map	Map format (DS1 map)	(Note 1)	non-contiguous circuit assignment is used

NOTE 1 - Each bit on the DS1 map indicates whether the corresponding 64 kbit/s circuit is used (value of 1) or not used (value of 0).

In order to minimize dual seizure, an appropriate circuit selection algorithm shall be used.

On receipt of an IAM at an intermediate exchange or a destination exchange, the Nx64 kbit/s bearer service is determined from the following indicators:

- Information transfer rate indicating Nx64 kbit/s; and
- Transfer rate multiplier field indicating the value N.

If the N DS0 trunks as implicitly specified by the CIC (contiguous) or by the Circuit Assignment Map (CAM) parameter (non-contiguous) of an incoming IAM are idle, the incoming Nx64 connection is made incoming busy for the Nx64 call. When the intermediate exchange selects an outgoing Nx64 connection and routes the Nx64 call to the succeeding exchange the received Nx64 call specific parameters, indicators, and code values with the exception of the optional CAM parameter from the preceding exchange are passed on transparently.

- Contiguous circuit selection:* When the IAM does not include the optional CAM parameter, contiguous circuit selection is implied. The CIC in the call control message indicates the controlling trunk. The circuits selected for the connection consist of the N contiguous DS0 trunks with the lowest member trunk identified by the CIC.
- Non-contiguous circuit selection:* When the IAM does include the optional CAM parameter, non-contiguous circuit selection is indicated. The CIC in the call control message indicates the controlling trunk. The circuits selected for the connection consist of the N DS0 trunks specified by the CAM. The lowest member trunk is also identified by the CIC. Note that the lowest member DS0 specified in the CAM must correspond to the trunk identified by the CIC.

2.9B.1.1.3 Completion of Transmission Path

Through connect of an Nx64 connection uses the same procedure as for the single-64 kbit/s unrestricted bearer capability. Each of the N DS0 circuits in an Nx64 connection is through-connected as follows:

- At a destination exchange, through connect of the transmission path for an Nx64 call at both directions is completed when called party answers;
- At an intermediate exchange, through connect in both directions of the transmission path for an Nx64 call shall be completed no later than at receipt of an Answer Message;

- At an originating exchange, through connect in both directions of the transmission path for an Nx64 call shall be completed no later than at receipt of an Answer Message.

2.9B.1.1.4 Continuity-Check

The application of the continuity-check depends on the type of transmission system used for the connection and shall be a provisionable option. Decision on whether or not a continuity-check shall be performed on a given connection shall be made by an outgoing exchange and indicated by the continuity-check indicator in the IAM or by a continuity check request in a continuity-check test call.

Since all trunks of an Nx64 connection are in the same DS1 facility, a continuity-check, when requested, is only applied to the controlling trunk. The single-DS0 continuity-check procedures apply. If a continuity-check failure occurs, the single-DS0 continuity-check failure procedures are applied to the controlling trunk, and the non-controlling trunks are idled.

2.9B.1.1.5 Address Complete Message, Answer Message, Exit Message, Continuity Message, Call Progress Message

For Nx64 calls, the procedures for the sending and receipt of an Address Complete Message, Exit Message, Answer Message, Continuity Message, or Call Progress Message are the same as for the single-64 calls.

2.9B.1.2 Unsuccessful Call Set-Up

If at any time in the Nx64 call set-up the Nx64 connection cannot be completed, a Release Message is returned. The reason for release is indicated by an appropriate cause value. When an Nx64 connection cannot be allocated by the originating or intermediate exchange, the Cause Value 34 is used to signify no Nx64 connection is available. In the case that an Nx64 call cannot be setup because there are no ISUP circuits provisioned, the Cause Value 65 (bearer capability not implemented) shall be used. Timers T_1 and T_5 are started to ensure that a Release Complete Message is received from the preceding exchange. On receipt of Release Complete, the Nx64 call indication, if it exists, shall be released.

On receipt of a Release Message from the succeeding exchange, an exchange shall:

- Immediately start the release of the switched paths, if established, of the Nx64 connection. When all the switched paths of an Nx64 connection have been fully disconnected, a single Release Complete Message is returned to the succeeding exchange and all N DS0 circuits are made idle;
- At the same time as the start of the release of the switched paths, a Release Message is sent to the preceding exchange.

An Nx64 call will not be set up if the called user has not subscribed to the service. In this case a Release Message is sent by the destination exchange to the preceding exchange with a Cause Value 57 to signify bearer capability not authorized.

2.9B.1.2.1 Tones & Announcements

Tones and announcements procedures are not applicable, as an Nx64 kbit/s bearer service is a digital data service.

2.9B.1.3 Normal Call Release

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Normal call release of an Nx64 call can be initiated by the calling party, the called party, or the network.

An Nx64 connection and an Nx64 call can be released using a single REL message referencing the lowest member DS0. The Cause Value 16 is used to signify "normal clearing".

On receipt of a Release Message from the succeeding exchange, an exchange shall:

- Immediately start the release of the switched paths of the Nx64 connection. When the switched paths of an Nx64 connection have been fully disconnected, a single Release Complete Message is returned to the succeeding exchange and all N DS0 circuits are made idle;
- At the same time as the start of the release of the switched paths, a Release Message is sent to the preceding exchange.

Timers T_1 and T_5 are started to ensure that a Release Complete Message is received from the preceding exchange. On receipt of Release Complete, the Nx64 call indication, if it exists, shall be released.

2.9B.1.4 Transfer of User-to-User Information

User-to-User Information may be contained in appropriate messages of an Nx64 call.

2.9B.1.5 Transfer of Access Signaling Information

The Access Transport Parameter may be contained in appropriate messages of an Nx64 call.

2.9B.1.6 Transfer of Network Signaling Information

The Network Transport Parameter may be contained in appropriate messages of an Nx64 call.

2.9B.1.7 Suspend, Resume

Suspend and Resume procedures are not allowed in an Nx64 kbit/s bearer service.

2.9B.1.8 Echo Control Procedure

An Nx64 call is a data call. The Echo Control procedures for the single-64 kbit/s unrestricted bearer service apply.

2.9B.2 Interworking

2.9B.2.1 Interaction with 384 kbit/s & 1536 kbit/s Bearer Services

The 384 kbit/s and 1536 kbit/s bearer services use the following codepoints in the information transfer rate of the User Service Information parameter:

information transfer rate

10011	384 kbit/s
10101	1536 kbit/s

When an (N=6)x64 kbit/s or (N=24)x64 kbit/s bearer service interacts with a 384 kbit/s and 1536 kbit/s bearer service, respectively, the 384 kbit/s or 1536 kbit/s codepoint in the information transfer rate shall be recognized. When interworking between (N=6)x64 multi-rate and the 384 kbit/s bearer service, the lowest member circuit shall be one of 1, 7, 13, or 19.

Use of either the transfer rate multiplier or the specific codepoints of information transfer rate (384 kbit/s and 1536 kbit/s) shall be as follows:

- When an exchange supports Nx64 multi-rate connection type (i.e., Nx64), the transfer rate multiplier shall be used when the exchange at the other end of the connection also supports Nx64 bearer capability;
- When an exchange supports Nx64 multi-rate connection type (i.e., Nx64), but the exchange at the other end of the connection only supports 384/1536 kbits, the specific codepoints of information transfer rate (10011 for 384 kbit/s and 10101 for 1536 kbit/s) shall be used;
- If an exchange does not support Nx64 multi-rate connection type (i.e., Nx64), but does support the 384 kbit/s rate, the 1536 kbit/s rate, or both, the specific codepoints of information transfer rate (10011 for 384 kbit/s and 10101 for 1536 kbit/s) shall be used.

2.9B.2.2 Interworking Requirements for Non-Contiguous Capability

For interworking between exchanges providing contiguous and non-contiguous circuit selection capabilities, an exchange providing the non-contiguous circuit selection option shall be able to support, on a per trunk group basis, the contiguous circuit selection protocol and procedures.

2.9B.3 Network Features

2.9B.3.1 Automatic Repeat Attempt

Clause 2.8.1 recommends that under some conditions an automatic repeat attempt should be made for a single-circuit call. For all of these conditions, an automatic repeat attempt shall be made for Nx64 calls.

2.9B.3.2 Blocking & Unblocking Of Circuits & Circuit Groups

2.9B.3.2.1 Blocking & Unblocking Messages

Recommendations in Clause 2.8.2.1 shall be extended to the Nx64 calls with the following enhancements:

- a) If a Blocking Message is sent (locally blocked) and subsequently an IAM for an Nx64 call that would use the locally blocked circuit is received in the opposite direction, the Blocking Message shall be returned and the IAM shall be discarded;

If an IAM for an Nx64 call is received and if the Nx64 connection contains one or more remotely blocked circuits, the remotely blocked state of the circuit is removed and the IAM is processed normally;

- b) When a Blocking Message for a DS0 trunk that has been allocated to an Nx64 connection is received after an IAM for an Nx64 call has been sent and before an ACM or ANM message related to the Nx64 call has been received, an automatic repeat attempt shall be made on another connection. The exchange receiving the BLO shall release the original Nx64 call attempt in the normal manner after sending the Blocking Acknowledgment Message. The relevant circuit shall not be seized for subsequent calls;

- c) When a Blocking Message for a DS0 trunk that has been allocated to an Nx64 connection is received after an IAM for an Nx64 call has been sent and an ACM or ANM message related to the Nx64 call has been received, the original Nx64 call shall continue. The exchange shall send the Blocking Acknowledgment Message and shall not seize the relevant circuit for subsequent calls;
- d) When a Blocking Message for a DS0 trunk that has been allocated to an Nx64 connection is received after an IAM for an Nx64 call that uses the relevant circuit has been received beforehand, the original Nx64 call shall continue. The exchange shall send the Blocking Acknowledgment Message and shall not seize the relevant circuit for subsequent calls.

2.9B.3.2.2 Circuit Group Blocking & Unblocking Messages

Procedures in Clause 2.8.2.2 shall be extended to the Nx64 calls as follows:

- a) Since "circuit group blocking without release of circuits" does not release circuits until any calls in progress have completed, no new procedures are required for the Nx64 calls;
- b) On receipt of "circuit group blocking with immediate release of all circuits and related calls" during an Nx64 call, if any affected circuit/s has/have been allocated to an Nx64 connection, all interconnected circuits have to be released by the appropriate signals and the affected circuits are set to the blocked state without exchange of clearing messages;
- c) If a Circuit Group Blocking Message is sent and subsequently an IAM Message is received in the opposite direction, the Circuit Group Blocking Message shall be returned and the IAM shall be discarded;
- d) In the event of a Circuit Group Blocking Message for DS0 circuit/s that has/have been allocated to an Nx64 connection being received after an IAM for an Nx64 call has been sent, and before an ACM or ANM message relating to the Nx64 call has been received, an automatic repeat attempt shall be made on another connection. The original Nx64 call attempt shall be released in the normal manner after sending the Circuit Group Blocking Acknowledgment Message. The relevant circuit shall not be seized for subsequent calls.

2.9B.4 Abnormal Conditions

2.9B.4.1 Dual Seizure

2.9B.4.1.1 Action to be Taken on Detection of Dual Seizure

For the purpose of resolution of dual seizure between two Nx64 calls or between an Nx64 call and a single-64 call, the control of the circuits shall be assigned to an exchange using method (2), the "all-none" method. That is, one exchange shall control all the circuits in a circuit group while the other exchange shall control none of the circuits in that same circuit group. The non-control exchange shall make an automatic repeat attempt.

2.9B.4.2 Reset of Circuits & Circuit Groups

In the event that circuit/trunk-related memory becomes mutilated, either Reset Circuit Message (RSC) or Circuit Group Reset Message (GRS) shall be sent to the other exchange(s) to ensure the circuits in both exchanges are reset to idle state.

The exchange with memory mutilated (the affected exchange) shall send:

- A Reset Circuit Message for each affected circuit; or
- A Circuit Group Reset Message for all the affected circuits.

2.9B.4.2.1 Reset Circuit Message

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On receipt of an RSC message, if the receiving exchange determines that an affected DS0 is on a connection in any state of an Nx64 call, the received RSC message shall be processed as follows:

- a) Apply single-circuit reset procedure (see Clause 2.9.3.1) to the affected circuit,
- b) For the received RSC Message, return a Release Complete (RLC) Message with the CIC coded to the same value as in the received RSC Message,
- c) Since the affected circuit is involved in an Nx64 call, the exchange shall also idle unaffected circuits in the Nx64 connection by sending,
 - A Release (REL) Message with Cause Value 41 "temporary failure" for each unaffected circuit; or,
 - A GRS Message covering both the affected and the unaffected circuits; or,
 - A GRS Message with optional CAM parameter covering both the affected and the unaffected circuits; or,
 - A combination of GRS and RSC Messages for all the unaffected circuits back to the affected exchange to ensure that the unaffected circuits are also made idle at the affected exchange;
- d) Send a REL Message with Cause Value 41 "temporary failure" and with the CIC indicating the controlling trunk to preceding exchange.

On receipt of an RSC message, if the receiving exchange determines that an affected DS0 is not on a connection in any state of an Nx64 call, the received RSC message shall be processed based on the single-DS0 reset procedure (see Clause 2.9.3.1).

2.9B.4.2.2 Circuit Group Reset Message

A Circuit Group Reset (GRS) Message may contain the optional CAM parameter when the non-contiguous allocation scheme is used. When the CAM is present it is used to indicate the DS0s that are to be cleared and the Range parameter is ignored.

On receipt of a GRS message, if the receiving exchange determines that the range value or the CAM, if present, of the GRS Message contains an affected DS0 circuit or a group of DS0 circuits that is/are on a connection in any state of an Nx64 call, the received GRS message shall be processed as follows:

- a) Apply circuit group reset procedure (see Clause 2.9.3.2) to the affected circuits;
- b) Return a Circuit Group Reset Acknowledgment (GRA) Message with the same CIC, range value, and CAM (if present) as in the received GRS Message to the affected exchange;
- c) Since the affected circuit/s is/are involved in an Nx64 call, the exchange shall also idle unaffected circuits in the Nx64 connection by sending:
 1. A Release (REL) Message with Cause Value 41 "temporary failure" for each unaffected circuit; or,
 2. A GRS Message covering both the affected and the unaffected circuits; or,
 3. A GRS Message with optional CAM parameter covering both the affected and the unaffected circuits; or,
 4. A combination of GRS and RSC Messages for all the unaffected circuits back to the affected exchange to ensure that the unaffected circuits are also made idle at the affected exchange;
- d) Send a REL Message with Cause Value 41 "temporary failure" and with the CIC indicating the controlling trunk to preceding exchange.

On receipt of a GRS message, if the receiving exchange determines that the affected DS0 circuit/s is/are not on a connection in any state of an Nx64 call, the received GRS message shall be processed based on the single-DS0 reset procedure (see Clause 2.9.3.2)

2.9B.4.3 Receipt of Unreasonable Signaling Information

2.9B.4.3.1 Call Control Messages Received on A Non-Controlling Trunk

Call control messages must be sent with the CIC indicating the controlling trunk. After an IAM has been sent, if any subsequent call control message, except the IAM (which indicates dual seizure), is received on a non-controlling trunk, it implies that the sending exchange is under some kind of failure condition. The call shall be released. In addition, in response to the received message, the exchange shall send either a Circuit Group Reset Message (GRS) or a Circuit Reset (RSC) Message and (N-1) Release Messages back to the sending exchange as follows:

- a) Idle the circuits that have been allocated to the Nx64 connection. If the circuits in the Nx64 connection are contiguous, option c1 or c3 (below) shall be used; If the circuits in the Nx64 connection are not contiguous, option c2 or c3 (below) shall be used;
- b) When a Release (REL) message is received on a non-controlling trunk, return a Release Complete (RLC) message with the CIC coded to the same value as in the received REL message;
- c) Send one of the following messages:
 - 1) A GRS Message with range value indicating all of the N DS0 circuits; or,
 - 2) A GRS message with the CAM parameter indicating the DS0 circuits involved with the call; or,
 - 3) A RSC Message with the CIC coded to the same value as in the received message, followed by (N-1) REL Messages with Cause Value 41 "temporary failure";
- d) Wait for GRA, if GRS was sent; or, wait for RLC messages, if RSC and REL messages were sent;
- e) Send a REL Message with Cause Value 41 "temporary failure" and with the CIC indicating the controlling trunk to preceding exchange.

2.9B.4.3.2 Protocol Errors

- ♦ **Mismatch between CAM and Information transfer multiplier:** Where the CAM parameter is used, the number of bits set (equal to one) in the map shall be equal to the binary coded value of the Transfer rate multiplier. Where these values are not equal, the call shall be released and the Cause Value of 111 "protocol error, unspecified" shall be sent to the far exchange.
- ♦ **Mismatch between CAM and CIC:** Where the CAM parameter is used in an IAM, the lowest numbered bit set (equal to one) in the CAM parameter shall indicate the DS0 identified by the CIC value in the IAM message. Where the CAM and CIC indicate different DS0s, the call shall be released and the Cause Value of 111 "protocol error, unspecified" shall be sent to the far exchange.
- ♦ **The N selected contiguous trunks are not in a single DS1 facility:** Where the CAM parameter is not used in an IAM, the circuits selected for the connection consist of the N contiguous DS0 trunks with the lowest member trunk identified by the CIC. If the highest of the trunks so indicated is not within the same DS1 as the trunk indicated by the CIC, the call shall be released and the Cause Value of 111 "protocol error, unspecified" shall be sent to the far exchange.
- ♦ **Receipt of unexpected CAM parameter in IAM:** If an exchange receives an IAM including the CAM parameter for a trunk group which is known to convey only contiguous circuit selection, this constitutes a protocol error. When this situation occurs, the call shall be released and the Cause Value 99 "parameter non-existent or not implemented" shall be sent to the far exchange.

2.9B.4.3.3 Unexpected Messages Received on an Idle Trunk

If an unexpected message is received on an idle trunk the existing single-circuit procedures (see Clause 2.9.5.1) shall apply.

2.9B.4.3.4 Unexpected RLC Message on Controlling Trunk

If an RLC Message on a controlling trunk is received on a busy Nx64 connection for which an REL Message or RSC has not been sent, the Nx64 connection and the Nx64 call shall be released and a REL Message with Cause Value 41 "temporary failure" shall be sent to the far exchange.

2.9B.4.3.5 Other Unexpected Message

In this clause, for controlling trunks, the term "unexpected message" refers to all messages other than RLC that are unexpected. For non-controlling trunks "unexpected message" refers to all unexpected non-call control messages. If an "unexpected message" on a controlling or a non-controlling trunk is received on a busy Nx64 connection, the following actions shall be undertaken:

- a) If an unexpected message is received after receipt or sending of an ACM or ANM message required for the call setup on a busy Nx64 connection, the received unexpected message shall be discarded;
- b) If an unexpected message is received before receipt or sending of an ACM or ANM message required for the call set-up on a busy Nx64 connection, then, if the trunk is seized by an incoming Nx64 call, the call shall be released using the normal release procedures. Otherwise, if the trunk is seized by an outgoing Nx64 call, an automatic repeat attempt shall be provided on another connection. In addition, in response to the received message, the exchange shall send either a Circuit Group Reset Message (GRS) or a Circuit Reset (RSC) Message and (N-1) Release Messages back to the sending exchange as follows:
 - 1) Idle the circuits that have been allocated to the Nx64 connection. If the circuits in the Nx64 connection are contiguous, option 2a or 2c (below) shall be used. If the circuits in the Nx64 connection are not contiguous, option 2b or 2c (below) shall be used;
 - 2) Send one of the following:
 - a) A GRS Message with range value indicating all of the N DS0 circuits; or,
 - b) A GRS message with the CAM parameter indicating the DS0 circuits involved with the call; or,
 - c) An RSC Message with the CIC coded to the same value as in the received message, followed by (N-1) REL Messages with Cause Value 41 "temporary failure";
 - 3) Wait for GRA, if GRS was sent, or, wait for RLC messages, if RSC and REL messages were sent;
 - 4) Send a REL Message with Cause Value 41 "temporary failure" and with the CIC indicating the controlling trunk to preceding exchange.

2.9B.4.4 Unequipped Circuit Identification Code Message

For an Nx64 call, the existing procedure to send an Unequipped Circuit Identification Code Message (see Clause 2.9.8.3A) shall apply.

If a DS0 circuit of an Nx64 connection receives an Unequipped Circuit Identification Code (UCIC) Message, the receiving exchange shall:

- Follow the single-circuit procedure (see Clause 2.9.8.3A) and remove the indicated DS0 circuit from service and report to the maintenance system for maintenance action,
- Nx64 call reattempt shall be made on another Nx64 connection, provided the rejected attempt was the first attempt and considering that the circuit was seized and an IAM transmitted.

If the rejected Nx64 call attempt was a second attempt, the exchange receiving the UCIC message shall send a Release message to the incoming circuit referencing the controlling DS0 in the Nx64 connection and release the Nx64 connection and the Nx64 call.

2.9C Connection Type Allowing Fallback

A new connection type, "connection type allowing fallback", is specified. With this connection type a call is setup using 64 kbit/s "unrestricted digital information with tones and announcements (UDI-TA)" circuit as the preferred bearer capability and is allowed to fallback to either speech or 3.1 kHz audio if the calling user has indicated that fallback is allowed by including another bearer capability information element in the setup. This means that connection type allowing fallback shall be capable of invoking echo control as it may be required for speech or 3.1 kHz audio.

When fallback has occurred, the call is routed on a fallback connection type, which is either speech or 3.1 kHz audio as indicated by the calling user.

In order to support the connection type allowing fallback, the following new optional parameters are required:

- User Service Information Prime (USI') and
- Transmission Medium Used (TMU).

The optional USI' parameter may be contained in an IAM. If a USI' parameter is not present, fallback is not allowed. The optional TMU parameter may be contained in an ACM, CPG, or ANM.

2.9C.1 Actions in the Forward Direction

2.9C.1.1 Actions at the Originating Exchange

Two bearer capability information elements are received in the call request from the access. These bearer capability information elements are mapped into one corresponding User Service Information (USI) parameter and one corresponding User Service Information Prime (USI') to be carried in the Initial Address Message. If a USI' parameter is not present, fallback is not allowed.

The User Service Information Prime parameter carries the preferred bearer capability and the User Service Information parameter carries the fallback bearer capability.

The User Service Information Prime parameter is coded "64 kbit/s UDI-TA", and the call is routed on a circuit of connection type allowing fallback as implicitly indicated by the presence of the User Service Information Prime parameter.

This means that the connection shall be capable of satisfying the connection type requirements of both 64 kbit/s UDI-TA and 3.1 kHz audio or speech connection types, e.g., it shall be possible to invoke echo control on the connection if applicable.

The User Service Information parameter carries the fallback connection type and is coded either as 3.1 kHz audio or speech, depending on which connection type shall be used in the case of fallback.

2.9C.1.2 Actions at an Intermediate Exchange

2.9C.1.2.1 Succeeding Network Does Have the Capability of Performing Fallback

The intermediate exchange will set up the call on a circuit of connection type allowing fallback as implicitly indicated by the presence of the User Service Information Prime parameter whenever available.

If congestion on the route is encountered, and if there is an alternative route available which does not support either the connection type allowing fallback or a signaling capability to fallback, fallback procedures will be initiated according to Clause 2.9C.1.2.2.

2.9C.1.2.2 Succeeding Network Does Not Have The Capability of Performing Fallback

In case of either:

- Interworking to an ISDN User Part not supporting the User Service Information Prime (USI') parameter; or
- There is no circuit available being capable of satisfying the requirements of connection type allowing fallback,

the intermediate exchange will continue the call, discard the User Service Information Prime parameter, and maintain the User Service Information parameter. This will typically be the case when the succeeding network consists of an ISDN User Part not supporting the procedures.

In case of interworking to PSTN, the intermediate exchange will continue the call into the PSTN with the fallback connection type.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.1.3 Actions at The Destination Exchange

If the destination access is ISDN, then the information carried in the User Service Information parameter and the User Service Information Prime parameter are sent to the called user in accordance with the user network interface protocol.

If the called user is an analog subscriber, the destination exchange will continue the call into the PSTN.

2.9C.2 Actions in the Backward Directions - Fallback Indicated Before Answer

2.9C.2.1 Actions at the Destination Exchange

Fallback before answer may be indicated by the access. The destination exchange will also know that fallback has occurred when the called user is an analog subscriber.

If the destination exchange knows that fallback has occurred, this will be indicated in the backward direction by including a Transmission Medium Used (TMU) parameter (which has been set according to the fallback connection type indicated in the User Service Information parameter) in the Address Complete Message or in the Call Progress message if an ACM has already been returned.

The Transmission Medium Used parameter indicates the fallback connection type.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.2.2 Actions at the Intermediate Exchange

2.9C.2.2.1 Succeeding Network Does Have Capability of Performing Fallback

The intermediate exchange will know that fallback has occurred by receipt of the Transmission Medium Used parameter. The Transmission Medium Used parameter indicates the fallback connection type.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.2.2.2 Succeeding Network Does Not Have The Capability of Performing Fallback

The intermediate exchange will include a Transmission Medium Used parameter (which has been set according to the fallback connection type indicated in the User Service Information parameter) in the Address Complete Message or Call Progress Message indicating that fallback has occurred for this call.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.2.3 Actions at the Originating Exchange

The originating exchange will know that fallback has occurred by receipt of the Transmission Medium Used parameter. The Transmission Medium Used parameter also indicates the fallback connection type.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.3 Actions in the Backward Directions - Fallback Indicated at Answer

2.9C.3.1 Actions at the Destination Exchange

When the destination exchange knows at answer that fallback has occurred, this will be indicated by including a Transmission Medium Used parameter (which has been set according to the fallback connection type indicated by the presence of the User Service Information parameter) in the Answer message.

This will typically be the case when the called user is ISDN, and has indicated fallback bearer capability information or no bearer capability information at all when answering the call.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.3.2 Actions at the Intermediate Exchange

The intermediate exchange will know that fallback has occurred by receipt of the Transmission Medium Used parameter. The Transmission Medium Used parameter indicates the fallback connection type.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.3.3 Actions at the Originating exchange

The originating exchange will know that fallback has occurred by receipt of the Transmission Medium Used parameter. The Transmission Medium Used parameter also indicates the fallback connection type.

If echo control is required on the connection, appropriate procedures will be initiated (see Clause 2.9C.6).

2.9C.4 Actions in the Backward Direction - Fallback does not Occur

The non-occurrence of fallback is indicated in the backward direction by the absence of the Transmission Medium Used parameter.

No further action is required in any of the exchanges involved in the call.

2.9C.5 Completion of Transmission Path

For a call using connection type allowing fallback, the through-connect procedure at an originating exchange, intermediate exchange, and destination exchange shall be the same as for the 3.1 kHz audio.

2.9C.6 Echo Control Procedures Supporting Fallback

2.9C.6.1 General

The echo control procedure is used on a per call basis to convey information between exchange nodes about the demand and ability to insert echo control devices.

The procedure is invoked when a call is to be routed on a connection for which echo control will be necessary if fallback occurs. It could be initiated at the originating exchange or at an intermediate exchange.

This clause will use the terms "disabled" or "not enabled" to indicate that an echo control device is in a bit transparent state.

2.9C.6.2 Forward Direction

2.9C.6.2.1 Actions at the Originating Exchange

If an originating exchange has sufficient information to determine that echo control will be necessary for the outgoing circuit if fallback occurs then:

- 1) An outgoing half echo control device is reserved, but it is not enabled at this time unless fallback occurs immediately as a result of the outgoing trunk selected.
- 2) The Echo Control Device Indicator of the Nature of Connection Indicators parameter in the Initial Address Message is set.

2.9C.6.2.2 Actions at an Intermediate Exchange

If an intermediate exchange has sufficient information to determine that echo control will be required for the outgoing circuit if fallback occurs then one of the following actions can occur:

- 1) When the Echo Control Device Indicator of the Nature of Connection Indicators parameter in the Initial Address Message is already set:
 - a) No change to the Nature of Connection Indicators parameter in the Initial Address Message is made.
 - b) An incoming half echo control device is reserved but not enabled.
 - c) Any outgoing half echo control device is disabled.
- 2) When the Echo Control Device Indicator of the Nature of Connection Indicators parameter in the Initial Address Message is not already set:

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- a) An outgoing half echo control device is reserved, but it is not enabled at this time unless fallback occurs immediately as a result of the outgoing trunk selected.
- b) The Echo Control Device Indicator in the Nature of Connection Indicators parameter is set.

If an intermediate exchange has sufficient information to determine that echo control is not required for the outgoing circuit then one of the following actions can occur:

- 1) When the Echo Control Device Indicator of the Nature of Connection Indicators parameter in the Initial Address Message is already set:
 - a. No change to the Nature of Connection Indicators parameter in the Initial Address Message is made.
 - b. An incoming half echo control device is reserved but not enabled.
- 2) When the Echo Control Device Indicator of the Nature of Connection Indicators parameter in the Initial Address Message is not already set: No additional action is required.

2.9C.6.2.3 Actions at the Destination Exchange

See Clause 2.9C.6.3.1.

2.9C.6.3 Backward Direction

2.9C.6.3.1 Actions at the Destination Exchange

Upon receipt of an Initial Address Message with the Echo Control Device Indicator of the Nature of Connection Indicators parameter already set, the following action is taken:

- 1) An incoming half echo control device is reserved but it is not enabled unless fallback occurs. The echo control device is activated if fallback does occur, either as a result of the destination access to which the call is offered or as indicated by the DSS1 signaling messages received from the destination user. If the call is answered without fallback having occurred, the reserved incoming half echo control device is released.
- 2) The Echo Control Device Indicator in the Backward Call Indicators parameter in the first backward message (i.e., Address Complete, Answer, or Call Progress) is set.

If the destination exchange is unable to include an incoming half echo control device, this information is conveyed to the preceding exchange by the Echo Control Device Indicator in the Backward Call Indicators parameter not being set in the first backward message.

2.9C.6.4 Actions at an Intermediate Exchange

If an outgoing half echo control device has been reserved, and if a backward message contains the TMU, the outgoing half echo control device is enabled. If an Answer message is received without a TMU having been received in any backward message, the outgoing half echo control device is released.

Upon receipt of the first backward message (i.e., Address Complete, Answer, or Call Progress Message) in response to an Initial Address Message which had the Echo Control Device Indicator of the Nature of Connection parameters set, then one of the following actions can occur:

- 1) When the Echo Control Device Indicator in the Backward Call Indicators parameter is not already set:

- a. If the received message contains the TMU, the reserved incoming half echo control device is enabled.
 - b. If the received message does not contain the TMU, the reserved incoming half echo control device is not enabled, but it remains reserved. If a subsequently backward message contains the TMU, the incoming half echo control device is enabled. If an Answer message is received without a TMU having been received in any backward message, the incoming half echo control device is released.
 - c. The Echo Control Device Indicator in the Backward Call Indicators parameter is set.
- 2) When the Echo Control Device Indicator in the Backward Call Indicators parameter is already set:
- a. The reserved incoming half echo control device is released.
 - b. No change to the Backward Call Indicators parameter in the backward message is made.

2.9C.6.5 Actions at the Originating Exchange

If an outgoing half echo control device has been reserved, and if a backward message contains the TMU, the outgoing half echo control device is enabled. If an Answer message is received without a TMU having been received in any backward message, the outgoing half echo control device is released.

2.10 ISDN User Part Signaling Congestion Control

(No procedure specified for U.S. networks.)

2.10A ISDN User Part Flow Control

2.10A.1 Actions on Receipt of MTP-STATUS Primitive

On receipt of an MTP-STATUS primitive with the cause "user part unavailability inaccessible remote user" the ISDN User Part shall inform the network management/overload control function so that any new traffic to the affected exchange is restricted. The ISDN User Part shall start the availability test procedure by sending a Circuit Validation Test Message to the affected remote ISDN User Part and starting timer T_{37} [provisionally 30 seconds] which supervises the receipt of a test response. All MTP-STATUS primitives received with the cause "user part unavailability - inaccessible remote user" for the same remote ISDN User Part while timer T_{37} is running are ignored.

If the remote ISDN User Part is in service and receives a Circuit Validation Test Message, it returns a Circuit Validation Response Message in accordance with the procedures in C.3 of Annex C of ATIS-1000113.2015 – Chapter 4.

On receipt of the Circuit Validation Response Message or any other ISDN-UP message from the affected exchange, timer T_{37} is stopped and the network management/overload control function is informed so that traffic may be restarted.

On expiry of timer T_{37} , the procedure is restarted.

On receipt of an MTP STATUS primitive with the cause "user part unavailability - unequipped remote user" the ISDN User Part shall inform the management system so that further traffic to the affected exchange is restricted. The ISDN User Part shall not initiate the availability test procedure for this case.

2.10A.2 Actions on Receipt of MTP-RESUME Primitive

On receipt of an MTP-RESUME primitive for a newly available signaling point where a remote ISDN User Part resides, the local ISDN User Part should have the option to initiate the availability test procedure as described above.

2.10B Hop Counter Procedure²⁴

An exchange settable option to deactivate the hop counter capability applies per outgoing SS7 trunk group (in term of this procedure, an SS7 trunk group includes all SS7 circuits between two exchanges). The default is active.

The hop counter procedure specifies common exchange actions and those that result when calls are routed to outgoing trunk groups with the capability active or deactivated.

2.10B.1 Actions at Originating Exchange

An originating exchange shall not originate the hop counter parameter.

An outgoing exchange receiving a Release message with ANSI cause 25, exchange routing error, shall notify the management system of the exchange routing error and provide the called party number, identity of the succeeding exchange (via OPC and CIC), and if available, the calling party number.

2.10B.2 Actions at Destination Exchange

None; the exchange shall ignore the hop counter if received.

2.10B.3 Actions at an Intermediate Exchange (Includes Forwarding Exchanges)

Intermediate exchange actions are dependent upon whether a hop counter parameter is received from the preceding exchange, and if received, the result of decrementing the hop counter value. They are also dependent on the occurrence of call forwarding and rely on the use of the redirection information parameter to release calls that involve call forwarding looping.

If the hop counter parameter is received, the intermediate exchange shall decrement the hop counter value by 1, after first checking its value being equal to zero as received. If its value is zero upon receipt, the exchange shall release the call as specified in a) below. Subsequent actions are based on the result as described below:

- a) If the result equals 0, the exchange shall release the call by returning a Release message with ANSI standard Cause Value 25 (Normal Class), exchange routing error, to the preceding exchange. In addition, the management system shall be informed of the hop counter exhaust (value = 0), associated called party number, identity of the preceding exchange (via OPC and CIC), and if available, the calling party number.
- b) If result is greater than 0, the exchange shall include the hop counter parameter in the outgoing Initial Address Message with the counter value decremented as follows:
 - 1) If no call forwarding occurs and the hop counter capability is active, set
counter value = result = received hop counter - 1.

²⁴ This clause corresponds to ITU-T Recommendation Q.764, Clause 2.17.

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If no call forwarding occurs and the hop counter capability is deactivated on the outgoing SS7 trunk group set

counter value = result + 1 = received hop counter.

This is equivalent to the actions at an issue 2 exchange (unrecognized parameters are passed unchanged).

2) If call forwarding occurs, set

counter value = initial count,

independent of whether the hop counter capability is active or deactivated.

If no hop counter parameter is received (e.g., if the incoming circuit is non-SS7, or if it is an SS7 circuit from an exchange that has not yet implemented this capability) and the outgoing trunk group is SS7, the intermediate exchange shall take the following action:

- a) If the hop counter capability is active, a non-forwarding exchange shall include the hop counter parameter in the outgoing Initial Address Message and set
counter value = initial count.
- b) If the hop counter capability is deactivated, a non-forwarding exchange shall not originate the hop counter parameter.
- c) A forwarding exchange shall not originate the hop counter parameter if none is received, independent of whether the hop counter capability is active or deactivated.

The initial count value is sent by the exchange originating the hop counter parameter, and it shall be settable by the network operator on a per exchange basis (provisional range 10 to 20).

An interworking exchange receiving a Release message with ANSI cause 25, exchange routing error, shall notify the management system of the exchange routing error and provide the called party number, identity of the succeeding exchange (via OPC and CIC), and an indication that interworking occurred. Normal release treatment shall be passed back over the incoming MF circuit (e.g., play announcement or reorder tone).

A forwarding exchange receiving a Release message with ANSI cause 25, exchange routing error, shall notify the management system of the exchange routing error and provide the called party number, identity of the succeeding exchange (via OPC and CIC), and the forwarding number. Cause Value 31, normal unspecified, shall be returned to the preceding exchange.

A hop counter procedure logic diagram summarizing actions at an intermediate exchange upon receipt of an IAM can be found in Annex E of ATIS-1000113.2015 – Chapter 4.

2.10C Support for Temporary Alternative Routing (TAR)

As described in ITU-T Recommendation E.412 (Clause 3.2.3) an exchange which has invoked the network management temporary alternative routing (TAR) control shall include a TAR controlled call indication in the Network Management Controls parameter of the outgoing IAM.

A succeeding exchange which receives a TAR indicator indicating TAR controlled call in the Network management controls parameter shall not apply network management TAR to the same call. The received TAR indicator shall be passed on unchanged.

2.10D Calling Geodetic Location Procedure

2.10D.1 Introduction

The ISUP calling geodetic location procedure is used where the geodetic location information of the calling party is required to be transported from some point in the call path (typically the originating exchange) to another point.

NOTE - The transportation of the geodetic information related to the location of any other party (e.g., redirection, redirecting, called party, etc.) is for further study.

How geodetic location information is transformed into other forms is outside the scope of this standard.

Possible applications of the transport of calling geodetic location information include:

- Emergency services
- Location dependent routing
- Location number portability
- Location mobility services

2.10D.2 Transport of Geodetic Information

Where the exchange logic at a node determines that geodetic information is required to be transported in the forward direction, the Calling Geodetic Location parameter shall be sent in the IAM.

2.10E Signaling Procedures for Automatic Re-Routing (Crankback)

2.10E.1 Introduction

The automatic re-routing (crankback) signaling procedure allows the call set-up to return to a preceding exchange so that the call can be automatically re-routed from there. Crankback is an optional signaling procedure that allows for sophisticated support of the automatic re-routing (ARR) capability (refer to ITU-T Recommendation E.170). This procedure is an additional procedure to the unsuccessful call set-up procedures described in Clause 2.2. An exchange invokes the automatic re-routing signaling procedure when a call cannot be routed further from that exchange. There are three possible cases:

1. The process to select an outgoing circuit from the exchange fails
2. A backward REL is received during the outgoing call set-up. The cause value received is either specific for the route chosen (e.g., bearer capability not implemented) or is temporary in nature (e.g., congestion)
3. The call cannot be established to the user at the destination local exchange.

The number of attempts to re-route a call is limited. This limit is a network specific value, not exceeding 63.

It needs to be emphasized that the automatic re-routing signaling procedure can only be effective when introduced on a network wide basis.

2.10E.2 Actions at an Intermediate Exchange

2.10E.2.1 Sending a REL with the Possible Invocation of Automatic Re-Routing

Automatic re-routing may or may not be invoked when the call cannot be routed further from an intermediate exchange as described in the cases 1 and 2 in Clause 3.1. Invocation of automatic re-routing involves the setting or updating of the Re-routing Counter which keeps track of the number of re-routing attempts. A reason for not invoking automatic re-routing is when the counter has reached its upper limit.

Four cases can be distinguished in an intermediate exchange:

- a) Automatic re-routing is invoked and the Automatic Re-routing parameter has not been received in the IAM for the incoming call.

In this case the intermediate exchange sends a REL towards the preceding exchange including the Automatic Re-routing parameter with the Re-routing Counter set to *"one"* and the Re-routing Inhibit Indicator set to *"no indication"*.
- b) Automatic re-routing is invoked and the Automatic Re-routing parameter has been received in the IAM for the incoming call.

In this case the intermediate exchange sends a REL towards the preceding exchange including the Automatic Re-routing parameter with the Re-routing Counter incremented by one and the Re-routing Inhibit Indicator set to *"no indication"*.
- c) Automatic re-routing is not invoked and the Automatic Re-routing parameter has or has not been received in the IAM for the incoming call.

In this case the intermediate exchange sends a REL towards the preceding exchange including the Automatic Re-routing parameter with the Re-routing Inhibit Indicator set to *"do not crankback"*. The Re-routing Counter is not incremented if it was received in the incoming IAM.
- d) If the intermediate exchange does not support the automatic re-routing signaling procedure, no Automatic Re-routing parameter is sent in the REL message and thus a regular backward release according to Clause 2.2.2 or 2.2.3 takes place.

As a network option, the reason for invoking or not invoking automatic re-routing can be indicated in the Automatic Re-routing parameter. This information could be helpful for operations and maintenance purposes. For example, it could be important to know whether an invocation (and, in particular, a re-routing inhibit) is based on:

- A cause code as received in a REL received during outgoing call set-up
- Trunk group data (which could, for instance, indicate that re-routing is useless since no other trunk group in the network exists to the final destination of the call)
- Routing data (which could, for instance, indicate that re-routing is useless since no other route exists to the final destination of the call).

2.10E.2.2 Receiving a REL with the Automatic Re-Routing Parameter

An intermediate exchange can take four possible actions when it receives a REL from the succeeding exchange with the Automatic Re-routing parameter:

It attempts to re-route the call to an alternative route if

- Automatic re-routing has been invoked (re-routing counter greater or equal to one and Re-routing Inhibit Indicator coded as *"no indication"*),
- Autonomous logic in the exchange indicates that re-routing should be applied in this exchange,

If an alternate route is available and the maximum number of re-routing attempts has not been exceeded, the exchange includes the Automatic Re-routing parameter into the IAM, to indicate how many automatic re-routing (crankback) attempts have already occurred. If no alternative route is available, or the re-routing counter exceeds the maximum number of re-routing attempts allowed by the network, the received REL shall

be passed towards the preceding exchange with the inclusion of the Automatic Re-routing parameter as received.

NOTE - The maximum number of re-routing attempts is network specific.

- a) It does not attempt re-routing but passes the received REL towards the preceding exchange with the inclusion of the Automatic Re-routing parameter as received if the Re-routing Inhibit Indicator is coded as *"do not crankback"*.

NOTE: The Re-routing Inhibit Indicator is the means by which a succeeding exchange can explicitly prevent a preceding exchange from performing automatic re-routing.

- b) It does not attempt re-routing but passes the received REL towards the preceding exchange with the inclusion of the Automatic Re-routing parameter as received if the Re-routing Inhibit Indicator is coded as *"no indication"* and autonomous logic in the exchange indicates that no re-routing should be applied in this exchange. If the intermediate exchange wants to inhibit re-routing, it includes the Re-routing Inhibit Indicator set to *"do not crankback"* in the Automatic Re-routing parameter.
- c) It handles the Automatic Re-routing parameter as an unrecognized parameter according to Clause 2.9.5.3.2 if the exchange does not support the automatic re-routing signaling procedure and, as a result, does not recognize the parameter. This may render the automatic re-routing mechanism ineffective.

2.10E.2.3 Receiving an IAM with the Automatic Re-Routing Parameter

The intermediate exchange may receive the Automatic Re-routing parameter in an IAM. This parameter is passed on if the call is routed to the succeeding exchange. If the call cannot be routed to the succeeding exchange, Clause 2.10E.2.1 applies.

Procedures for unrecognized parameters apply if the intermediate exchange does not support the automatic re-routing signaling procedure and, as a result, does not recognize the parameter; see Clause 2.9.5.3.2. This may render the automatic re-routing mechanism ineffective.

2.10E.3 Actions at a Gateway Exchange

The actions as described in Clause 2.10E.2 apply. However, passing of the Automatic Re-routing parameter in the IAM and REL messages between networks depends on bilateral agreement (e.g., exchanging automatic re-routing information may not be deemed desirable when crossing a network boundary).

2.10E.4 Actions at the Originating Exchange

The originating exchange performs the same actions as described in Clause 2.10E.2.2 with the exception, that the call is released according to the normal release procedures if it is not re-routed.

2.10E.5 Actions at the Destination Exchange

When a destination local exchange cannot establish a call towards a user (case 3 in Clause 2.10E.1) and the incoming call is to be released:

- The same actions as described in Clause 2.10E.2.1 apply if it is known that the user is connected to at least one other exchange over a physically separate link
- The destination local exchange shall not invoke the automatic re-routing signaling procedure if it is known that the user is not connected to any other exchange over a physically separate link or if there is no sufficient knowledge about an alternate link to the user; the Automatic Re-routing parameter with the Re-routing Inhibit Indicator coded as *"do not crankback"* shall be included in the REL

- No Automatic Re-routing parameter is sent in the REL message and thus a regular backward release according to Clause 2.2.1 takes place if the destination local exchange does not support the automatic re-routing signaling procedure.

2.11 Automatic Congestion Control

Automatic congestion control (ACC) is used when an exchange is in an overload condition (see Annex D of ATIS-1000113.2015 – Chapter 4). Three levels of congestion are distinguished, a less severe congestion threshold (congestion level 1), a more severe congestion threshold (congestion level 2) and optionally a most severe congestion threshold (congestion level 3). This option is applied to an entire exchange.

If any of the three congestion thresholds are reached, an Automatic Congestion Level parameter is added to all Release Messages generated by the exchange. This parameter indicates the level of congestion (congestion level 1, 2, or 3) to the adjacent exchanges. An exchange which supports three levels of congestion needs to have the ability to distinguish between far exchanges which support two levels of congestion and far exchanges that support three levels of congestion. The exchange shall not send an indication of congestion level 3 to an adjacent exchange which does not support three levels of congestion. A congestion level 2 would be sent in this case. An exchange which recognizes a single level of congestion should only send indication of congestion level 2 (CL2), and treat receipt of indication of congestion level 1 (CL1) or congestion level 2 (CL2) identically. The adjacent exchanges, when receiving a Release Message containing an Automatic Congestion Level parameter should reduce their traffic to the overload affected exchange. Annex D describes the automatic congestion control system.

If the overloaded exchange returns to a normal traffic load it shall cease including Automatic Congestion Level parameter in Release Messages. The adjacent exchanges then, after a predetermined time, automatically return to their normal status.

2.11.1 Receipt of a Release Message Containing an Automatic Congestion Level Parameter

When an exchange receives a Release Message containing an Automatic Congestion Level parameter the ISDN User Part should pass the appropriate information to the signaling system independent network management/overload control function within the exchange. This information consists of the received congestion level information and the circuit identification to which the Release Message applies. The exchange should reduce its traffic to the overload affected exchange as described in Annex D.

ACC actions are applicable only at exchanges adjacent to the congested exchange. Therefore, an exchange that receives a Release Message containing an Automatic Congestion Level parameter should discard that parameter after notifying the network management/overload control function. If this is an intermediate exchange, the cause value in the received Release Message shall be passed on unchanged unless the exchange provides a tone/announcement (see Clause 2.2.4).

2.11.2 Action Taken During Overload

Whenever an exchange is in an overload state (congestion level 1, 2, or 3), the signaling system independent network management/overload control function shall direct the ISDN User Part to include an Automatic Congestion Level parameter in every Release Message transmitted by the exchange. The network management/overload control function shall indicate which congestion level (1, 2, or 3) to code in the Automatic Congestion Level parameter.

If a destination exchange is in an overload state and the Release Message is generated due to the overload state, Cause Value 42 (switching equipment congestion) shall be used. Otherwise, another applicable cause value shall be used. If an intermediate exchange is in an overload state and the Release Message is generated due to the overload state, Cause Value 42 (switching equipment congestion) shall be used. Otherwise, the cause value in the received Release Message shall be passed on unchanged unless the exchange provides a

tone/announcement (see Clause 2.2.4) If an originating exchange is in an overload state, a Release Message for the outgoing circuit shall include an appropriate cause value other than 42 (switching equipment congestion).

When the overload condition has ended the network management/overload control function shall direct the ISDN User Part to cease including Automatic Congestion Level parameters in the transmitted Release Messages. An applicable cause value other than 42 (switching equipment congestion) shall be used.

2.11A Examples of Call Set-Up Sequences

Examples of ISDN call set-up sequences may be found in Figure 4.1 through 4.13 of ATIS-1000113.2015 – Chapter 4.

2.11B State transition diagrams

NOTE - The text previously contained in this clause, the related Tables (Table 4.4 through Table 4.8 of ATIS-1000113.2015 – Chapter 4), and the SDL diagrams (Figure 23 through Figure 47 of ATIS-1000113.2015 – Chapter 4) have been moved to ATIS-1000113.2015 – Chapter 6.

3 End-to-End Signaling²⁵

3.1 Introduction

End-to-end messages contain only information that is relevant for the two "endpoints" of a circuit-switched connection. "Endpoints" are signaling points (with user functions) within the Signaling System 7 network.

Two methods are available for ISDN end-to-end signaling:

- The pass-along method;
- The Signaling Connection Control Part (SCCP) method.

The choice of method is, to some extent, dependent on the size and architecture of the signaling network.

Both methods may coexist in a given network.

The pass-along method and the SCCP methods are specified for circuit-switched connections.

An end-to-end signaling connection established for end-to-end signaling is called an "ISDN User Part end-to-end signaling connection" in this clause.

Clause 1.4A discusses the use of the end-to-end and link-by-link methods.

3.2 Pass-Along Method

In the pass-along method, use is made of an ISDN User Part end-to-end signaling connection which in fact is being set up whenever a physical connection between two end points is established. The ISDN User Part end-to-end signaling connection in this case consists of a number of connection sections in tandem which run in parallel with and use the same identification code as the circuits in the physical connection. The association of incoming

²⁵ This clause corresponds to ITU-T Recommendation Q.730, Clause 1.4.

and outgoing circuits in an intermediate exchange also establishes the coupling of the connection sections related to these circuits.

The pass-along method defines, section by section, the appropriate label for the message to be passed along via the ISDN User Part connection; but the content of Pass-Along Messages is only evaluated and possibly changed at the end points. The Pass-Along Message group is characterized by a special message type code as specified in ATIS-1000113.2015 – Chapter 3. One ISDN User Part message to be passed along may be embedded in one Pass-Along Message.

In a signaling connection for which the pass-along method is available, Pass-Along Messages may be sent in either the forward or backward direction.

A forward Pass-Along Message may not be sent until either a backward Pass-Along Message or an Address Complete or Answer Message has been received, or after the physical connection is released.

Call control path information (see 3.4) included in the Initial Address Message and backward set-up messages is used to indicate to the connection endpoints whether or not the call control path can support Pass-Along Message transfer (for example, whether or not Signaling System 7 is used in all parts of the connection between the endpoints).

A Pass-Along Message that has been received at an intermediate exchange and cannot be transferred to the subsequent exchange is discarded without affecting call states and timers in that exchange.

3.3 SCCP Method

In the SCCP method, the ISDN User Part employs the services of the Signaling Connection Control Part (SCCP) for the transfer of end-to-end signaling information.

3.3.1 Call Reference

The call reference is circuit independent information identifying a particular call. It is needed when end-to-end signaling information associated with the call is to be transferred by a connectionless SCCP service. If, in turn, a SCCP connection request for connection-oriented SCCP service is carried embedded in an ISDN User Part message, the call reference is omitted.

References for a given call are allocated independently in the two concerned signaling points and are exchanged during call set-up. The allocation of call references may be initiated by either side. The call reference consists of a call identity and the point code where the call identity is established.

If, for example, signaling point A initiates the exchange of call references, it selects a call identity CIA and transfers it together with the point code of A, PCA, in the Initial Address Message to signaling point B.

Signaling point B then allocates its own identity CIB to the call and returns it in a message together with the signaling point code of B, PCB, and call identity CIA to signaling point A. Subsequent call related end-to-end messages transferred from signaling point A to signaling point B contain call identity CIB and are routed directly using destination point code PCB. Conversely, end-to-end messages transferred from signaling point B to signaling point A contain call identity CIA and are routed using destination point code PCA.

A linkage of call references at network boundaries has to be provided.

Connections relating to a call may be released independently of each other irrespective of whether they are physical (circuit-switched connections) or logical (SCCP connections). With the release of the last connection (physical or logical) the call references are released. The release of call references without a connection requires further study.

3.3.1A Coupling of Connected Sections

An ISDN User Part end-to-end signaling connection may consist of a number of connection sections in tandem. In order to couple two connection sections at the SCCP relay point, linkage of call references is performed by the ISDN User Part for connectionless SCCP service and linkage of local references is performed by SCCP for connection-oriented SCCP service.

A SCCP relay point where linkage of call references is performed by the ISDN User Part is called an "intermediate relay node" in this clause.

3.3.2 Connectionless Service

For connectionless service, the ISDN User Part transfers the data to be transmitted to the SCCP together with a request for the appropriate protocol class of service. The signaling information, transfer, and delivery of this data to the distant ISDN User Part is controlled entirely by the SCCP. The association between the transferred information and a call is made by the ISDN User Part, which transfers the call reference as part of signaling information for this purpose.

The protocol class of service is assumed to be 0. Individual networks may choose class 1 based on a predetermined agreement.

3.3.3 Connection-Oriented Service

3.3.3.1 Connection Request Sent By The SCCP

(Deleted.)

3.3.3.2 Connection Request Embedded in an ISDN User Part Message

At the exchange initiating the establishment of an ISDN User Part end-to-end signaling connection based on connection-oriented SCCP service, the ISDN User Part requests the SCCP to provide the necessary information for a connection request for an SCCP end-to-end connection. This connection request is then carried embedded in an ISDN User Part message. At the destination exchange the connection request is passed to the SCCP by the ISDN User Part. The SCCP at the destination exchange then behaves as if the connection request had been sent directly by the SCCP from the originating exchange. It indicates the connection request to the ISDN User Part and upon response from the ISDN User Part it returns a connection confirm message to the SCCP at the originating exchange. The SCCP at the originating exchange confirms the set-up of the end-to-end connection to the ISDN User Part. The contents in the embedded connection request are not evaluated by the ISDN User Part at any exchange.

3.3.3.3 Protocol Class of Service

The protocol class of service is assumed to be 2. If the connection request is of protocol class 3, the ISDN User Part connection request parameter shall include explicit protocol class and credit indications in addition to the SCCP source local reference.

3.3.3.4 Mechanism of Coupling

Although coupling of connection sections may not be appropriate in combination with the embedded method, coupling is necessary at network boundaries. In this case the ISDN User Part at the intermediate point has knowledge that a coupling of end-to-end connections sections has to be performed, and therefore connection

requests received embedded in an ISDN User Part message are passed to the SCCP. The SCCP, in turn, furnishes the ISDN User Part with a connection request for the new connection section in order to have it included in the outgoing ISDN User Part message.

After the coupling of the connection sections has been successfully initiated by the ISDN User Part, end-to-end signaling information passing through an intermediate point is not passed to the ISDN User Part.

3.3.3.5 Release of ISDN User Part End-To-End Signaling Connection

The SCCP end-to-end connection is released according to the procedures described in ATIS-1000112 – Chapter 4.

The physical connection and the ISDN User Part end-to-end signaling connection can be released independently of each other.

Generally, both the ISDN User Part end-to-end signaling connection and the physical connection are released simultaneously. However, for certain applications it is possible to maintain the SCCP end-to-end connection although the physical connection has already been released.

3.3A Chaining of ISDN User Part End-To-End Signaling Connections

At an exchange where the contents of end-to-end signaling information may need to be evaluated by the ISDN User Part, ISDN User Part end-to-end signaling connections are chained. Chaining of two ISDN User Part end-to-end signaling connections means that one ISDN User Part signaling connection terminates and another ISDN User Part signaling connection associated with it originates with all end-to-end signaling information passing through the ISDN User Part. The new ISDN User Part signaling connection may have different characteristics from the previous one. See Figure 4.22 of ATIS-1000113.2015 – Chapter 4.

If chaining is not appropriate for the associated call when the service requirements cannot be satisfied because of it, the call may be released. In addition, if any of the ISDN User Part end-to-end signaling connections under chaining cannot be established or is abnormally disconnected, the associated call may be released if the required service cannot be completed without it.

3.4 Use of the Protocol Control Indicator

The protocol control indicator is control information concerning the end-to-end signaling procedures. It is contained in the Forward Call Indicators and the Backward Call Indicators, and has to be examined to determine which end-to-end signaling method should be used if any (when an embedded connection request is not included in the appropriate message) for the end-to-end transfer of messages.

The following indications are provided:

- Information available that could be transmitted (end-to-end) to the other endpoint;
- Signaling System 7 path between the two endpoints, no interworking along the route;
- Pass along method available;
- SCCP method available;
- ISDN User Part used all the way.

3.5 Operation of the Pass-Along Method

Figure 4.12 of ATIS-1000113.2015 – Chapter 4 illustrates the operation of the pass-along protocol. In this figure the PCI is the Protocol Control Indicator in the Initial Address Message. "Interworking" in the Initial Address Message or Address Complete Message indicates that the control path is not wholly Signaling System 7.

3.6 Operation of the SCCP Method - Connectionless Service

3.6.1 Successful Set-Up of the ISDN User Part End-To-End Signaling Connection

3.6.1.1 Simultaneous Establishment of an ISDN User Part End-To-End Signaling Connection & a Physical Connection

In the case of simultaneous establishment of a signaling connection with a physical connection, the Initial Address Message from the originating exchange of a call contains the call reference consisting of the point code of the originating exchange and the call identity. The inclusion of the call reference implicitly indicates that the establishment of a signaling connection is requested. When the destination exchange receives an Initial Address Message with a call reference in it and a signaling connection can be established, it responds to that with its own call reference included in the first backward message (e.g., an Address Complete Message).

At an intermediate relay node where SCCP is terminated, its own call reference is allocated to the signaling connection and the coupling of call references is made. When the first backward message contains a call reference, an intermediate relay node replaces that with its own call reference and relay this message towards the originating exchange.

When the originating exchange receives the destination call reference from the exchange at the other end of the connection section the signaling connection is regarded as in a ready state and end-to-end signaling information can be transferred over this connection.

Figure 4.13A of ATIS-1000113.2015 – Chapter 4 shows the procedure for this case.

3.6.1.2 Establishment of a Signaling Connection when the Circuit-Associated Signaling Path Has Been Established

When the circuit-associated signaling path has already been established, the establishment of a signaling connection can be initiated either by the originating or the destination exchange of a call. In this case, an Information Request Message is transferred from the initiating exchange to the other end. This Information Request Message contains a call reference as in the case of an Initial Address Message as described in Clause 3.6.1.1 above.

An Information Message containing a call reference as in the case of the first backward message in Clause 3.6.1.1 is returned to the initiating exchange and a signaling connection is successfully established.

Figure 4.13B of ATIS-1000113.2015 – Chapter 4 shows the procedure for this case.

3.6.2 Unsuccessful Set-Up of a Signaling Connection

In case that a signaling connection cannot be established, e.g., due to interworking with a PSTN, the first backward message in response to the Initial Address Message containing the originating call reference includes no call reference.

The procedure for this case is shown in Figure 4.14 of ATIS-1000113.2015 – Chapter 4.

In case that the establishment for a signaling connection is requested by an Information Request Message as shown in Figure 4.13B of ATIS-1000113.2015 – Chapter 4, the initiating exchange usually knows the end-to-end

signaling capability for the call concerned and a signaling connection can successfully be established. However, if a signaling connection cannot be established for some reason, an Information Message containing no call reference is returned to the initiating exchange.

In these situations, the call may be released if the ISDN User Part end-to-end signaling connection is essential to satisfy the service requirements of the call.

In these cases, the call reference(s) is (are) frozen for the time (T_{31}) as described in Clause 3.6.4.2.

3.6.3 Abnormal Situations

In case that no response to the Information Request Message containing the originating call reference is received for the time T_{33} at the initiating exchange and if necessary (e.g., being an interworking exchange of different end-to-end signaling schemes) at an intermediate relay node, the call is released (see Clause 2.9.7).

In this case, the call reference(s) is (are) frozen for the time T_{31} as described in Clause 3.6.4.2.

The procedure for this case is shown in Figure 4.15 of ATIS-1000113.2015 – Chapter 4.

3.6.4 Release of a Signaling Connection

3.6.4.1 Simultaneous Release of a Physical Connection & a Signaling Connection

When the call is released, the ISDN User Part end-to-end signaling connection is considered to be released simultaneously. Call references allocated at local exchanges and intermediate relay node(s) are frozen for time T_{31} as described in Clause 3.6.4.2.

The procedure for this case is shown in Figure 16 of ATIS-1000113.2015 – Chapter 4.

3.6.4.2 Frozen Call Reference

When an ISDN User Part end-to-end signaling connection is released, call references allocated for this signaling connection are frozen for time T_{31} . These references will not be used for another signaling connection during the frozen period. T_{31} is chosen to sufficiently reduce the probability of erroneously associating a message with the previously used call reference. Optionally call identities may be allocated to individual signaling connections in a cyclic manner so that a previously used call identity is not to be used again for sufficient amount of time.

If an end-to-end message containing a frozen call reference is received, it is discarded.

3.6.5 End-To-End Message Transfer

An end-to-end message is transferred in an SCCP unitdata (UDT) message according to the procedures defined in ATIS-1000112 – Chapter 4. ISDN User Part interfaces with SCCP via the primitives are defined in ATIS-1000112 – Chapter 1 for this transfer. The unit-data request/indication primitive includes in its user data parameter an ISDN User Part message beginning with the message type and ending with the parameters.

At the local exchange which has responded to the request of establishment of an ISDN User Part end-to-end signaling connection from the other local exchange, an end-to-end message cannot be transferred for time T_{32} or until the first end-to-end message has been received from the other end. T_{32} is chosen to sufficiently reduce the probability that an end-to-end message from the responding local exchange is received at the initiating local exchange or the intermediate relay node, before the ISDN User Part message which contains the response to the signaling connection establishment request.

If a relay exchange receives an end-to-end message in a UDT, in any case the UDT will be forwarded to the succeeding exchange if possible.

The procedure for this case is shown in Figure 4.17 of ATIS-1000113.2015 – Chapter 4.

3.7 Operation of the SCCP Method - Connection-Oriented Service²⁶

3.7.1 Connection Request Sent by the SCCP

(Deleted.)

3.7.2 Connection Request embedded in an ISDN User Part Message

The Initial Address Message and the Information Message may be used for the embedded transfer of the connection request. The procedures described and the figures refer to the case where the connection request is sent in the forward direction. In principle, they also apply when the connection request is sent in the backward direction in the Information Message.

For the connection request embedded in an ISDN User Part message an additional interface is used. This functional interface is described in ATIS-1000112 – Chapter 1 and ATIS-1000112 – Chapter 4. The interface elements are listed in 3.8.

Procedures concerning the SCCP are in accordance with those described in ATIS-1000112 – Chapter 4 and described here only for illustrative purposes.

3.7.3 Successful Set-Up of the ISDN User Part End-To-End Signaling Connection

The following actions are performed at originating, intermediate, and destination exchanges for the set up of an SCCP end-to-end connection using embedded transfer of the connection request in an ISDN User Part message (step numbers in the text correspond to the numbers in Figure 4.18 of ATIS-1000113.2015 – Chapter 4).

3.7.3.1 Actions at the Originating Exchange

The following actions are performed at the originating exchange:

- 1) The ISDN User Part at the originating exchange requests the SCCP to provide the necessary information for a connection request to the called address using the REQUEST Type 1 interface element [Step 1];
- 2) The SCCP at the originating exchange generates a connection request and transfers it to the ISDN User Part using the REPLY interface element [Step 2];
- 3) The ISDN User Part at the originating exchange transmits the connection request embedded in an ISDN User Part message to the ISDN User Part at the destination exchange [Step 3];
- 4) Upon receiving a connection confirm message the SCCP at the originating exchange informs the ISDN User Part using the N-CONNECT Confirmation primitive [Step 12].

²⁶ Facility Request Message in ITU-T Recommendation Q.730 is not specified for U.S. networks.

3.7.3.2 Actions at an Intermediate Exchange

At those intermediate exchanges which are not SCCP relay points the connection request embedded in an ISDN User Part message is left unchanged by the ISDN User Part and transferred into the forward direction.

An SCCP relay point is an exchange where two connection sections belonging to the same end-to-end connection are coupled.

The following actions are performed at an SCCP relay point for the coupling of two connection sections:

- 1) Upon receiving an embedded connection request in an ISDN User Part message, the ISDN User Part at the SCCP relay point transfers the received connection request to the SCCP using the REQUEST Type 2 interface element with the reply request set [Step 4];
- 2) The reply request in the REQUEST Type 2 interface element causes the SCCP at the SCCP-relay point to provide a connection request for a new connection section. The new connection request is provided to the ISDN User Part using the REPLY interface element [Step 5];
 NOTE - The SCCP allocates an outgoing local reference and associates the incoming and outgoing local references and their corresponding point codes.
- 3) The ISDN User Part at the SCCP relay point transmits the connection request embedded in an ISDN User Part message [Step 6];
- 4) Upon receiving a connection confirm message, the SCCP at the SCCP-relay point sends a connection confirm message into the backward direction [Step 11].

3.7.3.3 Actions at the Destination Exchange

The following actions are performed at the destination exchange:

- 1) Upon receiving an embedded connection request in an ISDN User Part message, the ISDN User Part at the destination exchange transfers the received connection request to the SCCP using the REQUEST Type 2 interface element [Step 7];
- 2) The SCCP at the destination exchange informs the ISDN User Part of a request to establish an end-to-end connection using the N-CONNECT Indication primitive [Step 8];
- 3) The ISDN User Part responds to the request using the N-CONNECT Response primitive [Step 9];
- 4) Upon receiving the N-CONNECT Response primitive from the ISDN User Part, the SCCP at the destination exchange sends a connection confirm message into the backward direction [Step 10].

3.7.4 Unsuccessful Set-Up of the SCCP End-To-End Connection

If the ISDN User Part end-to-end signaling connection cannot be extended beyond an intermediate exchange because, for example, interworking occurs, the ISDN User Part at this intermediate exchange initiates the refusal of the connection request which is then performed by the SCCP. The set-up of the physical connection may be continued.

If the ISDN User Part initiates the refusal of a connection request received embedded in the initial address message, in general the following actions are performed (see Figure 4.19 of ATIS-1000113.2015 – Chapter 4):

- 1) Upon receiving an embedded connection request, the ISDN User Part transfers the received connection request to the SCCP using the REQUEST Type 2 interface element with the refusal indicator set;
- 2) Upon receiving the REQUEST Type 2 interface element with the refusal indicator set, the SCCP sends a connection refused message into the backward direction;
- 3) Upon receiving a connection refused message, the SCCP at the originating exchange informs the ISDN User Part using the N-DISCONNECT Indication primitive.

If the SCCP at the SCCP relay point receives a connection refused message instead of a connection confirm message, the incoming connection section is also released by sending a connection refused message into the backward direction.

If the SCCP at the destination exchange fails to set up the requested end-to-end connection, the following actions are performed to refuse the connection request received in a REQUEST Type 2 interface element (see Figure 4.21 of ATIS-1000113.2015 – Chapter 4):

- 1) The SCCP at the destination exchange sends an N-DISCONNECT Indication primitive to the ISDN User Part;
- 2) At the same time the SCCP sends a connection refused message into the backward direction.

In these situations, the call may be released if the ISDN User Part end-to-end signaling connection is essential to satisfy the service requirements of the call.

3.7.5 Unsuccessful Set-Up of the Physical Connection

If the physical connection cannot be set up at an intermediate exchange, in addition to releasing the physical connection so far established the ISDN User Part initiates the refusal of the connection request. The same actions are performed as at an intermediate exchange beyond which a logical connection cannot be extended.

If the physical connection cannot be set up at the destination exchange, the ISDN User Part can initiate either the refusal or the confirmation of the connection request depending on supplementary services. It may be preferred to always confirm the connection request to allow for the initiation of supplementary services by the calling subscriber.

3.7.6 Release of the ISDN User Part End-To-End Signaling Connection

3.7.6.1 Simultaneous Release of the Physical & ISDN User Part End-To-End Signaling Connections

The release of the ISDN User Part end-to-end signaling connection is initiated from the exchange which initiates the release of the call concerned. At the initiating exchange of call release, when Release Message (REL) is transmitted, the ISDN User Part requests SCCP to transmit a Released Message (RLSD). This Released Message contains a cause value of "end user originated" in its cause parameter, if a normal call release initiated by a user is taking place.

Figure 4.21 of ATIS-1000113.2015 – Chapter 4 shows the procedure for this case.

In case that no application requires the ISDN User Part end-to-end signaling connection to be maintained, the ISDN User Part at a local exchange or an exchange performing chaining requests the SCCP to release the SCCP end-to-end connection if it receives a Release Message and the SCCP has not yet received a Released Message at that time (see Figure 4.22 of ATIS-1000113.2015 – Chapter 4).

3.7.6.2 Non-Simultaneous Release of the Physical & the ISDN User Part End-To-End Signaling Connections

Procedures for non-simultaneous release of the physical and the ISDN User Part end-to-end signaling connections are to be defined in appropriate supplementary services procedures.

3.7.7 End-To-End Message Transfer

An end-to-end message is transferred in an SCCP data (DT1/DT2) message according to the procedures defined in ATIS-1000112 – Chapter 4. ISDN User Part interfaces with SCCP via the primitives as defined in staATIS-1000112 – Chapter 1 for this transfer. The data request/indication primitive includes in its user data parameter an ISDN User Part message beginning with the message type code and ending with the parameters.

3.8 Interface Elements Between the ISDN User Part & SCCP (Embedded Transfer)

The ISDN User Part may use the functional interface as designed in ATIS-1000112 – Chapter 1.

Three interface elements are defined for this functional interface:

- The Request Type 1;
- The Request Type 2;
- The Reply.

The contents of these three interface elements are shown in Annex A of ATIS-1000113.2015 – Chapter 4.

Figures 4.18, 4.19, and 4.20 of ATIS-1000113.2015 – Chapter 4 indicate the usage of the interface elements during set up of a circuit switched connection together with a SCCP connection.

3.8A Examples of an SCCP Connection Set-Up by the ISDN User Part

Examples of the set-up of a SCCP connection by the ISDN User Part may be found in Figures 4.13A through 4.15 of ATIS-1000113.2015 – Chapter 4.

4 User facilities

(Deleted. Refer to 1.2 of ATIS-1000113.2015 – Chapter 1.)

4A Generic Supplementary Services Procedures

4A.1 Soliciting Information²⁷

4A.1.1 Requesting Information

An Information Request Message may be sent to any exchange in the forward (backward) call establishment direction after sending (receiving) an Initial Address Message during call set-up.

²⁷ This clause corresponds to ITU-T Recommendation Q.764, Clause 2.1.6.

4A.1.2 Sending Solicited Information

On sending of an Information Request Message a timer (T_{33}) is started. Optionally, a service-specific timer may also be started. No second Information Request Message may be sent in the same direction until a response Information Message is received. If timer T_{33} expires before the response message is received, the procedures in Clause 2.9.7 apply. The value of timer T_{33} is 12-15 seconds to allow for a cascade of Information Request Messages, as described in item (2). If the service-specific timer expires, timer T_{33} shall be stopped, and the appropriate service-specific actions shall be taken.

The response Information Message shall be sent as follows:

- 1) If all the information requested is available locally, then an Information Message containing all the required information is sent in response;
- 2) If all the information is not available locally, but may be available remotely, then an Information Request may be sent to a subsequent exchange in the connection in an attempt to extract the information not locally available. (This Information Request Message may be delayed if one has already been sent and the response not yet received). On receipt of a response, all the information necessary to respond to the original Information Request Message is sent in an Information Message;
- 3) If all the information is not available locally or remotely, then an Information Message containing only the available information is sent and the requested but not delivered information is indicated as "not available", using either the indication in the Information Indicator or an appropriate coding in the requested parameter.

4A.1.3 Receiving a Solicited Information Message

Upon receipt of an Information Message which does neither contain the requested information or an indication that the requested information is not available, the action taken will depend on whether the call can be progressed.

4A.2 Special Processing Request

4A.2.1 Actions Required at the Initiating Exchange

If an exchange recognizes that a call requires some special processing not resident at that exchange, based on available information, the exchange, referred to as the initiating exchange, determines which exchange has the needed processing capability. Associated with the selected exchange, referred to as the special processing exchange, is a routing number that is unique to that exchange. The initiating exchange forms an Initial Address Message in order to route the call to the special processing exchange. In addition to basic call set-up information (see Clause 2.1.1.1(3)), the Initial Address Message shall include:

- The routing number in the Called Party Number parameter;
- The dialed number in the Generic Address parameter;
- An indication of the type of processing required in the Special Processing Request parameter;
- The ISDN User Part Preference Indicator set to "required."

4A.2.2 Actions Required at an Intermediate Exchange

An intermediate exchange, on receipt of an Initial Address Message, shall analyze the called party number (routing number) and the other routing information (Clause 2.1.1.1(1)) to determine the routing of the call. The special processing request indication and the dialed number are passed on transparently to the next exchange.

4A.2.3 Actions Required at the Special Processing Exchange

The special processing exchange, on receipt of an Initial Address Message, shall analyze the called party number to determine if it is a special routing number reserved at the exchange in order to trigger special processing. If the called party number is such a routing number, the special processing exchange analyzes the contents of the Special Processing Request parameter and other information contained in the Initial Address Message (e.g., dialed number) and invokes the required processing.

4A.2.4 Abnormal Conditions

If the special processing exchange receives an Initial Address Message containing a called party number which is a special routing number but does not contain a Special Processing Request parameter, or if the special routing number and the Special Processing Request parameter are received but the dialed number is not received or is not readable, then the exchange should provide reorder tone to the calling party.

If the special processing request exchange receives an Initial Address Message containing a special processing request indication which the exchange does not understand, then the exchange should forward the call to another special processing request exchange or provide reorder tone to the calling party.

4A.3 Transfer of Supplementary Services Notification Information

4A.3.1 Actions at the Exchange which Initiates Message with Notification Information

When an exchange sends an ISDN User Part message, it may include the Notification Indicator parameter to transport notification information for supplementary services. If the Notification Indicator parameter is generated by the exchange invoking the service, it shall be coded according to the service invoked. If notification information is received from the access protocol, the information shall be mapped to the appropriate values in the Notification Indicator parameter.

The Notification Indicator parameter shall be carried in a call control message, if a suitable one is available (Initial Address, Address Complete, Answer, or Call Progress Message). If a suitable call control message is not available, the Notification Indicator parameter shall be carried in the Call Progress Message.

4A.3.2 Actions at an Intermediate Exchange

Upon receiving an ISDN User Part message containing the Notification Indicator parameter, an intermediate exchange shall include the parameter without modification in the outgoing message to the succeeding/preceding exchange.

4A.3.3 Actions at the Exchange which Terminates Message with Notification Information

Upon receiving an ISDN User Part message containing the Notification Indicator parameter, the exchange which terminates the message shall map the contents to the appropriate access protocol.

4A.4 Address Complete Message to Call Progress Message Mapping

The receipt of an Address Complete Message at an intermediate exchange which has previously sent an Address Complete Message shall cause the exchange to:

- 1) Cancel the awaiting address complete timer (T_7);

- 2) Send a Call Progress Message to the preceding exchange containing all of the parameters in the Address Complete Message received with the possible exception of End-to-End Method Indicator and the Echo Control Device Indicator in the Backward Call Indicators parameter which may have to be adjusted to reflect conditions for the incoming circuit. The mandatory Event Information parameter in the Call Progress Message, indicating the reason for sending the Call Progress Message, is set based on the Called Party Status field in the Backward Call Indicators parameter received in the Address Complete Message as follows:
- a. If the Called Party Status field is set to "subscriber free", the Event Information parameter shall indicate "ALERTing";
 - b. If the Called Party Status field is set to "no indication", the Backward Call Indicators parameter indicates "no interworking encountered", and the Address Complete Message contains the Optional Backward Call Indicators with the indication "inband information available", the Event Information parameter shall indicate "inband information now available";
 - c. For all other cases, the Event Information parameter shall indicate "PROGress."

4A.5 Generic Digit Transfer²⁸

This capability enables supplementary services to transfer digit information, which can not suitably be sent within any numbering address parameter, in a Generic Digit parameter. A Generic Digit parameter is transported in an Initial Address Message. Use of the Generic Digit parameter in other call control messages shall not be precluded.

The Generic Digit parameter is generated by the exchange invoking a service. This parameter is passed unchanged to the relevant exchange.

Examples of digit information in the Generic Digit parameter are account code, authorization code, etc.

4A.6 User Network Interaction

This procedure allows a network node to temporarily halt call set-up and play tones or announcements, or both, and collect additional in-band information from the calling user before routing the call further.

This procedure makes use of the User-Network Interaction Indicator (Bit H of Optional Backward Call Indicators parameter).

4A.6.1 Actions at a Controlling Exchange

When an exchange has received an Initial Address Message from a preceding exchange and has determined that additional information is necessary from the calling user before the call can be routed further, the exchange (namely, controlling exchange) shall send an Address Complete Message (ACM) containing the Optional Backward Call Indicator to the preceding exchange with the User-Network Interaction Indicator indicating "user-network interaction occurs, cut through in both directions" and the Inband Information Indicator indicating "inband information or an appropriate pattern is now available."

The Backward Call Indicator parameter shall be coded as follows:

Charge indicator	no indication
Called party's status indicator	no indication

²⁸ This clause corresponds to ITU-T Recommendation Q.730, Clause 1.3.2.

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Called party's category indicator	no indication
End-to-end method indicator	no end-to-end method available
Interworking indicator	no interworking encountered
IAM Segmentation indicator	no indication
ISDN-UP indicator	ISDN-UP used all the way
ISDN access indicator	non-ISDN
Echo control device indicator	coded the same as in the received Nature of Connection Indicators

In the case that the continuity check is performed the sending of ACM shall be withheld until a successful continuity indication has been received (see Clause 2.1.7).

After sending the ACM, the backward transmission path at the controlling exchange is connected to the appropriate tones or announcements, or both. The forward path is cut through to the preceding exchange so that information can be received from the calling user.

Subsequently, the call is routed further. Receipt of an ACM from a succeeding exchange will cause the mapping of ACM to a Call Progress Message as specified in Clause 4A.4. The CPG will transport all parameters of the received ACM.

If a Release message is received for outgoing circuit before an Address Complete Message is received for the outgoing circuit and the Release contains a Cause code which can be mapped into the playing of a tone/announcement, the Release message should not be returned to the preceding exchange (unless prior arrangement has assured that the appropriate announcement can be played). The appropriate tone or announcement should be played from the serving (controlling) exchange.

4A.6.2 Action at an Intermediate Exchange

Clause 2.1.4.2 shall apply. When the User-Network Interaction Indicator indicates "user-network interaction occurs, cut through in both directions", the exchange shall through connect the transmission paths in both connections, if not already connected. The Echo control device indicator in the Backward Call Indicator parameter shall be ignored.

4A.6.3 Action at the Originating Exchange

On the receipt of an ACM, the exchange shall cancel the awaiting address complete timer (T_7) (also known as Network Protection Timer). When the User-Network Interaction Indicator indicates "user-network interaction occurs, cut through in both directions", the exchange shall through connect the transmission paths in both directions. Appropriate progress indication shall be sent to the calling user, if possible. The Echo control device indicator in the Backward Call Indicator parameter shall be ignored.

4A.7 Network Excessive Delay

This procedure is used by a supplementary service at an exchange (namely, controlling exchange) when excessive processing delay is anticipated during call set-up.

This procedure makes use of the Call Completion Delay indicator in the Notification Indicator parameter (see clause 3.24B).

4A.7.1 Actions at a Controlling Exchange

When an exchange has received an IAM and has determined that call set-up will be delayed due to anticipation of excessive processing, the exchange (namely, controlling exchange) shall send an Address Complete Message to the preceding exchange to enable stopping of the awaiting address complete timer (T₇).

The ACM sent from the controlling exchange shall contain Notification Indicator indicating call completion delay. The Backward Call Indicator parameter shall be coded as follows:

Charge indicator	no indication
Called party's status indicator	no indication
Called party's category indicator	no indication
End-to-end method indicator	no end-to-end method available
Interworking indicator	no interworking encountered
IAM Segmentation indicator	no indication
ISDN-UP indicator	ISDN-UP used all the way
ISDN access indicator	non-ISDN
Echo control device indicator	coded the same as in the received Nature of Connection Indicators

In the case that the continuity check is performed the sending of ACM shall be withheld until a successful continuity indication has been received (see Clause 2.1.7.)

Subsequently, the call set-up proceeds normally. However, receipt of the ACM from a succeeding exchange shall cause the mapping of ACM to a CPG as specified in Clause 4A.4. The CPG shall transport all parameters of the received ACM.

4A.7.2 Action at an Intermediate Exchange

Clause 2.1.4.2 shall apply. The Echo control device indicator in the Backward Call Indicator parameter shall be ignored.

4A.7.3 Action at an ACM Controlling Exchange

On the receipt of ACM, the exchange shall cancel the awaiting address complete timer (T₇). The Echo control device indicator in the Backward Call Indicator parameter shall be ignored.

4A.7.4 Action at the Originating Exchange

On the receipt of ACM, the originating exchange shall cancel the awaiting address complete timer (T₇). When the Notification Indicator indicates Call Completion Delay, appropriate progress indication shall be sent to the calling user, if possible. The Echo control device indicator in the Backward Call Indicator parameter shall be ignored.

4A.8 Service Activation²⁹

The procedure described in this clause gives a node in the signaling network the capability to request a simple action to be performed at another node. The procedure can be used to report the acceptance or rejection of the requested action. The procedures described in this clause can only be used if no additional information specific to the requested action or its acknowledgment needs to be included in the message, unless that information is provided for other purposes as well.

If additional information specific to the requested action or its acknowledgment is to be sent and if this information is not provided in the message for other purposes, other procedures such as the Remote Operations Capability described in Clause 4A.9 can be used.

4A.8.1 Service Activation Procedure

Whenever a node in the signaling network determines that there is a need for the invocation of a simple action at another node or to report the result of such an action, the node will indicate this by including the Service Activation parameter in a call control message which is ready for transmission at the appropriate time. If no such call control message is available the Facility message is used. The specific action to be performed or acknowledged is identified by the value of the feature code(s) carried in the Service Activation parameter.

The service activation procedure can be used in a request-response mode, limited to one-cycle or in a unidirectional mode.

It is possible to include multiple feature codes requesting the invocation or acknowledgment of multiple independent actions in a single Service Activation parameter.

The assignment of feature codes and the application of the service activation procedure is up to individual supplementary service definition.

4A.9 Remote Operations Capability³⁰

4A.9.1 General Description

The procedures described in this clause give a node in the signaling network the capability to request that a particular operation be performed at a remote node; the remote node attempts to perform the operation and then reports the outcome of the attempt.

The generic structure of an operation is an elementary request/reply interaction. Remote operations provide in a structured way, an interactive capability which allows nodes to request an operation and receive result or error indications depending on the outcome of the operation. Remote Operations Service is defined in ITU-T Recommendations X.219 and the protocol in X.229.

The Remote Operation procedure makes use of the Remote Operations parameter. This parameter can be carried in any call control message of end-to-end significance and if there is no call control message available, the Remote Operations parameter can be carried in the Facility message.

In addition, the use of the Facility message allows the actions and events related to supplementary services to be clearly separated from those associated with basic call control, hence providing improved stability to the basic call control procedures.

The supplementary services definition will make use of this capability along with the basic call control procedures described in this chapter.

²⁹ This clause corresponds to ITU-T Recommendation Q.730, Clause 1.3.1.

³⁰ This clause corresponds to ITU-T Recommendation Q.730, Clause 1.3.3.

4A.9.2 Remote Operations Procedure

Whenever a node determines that there is a need to invoke an operation at the remote node, the originating node will format a Remote Operations parameter containing the Invoke component which will include the appropriate operation code and the associated parameters. The Remote Operations parameter is sent in any call control message of end-to-end significance if one is available; otherwise the Facility message is used.

Intermediate nodes may attempt to perform the operation upon receipt of this parameter. If the intermediate node does not understand the operation, it shall pass it to the next node. Similarly, any results or rejects not used by the intermediate nodes shall be passed to the next node.

The terminating node will attempt to perform the operation. If the operation can be successfully performed, the outcome is reported in the Remote Operations parameter containing a Return Result component and related parameters. If the operation was unsuccessful, a Return Error component is included in the Remote Operations parameter instead of the Return Result component. If a problem is detected in the requested operation, a Reject component is sent. The Remote Operations parameter is sent in any call control message of end-to-end significant if one is available; otherwise the Facility message is used to send this parameter to the originating node.

4A.9.3 Error Procedures

If a node is unable to process a Remote Operations parameter included in a call control message, then the following options apply:

- 1) The node may reject the call request. The call request is cleared using the procedures described in this chapter. A Return Error or a Reject component with appropriate parameter(s) is also sent to the originating node indicating terminating node's inability to process Remote Operations parameter.
- 2) The node may continue to process the call request according to normal call control procedures and reject the supplementary service invocation by sending a Return Error or a Reject component with appropriate parameter(s) in the Remote Operations parameter. This parameter can be sent either in the Facility message or in any appropriate call control message.
- 3) The node may continue to process the call request according to normal call control procedures and ignore the supplementary service invocation. In this case, the supplementary service at the originating node, which requested the supplementary service invocation at a remote node, will have to recover from the non-receipt of a reply.

The choice of an option depends on the individual supplementary service procedures. If the node does not have knowledge of the specific supplementary service, option 2) is preferred for each component that cannot be processed. Continuation of the call shall be subject to the control of the supplementary service procedures at the originating node. The originating node may allow the call to continue or may clear the call.

If a node is unable to process a Remote Operations parameter included in the Facility message then the following options apply.

- 1) The node may clear the call using the procedures described in Clause 2.2. The node will also send a Return Error or a Reject component with appropriate parameter(s) in the Remote Operations parameter. This parameter will be sent either in the Facility message or in any appropriate call control message.
- 2) The node may continue with the call but reject the supplementary service invocation. A Return Error or a Reject component with appropriate parameter(s) in the Remote Operations parameter is sent to the originating node. The Remote Operations parameter is sent either in the Facility message or in any appropriate call control message.

- 3) The node may ignore the supplementary service invocation. In this case, the supplementary service at the originating node, which requested the supplementary service invocation at a remote node, will have to recover from the non-receipt of a reply.

The choice of an option depends on the individual supplementary service procedures. If the node does not have knowledge of the specific supplementary service, option 2) is preferred for each component that cannot be processed. Continuation of the call shall be subject to the control of the supplementary service procedures at the originating node. The originating node may allow the call to continue or may clear the call.

If a call is cleared and there is an operation pending, the operation is aborted and no response is sent to the originating node. The supplementary service at the originating node will have to recover from this situation.

The supplementary service procedures will clearly describe the handling of components and error procedures specific to the service.

4A.10 Facility Message

A Facility message may be sent in either direction at any phase of the call. The Facility message could be sent or received after a call is answered. Originating exchange, intermediate exchange, and destination exchange are required to recognize the Facility message and shall not treat a Facility message as an unexpected message. Receiving and sending of a Facility message shall not cause change of basic call state.

Facility messages contain action request and response elements (collectively action elements). Examples of action request elements are Service Activation feature codes and Remote Operation Service Element (ROSE) invoke components. Examples of action response elements are Service Activation feature codes and ROSE return result or error components. Other parameters may also contain action elements (for further study).

Any exchange (originating exchange, intermediate exchange, or destination exchange) may initiate an action request element. An exchange which initiates an action request element is an initiating exchange. An exchange which performs the action requested by a received action request element is an action exchange. There may be intermediate exchange(s) between an initiating exchange and an action exchange; each is functioning as a relay exchange.

An initiating exchange generates a Facility message when it initiates an action request element and has no other message ready to transmit the action request element toward the action exchange.

When an exchange receives a Facility message, it separates the message into action elements. For each element received the exchange may act as an action exchange or a relay exchange.

The exchange may delete some of the action request elements from the message. The exchange may initiate new action request elements based on service requirements. If any action request elements remain after this process, the Facility message is forwarded to the next exchange.

An action exchange deletes the action element from the received Facility message. It is the responsibility of the service executing the action to determine if a response is required. If so, the service will generate an appropriate action response element. An action exchange generates a Facility message when it returns a response element and has no other message ready to transmit the response elements towards the initiating exchange. Transmission of the message containing these response elements is independent of further relaying the originally received Facility message.

A relay exchange passes the action element on unchanged.

In the course of processing the received Facility message the exchange may initiate additional action request elements for transfer in the same direction. These elements will be added to the received message.

Any action elements remaining or added after this process are forwarded to the next exchange in the same direction in a Facility message.

An exchange that receives an action request element but does not act on the contents of the element should pass the element on unchanged. If a relay exchange receives a Facility message containing an unrecognized parameter, the Facility message parameter shall be passed on by the relay exchange without affecting the call.

4A.11 Network Specific Facilities

When the length of the network identification field is set to zero in the Network Specific Facilities (NSF) information element received from a DSS1 access, then the services identified in this information element are to be provided by the network side of the DSS1 interface receiving the information element.

If the Originating exchange receives an NSF information element from an ISDN interface identifying a network provider with non-zero length of network identification and the identified network provider is consistent with the existing Transit Network Selection procedures, the Originating exchange routes the call to the indicated network provider and includes the NSF parameter in the outgoing IAM. The network specific facility indicator in the NSF parameter shall be coded identically to the corresponding field in the received NSF information element.

If the Originating exchange receives an NSF information element from an ISDN interface identifying a network provider with non-zero length of network identification, and the identified network provider is not consistent with the existing Transit Network Selection procedures, the call shall be rejected.

Table 4.27 - Switch-through when interworking - ATIS-1000113.2015 – Chapter 4

Systems	Rules on Switch-Through
SS7 -> SS7 No. 6 -> SS7 No. 5 -> SS7 R1 -> SS7	1. For a speech, 3.1 kHz audio, or 7kHz audio call, through connection of the transmission path in the backward direction shall be completed no later than at receipt of an Address Complete Message. 2. For any call, through connection in both directions shall be completed no later than at receipt of an interworking or answer indication.
SS7 -> No. 6	1. When no continuity check is to be made on the outgoing circuit, through connection can occur after sending the Initial Address Message. 2. When a continuity check is to be made on the outgoing circuit, through connection can happen after residual check tone has propagated through the return path of the speech circuit (refer to B1.3 of Annex B of ATIS-1000113.2015 – Chapter 4).
R2 -> SS7	Through connection should occur after receipt of address complete.
SS7 -> No. 5 SS7 -> R1	Through connection can occur after sending ST (End of Pulsing) signal and removal of a possible check loop.
SS7 -> R2	Through connection should occur after sending of address complete.

Table 4.28 - Circuit Query State Actions (sheet 1 of 5) - ATIS-100113.2015 – Chapter 4

NEAR-END STATE	FAR-END STATE	
	UNEQUIPPED	TRANSIENT
UNEQUIPPED	OK	OK
TRANSIENT	OK	OK
ACTIVE - IDLE	set Locally Blocked, print	OK
ACTIVE - Incoming Trunk BUSY	IDLE, set Locally Blocked, print	OK
ACTIVE - Outgoing Trunk BUSY	IDLE, set Locally Blocked, print	OK
LOCALLY BLOCKED - IDLE	OK	OK
LOCALLY BLOCKED -Incoming Trunk BUSY	IDLE	OK
LOCALLY BLOCKED - Outgoing Trunk BUSY	IDLE	OK
REMOTELY BLOCKED - IDLE	clear Remotely Blocked, set Locally Blocked, print	OK
REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, clear Remotely Blocked, set Locally Blocked, print	OK
REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, clear Remotely Blocked, set Locally Blocked, print	OK
LOCALLY BLOCKED AND REMOTELY BLOCKED - IDLE	clear Remotely Blocked, print	OK
LOCALLY BLOCKED AND REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, clear Remotely Blocked, print	OK
LOCALLY BLOCKED AND REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, clear Remotely Blocked, print	OK

Table 4.28- Circuit Query State Actions (sheet 2 of 5) – ATIS-1000113.2015 – Chapter 4

NEAR-END STATE	FAR-END STATE		
	ACTIVE		
	IDLE	Incoming Trunk BUSY	Outgoing Trunk BUSY
UNEQUIPPED	send BLO	send BLO send REL	send BLO send REL
TRANSIENT	OK	OK	OK
ACTIVE - IDLE	OK	send REL	send REL
ACTIVE - Incoming Trunk BUSY	IDLE	send REL, IDLE	OK
ACTIVE - Outgoing Trunk BUSY	IDLE	OK	send REL, IDLE
LOCALLY BLOCKED - IDLE	send BLO	send BLO, send REL	send BLO, send REL
LOCALLY BLOCKED -Incoming Trunk BUSY	IDLE, send BLO	send BLO, send REL, IDLE	send BLO
LOCALLY BLOCKED - Outgoing Trunk BUSY	IDLE, send BLO	send BLO	send BLO, send REL, IDLE
REMOTELY BLOCKED - IDLE	clear Remotely Blocked, print	send REL clear Remotely Blocked, print	send REL clear Remotely Blocked, print
REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, clear Remotely Blocked, print	send REL, IDLE, clear Remotely Blocked, print	clear Remotely Blocked, print
REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, clear Remotely Blocked, print	clear Remotely Blocked, print	send REL, IDLE, clear Remotely Blocked, print
LOCALLY BLOCKED AND REMOTELY BLOCKED - IDLE	send BLO, clear Remotely Blocked, print	send BLO, send REL, clear Remotely Blocked, print	send BLO, send REL, clear Remotely Blocked, print
LOCALLY BLOCKED AND REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, send BLO, clear Remotely Blocked, print	send BLO, send REL, IDLE, clear Remotely Blocked, print	send BLO, clear Remotely Blocked, print
LOCALLY BLOCKED AND REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, send BLO, clear Remotely Blocked, print	send BLO, clear Remotely Blocked, print	send BLO, send REL, IDLE, clear Remotely Blocked, print

BLO - Blocking message, UBL - Unblocking message, REL - Release message

Table 4.28 - Circuit Query State Actions (sheet 3 of 5) – ATIS-1000113.2015 – Chapter 4

NEAR-END STATE	FAR-END STATE		
	LOCALLY BLOCKED		
	IDLE	Incoming Trunk BUSY	Outgoing Trunk BUSY
UNEQUIPPED	OK	send REL	send REL
TRANSIENT	OK	OK	OK
ACTIVE - IDLE	set Remotely Blocked, print	send REL, set Remotely Blocked, print	send REL, set Remotely Blocked, print
ACTIVE - Incoming Trunk BUSY	IDLE, set Remotely Blocked, print	send REL, IDLE, set Remotely Blocked, print	set Remotely Blocked, print
ACTIVE - Outgoing Trunk BUSY	IDLE, set Remotely Blocked, print	set Remotely Blocked, print	send REL, IDLE, set Remotely Blocked, print
LOCALLY BLOCKED - IDLE	send BLO, set Remotely Blocked, print	send BLO, send REL, set Remotely Blocked, print	send BLO, send REL, set Remotely Blocked, print
LOCALLY BLOCKED -Incoming Trunk BUSY	IDLE, send BLO, set Remotely Blocked, print	send REL, IDLE, send BLO, set Remotely Blocked, print	send BLO, set Remotely Blocked, print
LOCALLY BLOCKED - Outgoing Trunk BUSY	IDLE, send BLO, set Remotely Blocked, print	send BLO, set Remotely Blocked, print	send REL, IDLE, send BLO, set Remotely Blocked, print
REMOTELY BLOCKED - IDLE	OK	send REL	send REL
REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE	send REL, IDLE	OK
REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE	OK	send REL, IDLE
LOCALLY BLOCKED AND REMOTELY BLOCKED - IDLE	send BLO	send BLO, send REL	send BLO, send REL
LOCALLY BLOCKED AND REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, send BLO	send BLO, send REL, IDLE	send BLO
LOCALLY BLOCKED AND REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, send BLO	send BLO	send BLO, send REL, IDLE

BLO - Blocking message, UBL - Unblocking message, REL - Release message

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Table 4.28- Circuit Query State Actions (sheet 4 of 5) – ATIS-1000113.2015 – Chapter 4

NEAR-END STATE	FAR-END STATE		
	REMOTELY BLOCKED		
	IDLE	Incoming Trunk BUSY	Outgoing Trunk BUSY
UNEQUIPPED	OK	send REL	send REL
TRANSIENT	OK	OK	OK
ACTIVE - IDLE	send UBL	send REL, send UBL	send REL, send UBL
ACTIVE - Incoming Trunk BUSY	IDLE, send UBL	send REL, IDLE, send UBL	send UBL
ACTIVE - Outgoing Trunk BUSY	IDLE, send UBL	send UBL	send REL, IDLE, send UBL
LOCALLY BLOCKED - IDLE	OK	send REL	send REL
LOCALLY BLOCKED -Incoming Trunk BUSY	IDLE	send REL, IDLE	OK
LOCALLY BLOCKED - Outgoing Trunk BUSY	IDLE	OK	send REL, IDLE
REMOTELY BLOCKED - IDLE	send UBL, clear Remotely Blocked, print	send REL, send UBL clear Remotely Blocked, print	send REL, send UBL clear Remotely Blocked, print
REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, send UBL clear Remotely Blocked, print	send REL, IDLE, send UBL clear Remotely Blocked, print	send UBL, clear Remotely Blocked, print
REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, send UBL clear Remotely Blocked, print	send UBL, clear Remotely Blocked, print	send REL, IDLE, send UBL, clear Remotely Blocked, print
LOCALLY BLOCKED AND REMOTELY BLOCKED - IDLE	clear Remotely Blocked, print	send REL, clear Remotely Blocked, print	send REL, clear Remotely Blocked, print
LOCALLY BLOCKED AND REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, clear Remotely Blocked, print	send REL, IDLE, clear Remotely Blocked, print	clear Remotely Blocked, print
LOCALLY BLOCKED AND REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, clear Remotely Blocked, print	clear Remotely Blocked, print	send REL, IDLE, clear Remotely Blocked, print

BLO - Blocking message, UBL - Unblocking message, REL - Release message

Table 4.28- Circuit Query State Actions (sheet 5 of 5) – ATIS-1000113.2015 – Chapter 4

NEAR-END STATE	FAR-END STATE		
	LOCALLY BLOCKED AND REMOTELY BLOCKED		
	IDLE	Incoming Trunk BUSY	Outgoing Trunk BUSY
UNEQUIPPED	OK	send REL	send REL
TRANSIENT	OK	OK	OK
ACTIVE - IDLE	send UBL, set Remotely Blocked, print	send REL, send UBL, set Remotely Blocked, print	send REL, send UBL, set Remotely Blocked, print
ACTIVE - Incoming Trunk BUSY	IDLE, send UBL, set Remotely Blocked, print	send REL, IDLE, send UBL, set Remotely Blocked, print	send UBL, set Remotely Blocked, print
ACTIVE - Outgoing Trunk BUSY	IDLE, send UBL, set Remotely Blocked, print	send UBL, set Remotely Blocked, print	send REL, IDLE, send UBL, set Remotely Blocked, print
LOCALLY BLOCKED - IDLE	set Remotely Blocked, print	send REL, set Remotely Blocked, print	send REL, set Remotely Blocked, print
LOCALLY BLOCKED -Incoming Trunk BUSY	IDLE, set Remotely Blocked, print	send REL, IDLE, set Remotely Blocked, print	set Remotely Blocked, print
LOCALLY BLOCKED - Outgoing Trunk BUSY	IDLE, set Remotely Blocked, print	set Remotely Blocked, print	send REL, IDLE, set Remotely Blocked, print
REMOTELY BLOCKED - IDLE	send UBL	send REL, send UBL	send REL, send UBL
REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE, send UBL	send REL, IDLE, send UBL	send UBL
REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE, send UBL	send UBL	send REL, IDLE, send UBL
LOCALLY BLOCKED AND REMOTELY BLOCKED - IDLE	OK	send REL	send REL
LOCALLY BLOCKED AND REMOTELY BLOCKED -Incoming Trunk BUSY	IDLE	send REL, IDLE	Ok
LOCALLY BLOCKED AND REMOTELY BLOCKED - Outgoing Trunk BUSY	IDLE	OK	send REL, IDLE

BLO - Blocking message, UBL - Unblocking message, REL - Release message

ATIS-1000113.2015(R2020) – Chapter 4

Table 4.29 - Timers in ATIS-1000113.2015 – Chapter 4 (sheet 1 of 7) - ATIS-1000113.2015 – Chapter 4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE INITIATION FOR	NORMAL TERMINATION	AT EXPIRY	CLAUSE
T ₁	4-15 seconds	Local	When Release Message is sent	At the receipt of Release Complete Message	Retransmit Release Message and restart timer T ₁	2.2.1 2.2.2 2.3.1 2.9.6
T ₂ (Note)						
T ₃ (Note)						
T ₄ (Note)						
T ₅	1 minute	Local	When initial Release Message is sent	At receipt of Release Complete Message	Send Reset Circuit Message, alert maintenance personnel, remove the circuit from service, start T ₁₇ , stop T ₁	2.2.1 2.2.2 2.3.1 2.9.6
T ₆	10-32 seconds (Specified in ITU-T Recommendation Q.118)	Dual	When controlling exchange receives Suspend (network) Message	At the receipt of Resume (network) Message	Initiate release procedure	2.5.1.3 2.5.2.3 2.5.3
T ₇	20-30 seconds	Dual	When the Initial Address Message is sent	When the condition for normal release of address and routing information is met (receipt of an Address Complete or Answer Message)	Release all equipment and connection (Send Release Message)	2.1.1.1 2.1.4.4 2.1.4.8 2.9.8.3
T ₈	10-15 seconds	Local	At receipt of Initial Address Message indicating previous or incoming continuity check	At receipt of Continuity Message	Release all equipment and connection (Send Release Message)	2.1.3B.2 2.1.6.2 2.1.6.3 2.9.8.3
T ₉	2-4 minutes (Specified in ITU-T Q.118)	Dual	When outgoing international exchange receives Address Complete Message	At the receipt of Answer Message	Release all equipment and connection (Send Release Message)	2.9.8.3

NOTE - Timer is not specified for U. S. networks.

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Table 4.29 - Timers in ATIS-1000113.2015 – Chapter 4 (sheet 2 of 7) – ATIS-1000113.2015 – Chapter 4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE INITIATION	FOR	NORMAL TERMINATION	AT EXPIRY	CLAUSE
T ₁₀ (Note)							
T ₁₁	15-20 seconds	Dual	When Address Message is received in interworking situations	Initial	When Address Complete Message is sent	Send Address Complete Message	2.1.4.8
T ₁₂	4-15 seconds	Local	When Blocking Message is sent		At receipt of Blocking Acknowledgment Message	Retransmit Blocking Message and restart T ₁₂	2.9.4
T ₁₃	1 minute	Local	When initial Blocking Message is sent		At receipt of Blocking Acknowledgment Message	Retransmit Blocking Message, alert maintenance personnel, start T ₁₃ , and stop T ₁₂	2.9.4
T ₁₄	4-15 seconds	Local	When Unblocking Message is sent		At receipt of Unblocking Acknowledgment Message	Retransmit Unblocking Message and restart T ₁₄	2.9.4
T ₁₅	1 minute	Local	When initial Unblocking Message is sent		At receipt of Unblocking Acknowledgment Message	Retransmit Unblocking Message, alert maintenance personnel, start T ₁₅ timer and stop T ₁₄	2.9.4
T ₁₆	4-15 seconds	Local	When Reset Circuit Message is sent not due to expiry of T ₅		At the receipt of the Release Complete Message	Retransmit Reset Circuit Message and restart T ₁₆	2.1.6.3 2.9.3.1
T ₁₇	1 minute	Local	When initial Reset Circuit Message is sent		At receipt of the Release Complete Message	Alert maintenance personnel, retransmit Reset Circuit Message, restart T ₁₇ and stop T ₁₆	2.1.6.3 2.9.3.1

NOTE - Timer is not specified for U. S. networks.

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Table 4.29 - Timers in ATIS-1000113.2015 – Chapter 4 (sheet 3 of 7) – ATIS-1000113.2015 – Chapter 4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE FOR INITIATION	NORMAL TERMINATION	AT EXPIRY	CLAUSE
T ₁₈	4-15 seconds	Local	When Circuit Group Blocking Message is sent	At receipt of Circuit Group Blocking Acknowledgment Message	Retransmit Circuit Group Blocking Message and restart T ₁₈	2.9.4
T ₁₉	1 minute	Local	When initial Circuit Group Blocking Message is sent	At receipt of Circuit Group Blocking Acknowledgment Message	Retransmit Circuit Group Blocking Message, alert maintenance personnel, restart T ₁₉ and stop T ₁₈	2.9.4
T ₂₀	4-15 seconds	Local	When Circuit Group Unblocking Message is sent	At receipt of Circuit Group Unblocking Acknowledgment Message	Retransmit Circuit Group Unblocking Message and restart T ₂₀	2.9.4
T ₂₁	1 minute	Local	When initial Circuit Group Unblocking Message is sent	At receipt of Circuit Group Unblocking Acknowledgment Message	Retransmit Circuit Group Unblocking Message, alert maintenance personnel, restart T ₂₁ and stop T ₂₀	2.9.4
T ₂₂	4-15 seconds	Local	When Circuit Group Reset Message is sent	At the receipt of the acknowledgment	Retransmit Circuit Group Reset Message and restart T ₂₂	2.9.3.2
T ₂₃	1 minute	Local	When initial Circuit Group Reset Message is sent	At the receipt of the acknowledgment	Alert maintenance personnel, restart T ₂₃ , retransmit Circuit Group Reset Message, and stop T ₂₂	2.9.3.2

Table 4.29 - Timers in ATIS-1000113.2015 – Chapter 4 (sheet 4 of 7) – ATIS-1000113.2015 – Chapter 4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE FOR INITIATION	NORMAL TERMINATION	AT EXPIRY	CLAUSE
T ₂₄	<2 seconds	Local	When check tone is sent	At the receipt of backward check tone	Send Continuity Message indicating failure, start T ₂₅ , and make automatic repeat attempt (if applicable)	B.1.4
T ₂₅	1-10 seconds	Local	When initial continuity check failure is detected	On expiry	Send Continuity Check Request Message and repeat continuity check	2.1.6.1
T ₂₆	1-3 minutes	Local	When second continuity check failure is detected	When continuity is detected	Send Continuity Check Request Message, restart T ₂₆ , and repeat continuity check	2.1.6.1
T ₂₇	>3 minutes	Local	At receipt of Continuity Message indicating failure of repeat continuity check	At receipt of Continuity Check Request Message	Send Reset Circuit Message and start T ₁₆ and T ₁₇	2.1.6.2 2.1.6.3
T ₂₈	10 seconds	Local	When Circuit Query Message is sent	At receipt of Circuit Query Response Message	Alert maintenance	2.8.2A.2
T ₂₉ (Note)		Local				
T ₃₀ (Note)		Local				
T ₃₁	>6 minutes	Local	Release of ISDN User Part end-to-end signaling connection based on connectionless SCCP	On expiry	Call reference reusable	3.6.2 3.6.4.1 3.6.4.2

NOTE - Timer is not specified for U. S. networks.

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Table 4.29 - Timers in ATIS-1000113.2015 – Chapter 4 (sheet 5 of 7) – ATIS-1000113.2015 – Chapter 4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE INITIATION FOR	NORMAL TERMINATION	AT EXPIRY	CLAUSE
T ₃₂	3-5 seconds	Local	When response to request of end-to-end connection establishment is sent	At receipt of first end-to-end message from remote end	End-to-end message allowed to be sent	3.6.5
T ₃₃	12-15 seconds	Local	When Information Request Message is sent	At receipt of Information Message (or expiration of service-specific timer)	Release call, alert maintenance personnel	2.9.7 3.6.3 4A.1.2
T ₃₄	10-15 seconds	Local	When Loop-Back Acknowledgment Message is sent in response to receipt of Continuity Check Request Message	At receipt of Continuity or Release Message	Release all equipment, send Reset Circuit Message, and start T ₁₆ and T ₁₇	2.1.6.2 2.1.6.3
T ₃₅ (Note)						
T ₃₆	2-4 seconds	Local	When a message is received indicating that another segment follows	Receipt of a Segmentation Message	Proceed with call processing	2.1.4B.3
T ₃₇	30 seconds	Local	When ISDN User Part availability test is started	Receipt of a message from the affected ISDN User Part	Restart availability test	2.10A
T _{ACC,r}	5 seconds	Local	At receipt of ACC indicator	On expiry	Remove ACC controls in the exchange	D.1.2

NOTE - Timer is not specified for U. S. networks.

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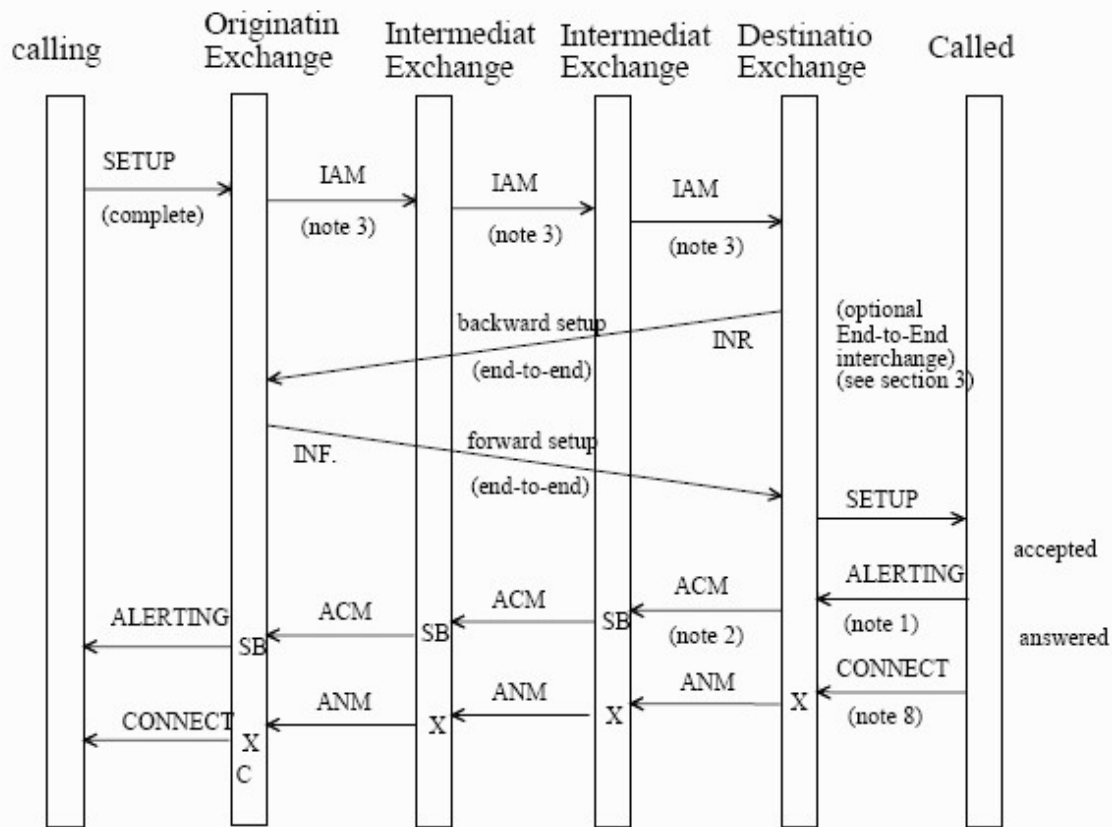
Table 4.29 - Timers in ATIS-1000113.2015 – Chapter 4 (sheet 6 of 7) – ATIS-1000113.2015 – Chapter.4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE FOR INITIATION	NORMAL TERMINATION	AT EXPIRY	CLAUSE
T _{CCR}	2 seconds	Local	When Continuity Check Request Message is sent	At receipt of Loop-Back Acknowledgment Message	Disconnect transceiver, send Reset Circuit Message and start T ₁₆ and T ₁₇	2.1.6.1 2.1.6.3
T _{CCR,r}	20 seconds	Local	At receipt of initial Continuity Message indicating failure	At receipt of Continuity Check Request Message	Send Reset Circuit Message and start T ₁₆ and T ₁₇	2.1.6.2 2.1.6.3
T _{CGB}	5 seconds	Local	At receipt of Circuit Group Blocking Message	At receipt of Circuit Group Blocking or Circuit Group Unblocking Message	Accept subsequent Circuit Group Blocking Message as a new message	2.8.2.2
T _{CRA}	20 seconds	Local	When Circuit Reservation Acknowledgment Message is sent	At receipt of Initial Address Message or Release Message	Initiate release procedure	2.1.3B.2
T _{CRM}	3-4 seconds	Local	When Circuit Reservation Message is sent	At receipt of Circuit Reservation Acknowledgment Message	Initiate release procedure	2.1.3B.1
T _{CVT}	10 seconds	Local	When Circuit Validation Test Message is sent	At receipt of Circuit Validation Response Message	Retransmit Circuit Validation Test Message and restart T _{CVT} ; at second expiry, alert maintenance personnel	C.3.3
T _{EXM,d}	Network dependent	Local	When Initial Address Message is sent to succeeding network	On expiry	Send Exit Message to preceding exchange	2.1.3A.1

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Table 4.29- Timers ATIS-1000113.2015 – Chapter 4 (sheet 7 of 7) – ATIS-1000113.2015 – Chapter 4

SYMBOL	TIME-OUT VALUE	SIGNIFICANCE	CAUSE INITIATION	FOR NORMAL TERMINATION	AT EXPIRY	CLAUSE
T _{GRS}	5 seconds	Local	At receipt of Circuit Group Reset Message	At receipt of Circuit Group Reset Message	Accept subsequent Circuit Group Reset Message as a new message	2.9.3.2
T _{HGA}	0-5 minutes	Local	Carrier loss	Carrier restoral	Alert maintenance personnel	C.5.1
T _{SCGA}	0-2 minutes	Local	On failure of initial demand continuity check in SCGA group	On success of demand continuity check in SCGA group	Alert maintenance personnel	C.4.3
T _{SCGA,d}	5-120 seconds	Local	On failure of demand continuity check in SCGA group	On expiry	Initiate demand continuity check on another circuit in failed group	C.4.3



X switchpath must be complete at this point
 SB switchpath completed in the backward direction
 C charging begins (optionally charging may begin prior to receipt of

IAM Initial Address Message
 ACM Address Complete Message
 ANM Answer Message
 INF Information
 INR Information Request

NOTE - The following notes apply to the call setup sequence:

- 1) The Alerting (Call Confirmation) message may not be given by a called terminal having automatic answer. Under these circumstances when the Connect (Call Acceptance) message is received Answer Message will sent as soon as through connection of the speech path has been completed.
- 2) For telephone calls within the ISDN, ringing tone will be applied by the destination exchange after the Address Complete Message. For data calls, application of ringing tone is not required.
- 3) The continuity check may be applicable on an intermediate circuit if analog circuits are used.
- 4) Access protocol example is for point to point operation only. The access messages are representative of function only and the names may change.

Figure 4.32 - Successful ordinary call (en bloc operation) - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.33 - Successful ordinary call (overlap operation) - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.34 - Transfer of user to user data on call setup - ATIS-1000113.2015 – Chapter 4

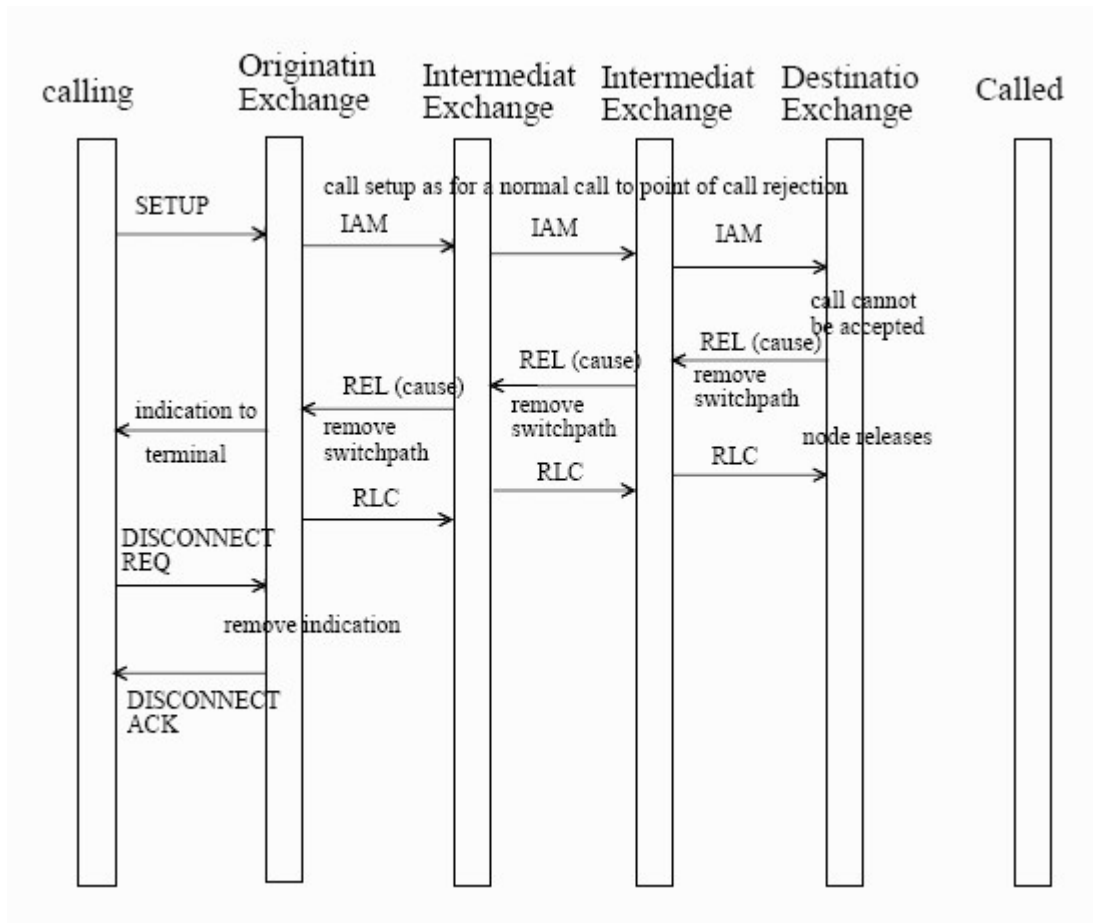


Figure 4.35 - Unsuccessful call setup (no-rerouting) - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.36 - Unsuccessful call setup (with rerouting) - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.37 - Suspend request and resume - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.38 - Suspend request with no reconnection - ATIS-1000113.2015 – Chapter 4

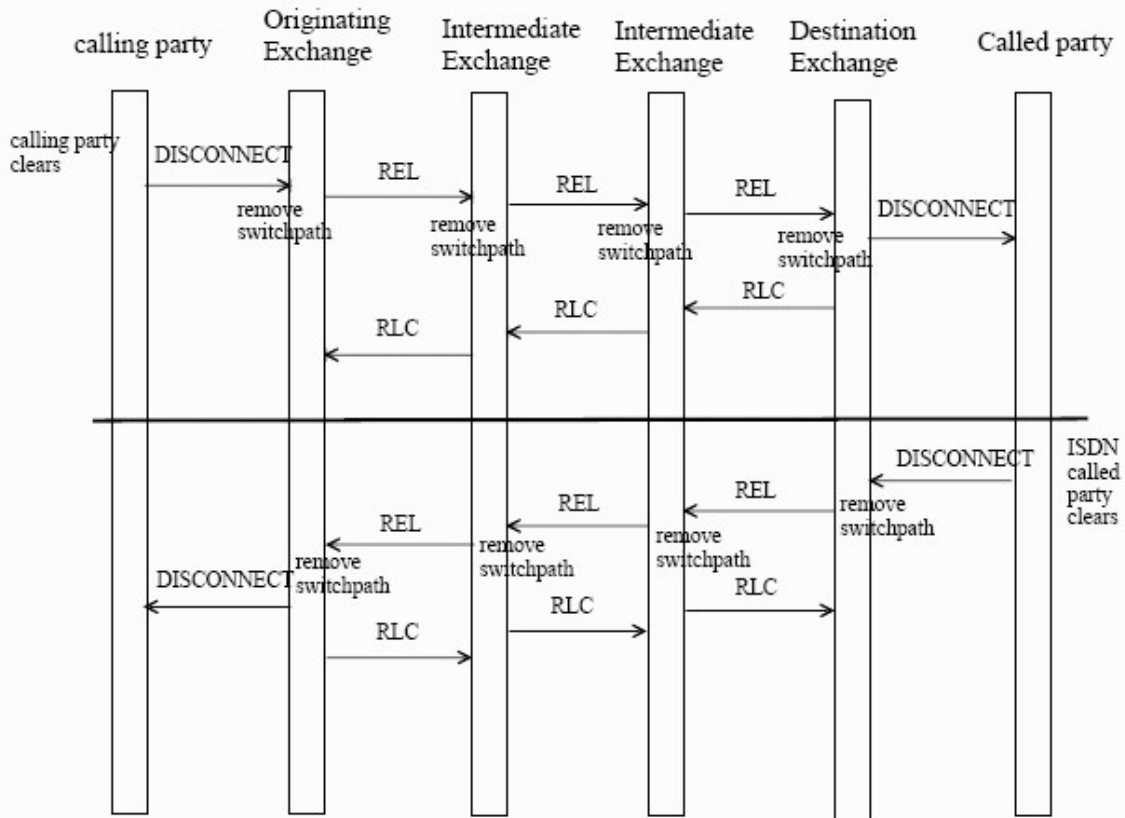


Figure 4.39 - Normal call release (ISDN called party) - ATIS-1000113.2015 – Chapter 4

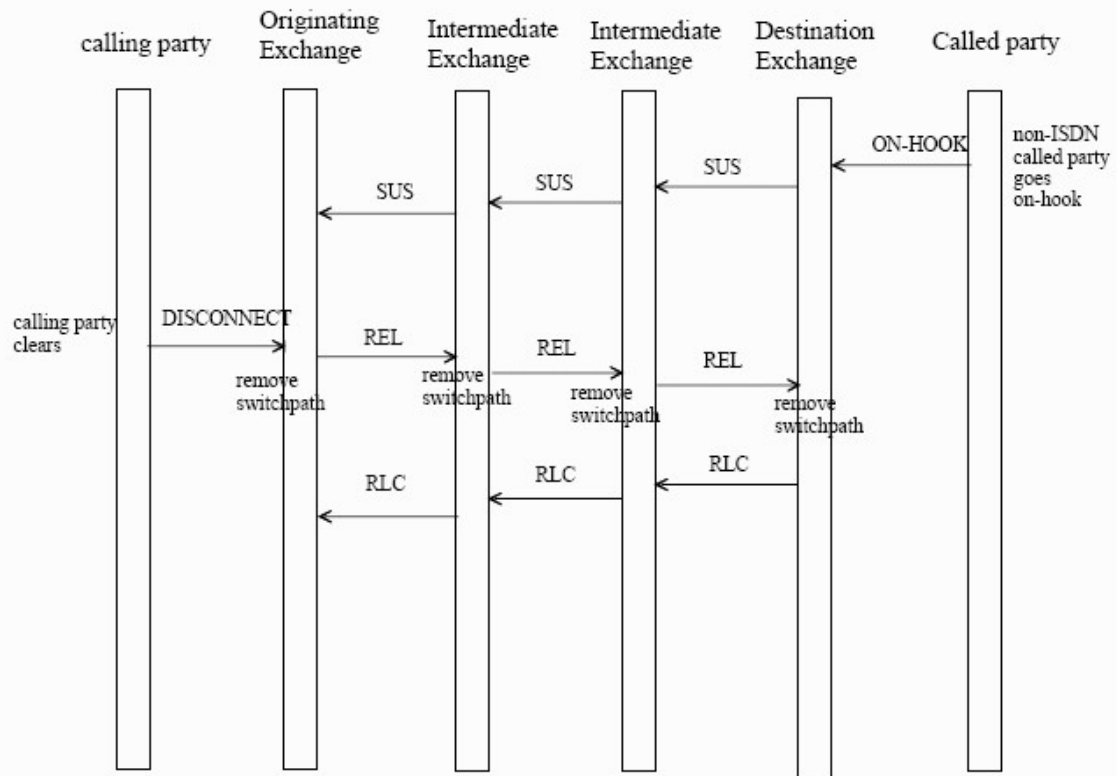


Figure 4.39A - Normal Call Release (non-ISDN called party) - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.40 - Delayed release - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.41 - In call modification - Successful - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.42 - In call modification – Not allowed and failed - ATIS-1000113.2015 – Chapter 4

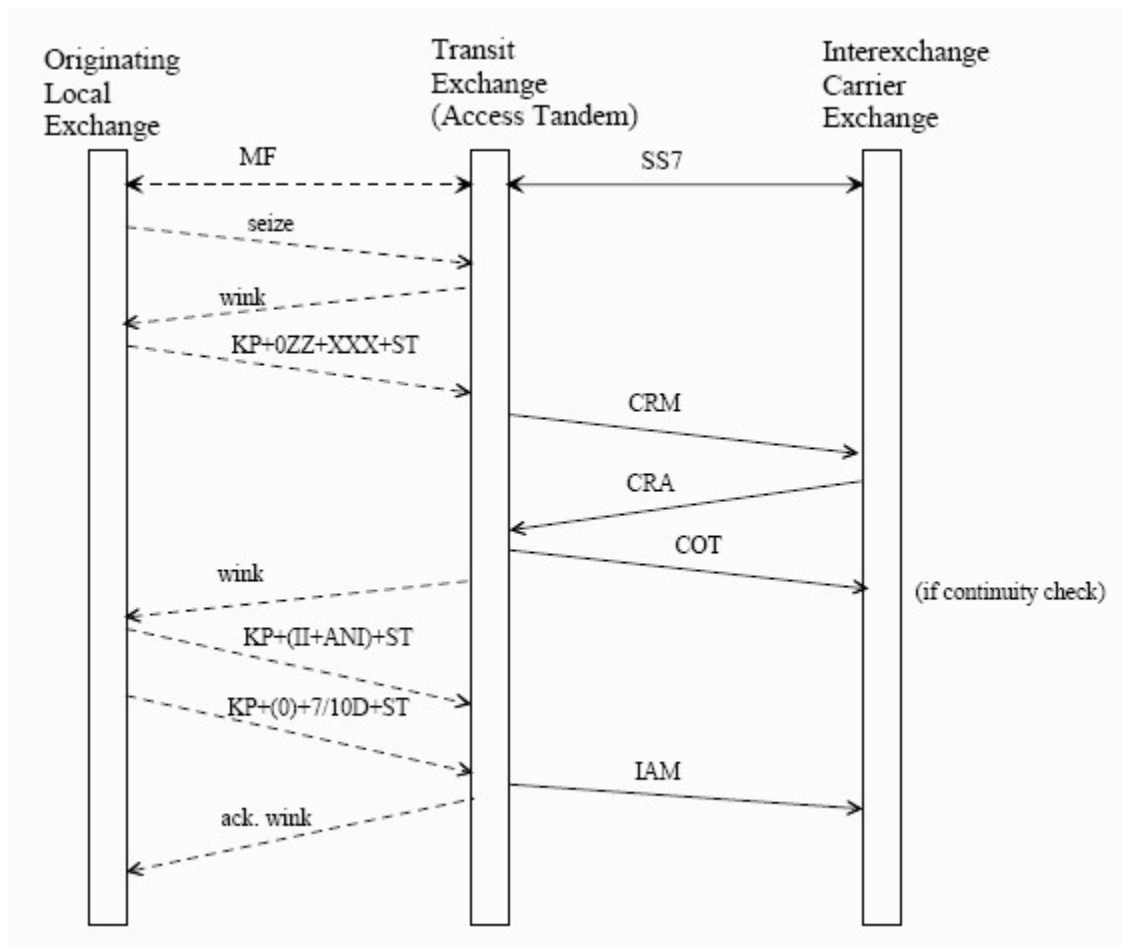


Figure 4.42A - Successful call using circuit reservation procedure - ATIS-1000113.2015 – Chapter 4

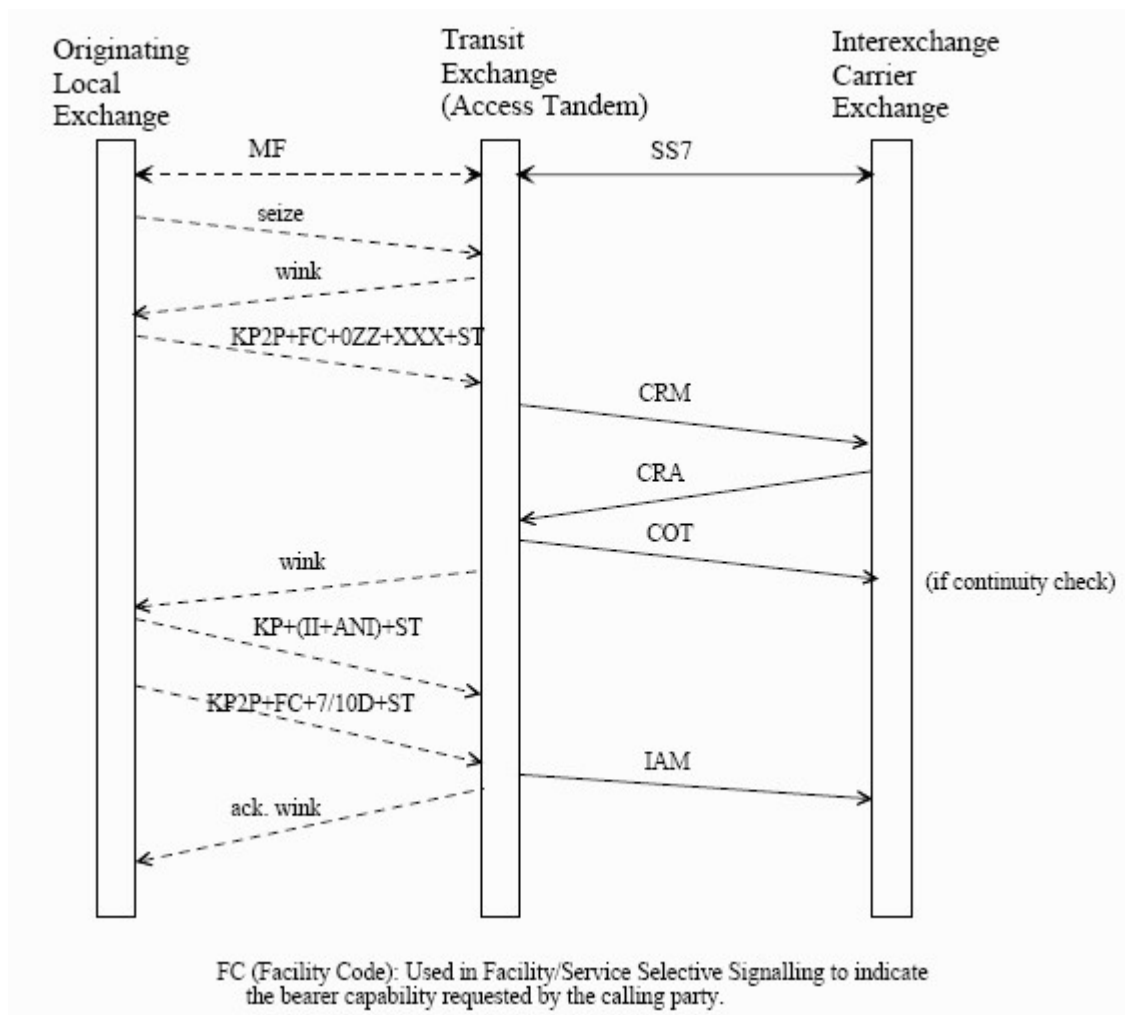


Figure 4.42B - Successful call using circuit reservation procedure with Facility/Service Selective Signaling - ATIS-1000113.2015 – Chapter 4

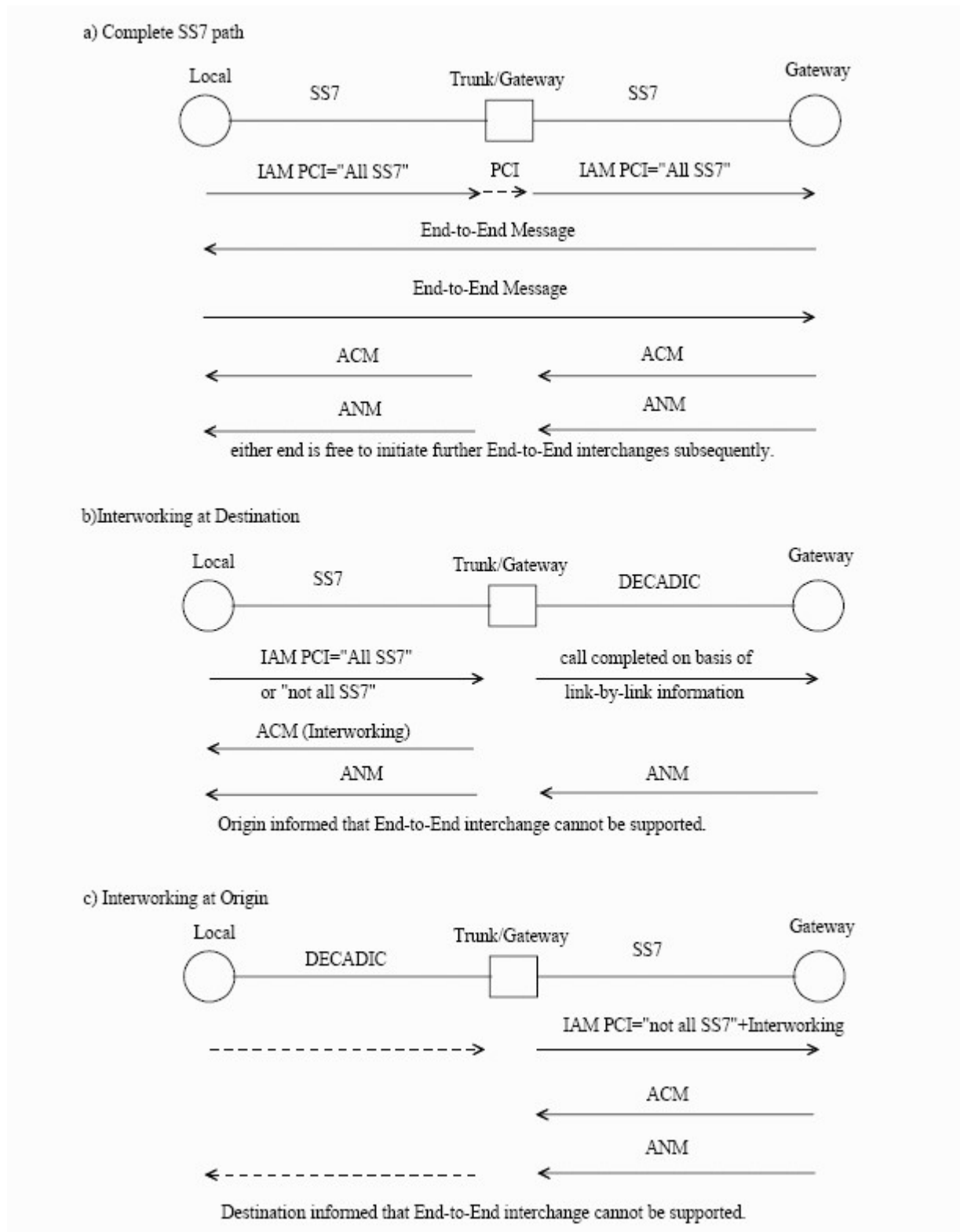


Figure 4.43 - Operation of end to end protocol (pass along method) - ATIS-1000113.2015 – Chapter 4

Deleted. (No procedure specified for U.S. networks)

Figure 4.44 - Setup resource available, coupling in B - ATIS-1000113.2015 – Chapter 4

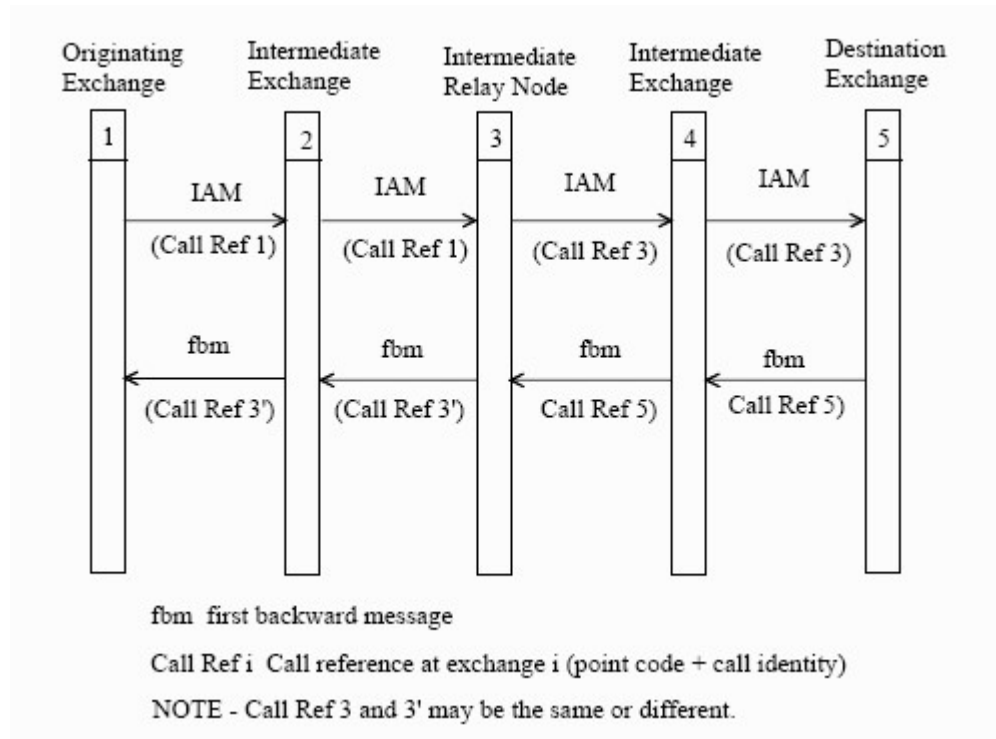


Figure 4.44A - Simultaneous establishment of bearer connection and an ISDN User Part end-to-end signaling connection, based on SCCP connectionless class - ATIS-1000113.2015 – Chapter 4

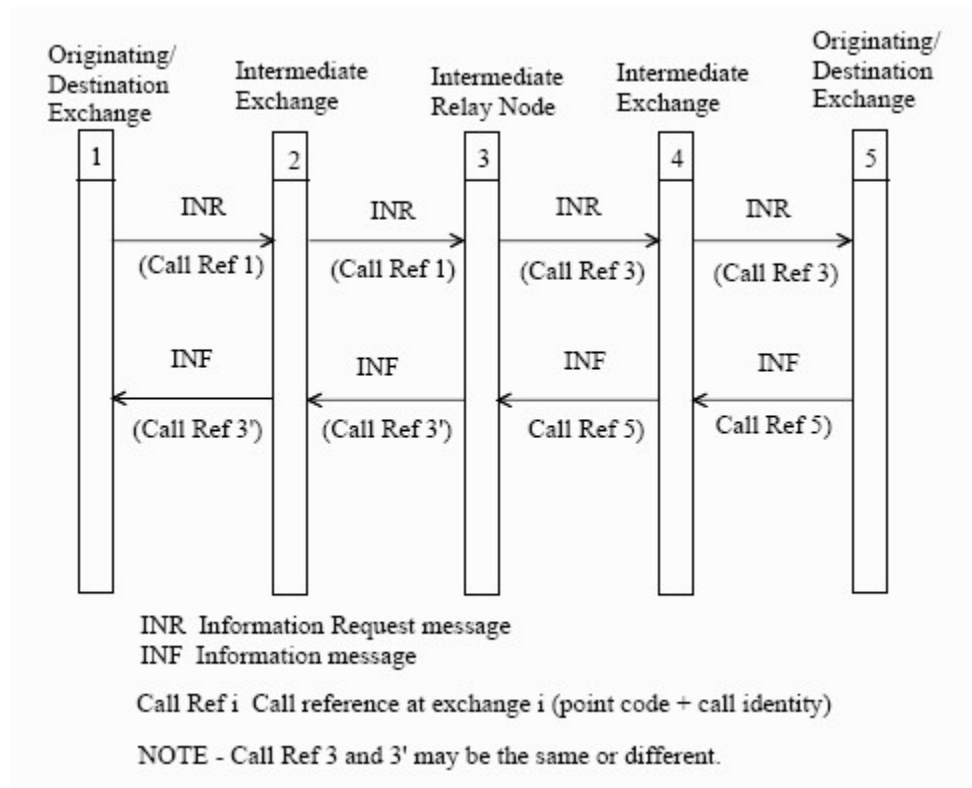


Figure 4.44B - Establishment of ISDN User Part signaling connection based on SCCP connectionless class, after the establishment of a circuit-associated signaling path - ATIS-1000113.2015 – Chapter 4

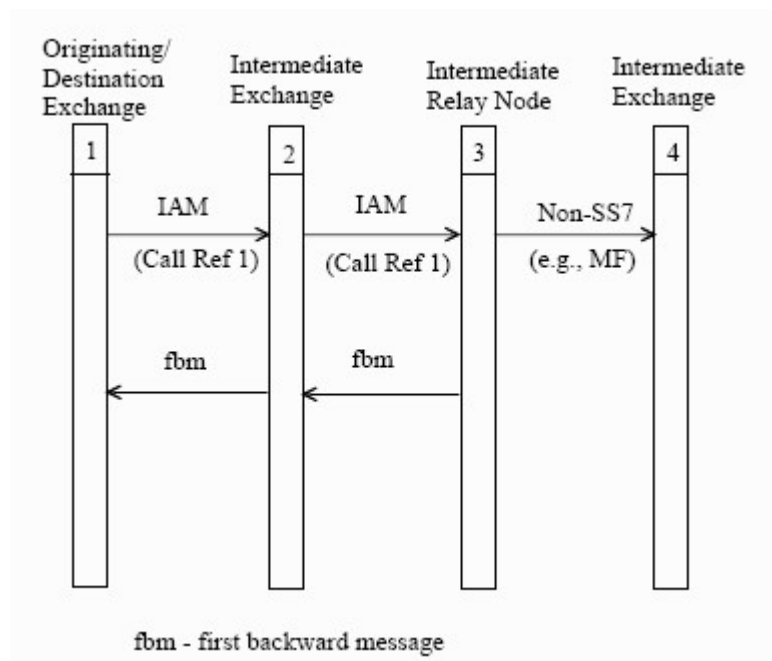


Figure 4.45 - Unsuccessful establishment of ISDN User Part signaling connection based on SCCP connectionless class, e.g., do to interworking with PSTN - ATIS-1000113.2015 – Chapter 4

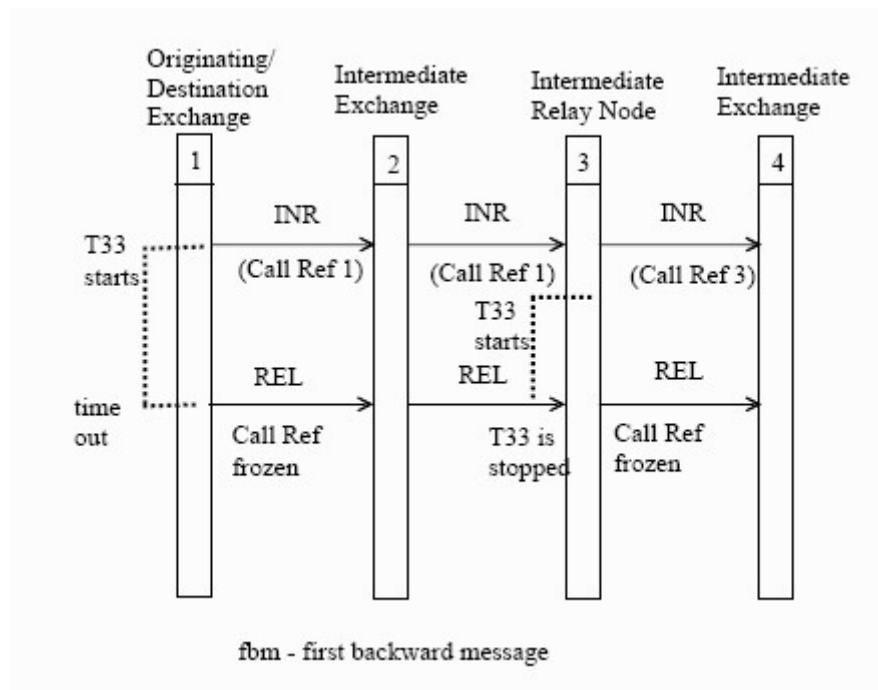


Figure 4.46 - No response from SCCP after time T33 after the transmission of the originating call reference, during establishment of an ISDN User Part end-to-end signaling connection based on SCCP connectionless class - ATIS-1000113.2015 – Chapter 4

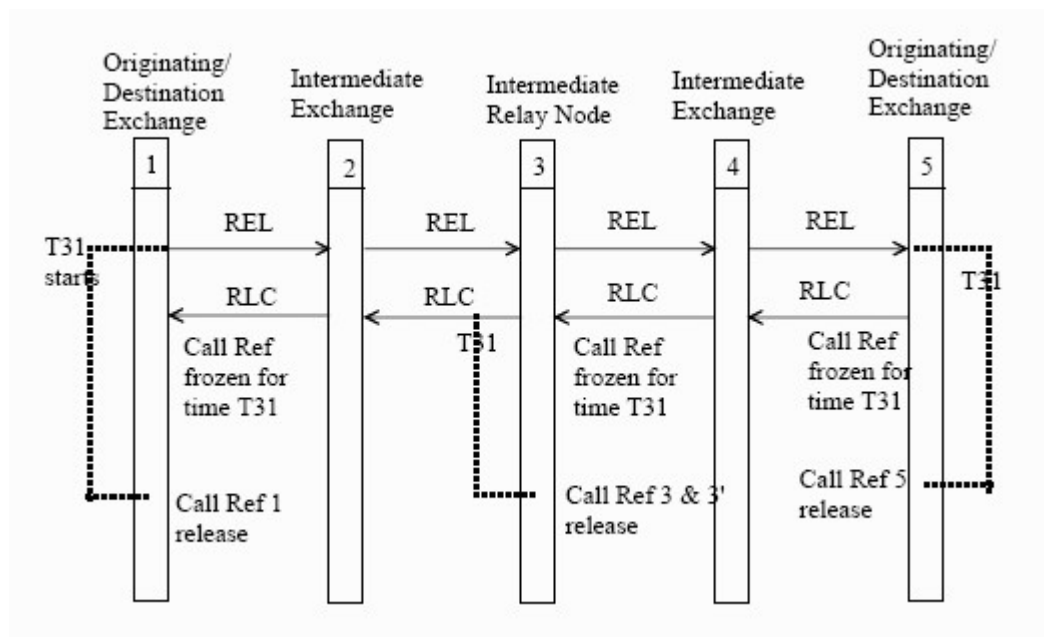


Figure 4.47 - Simultaneous release of a bearer connection and an ISDN User Part end-to-end signaling connection based on SCCP connectionless class - ATIS-1000113.2015 – Chapter

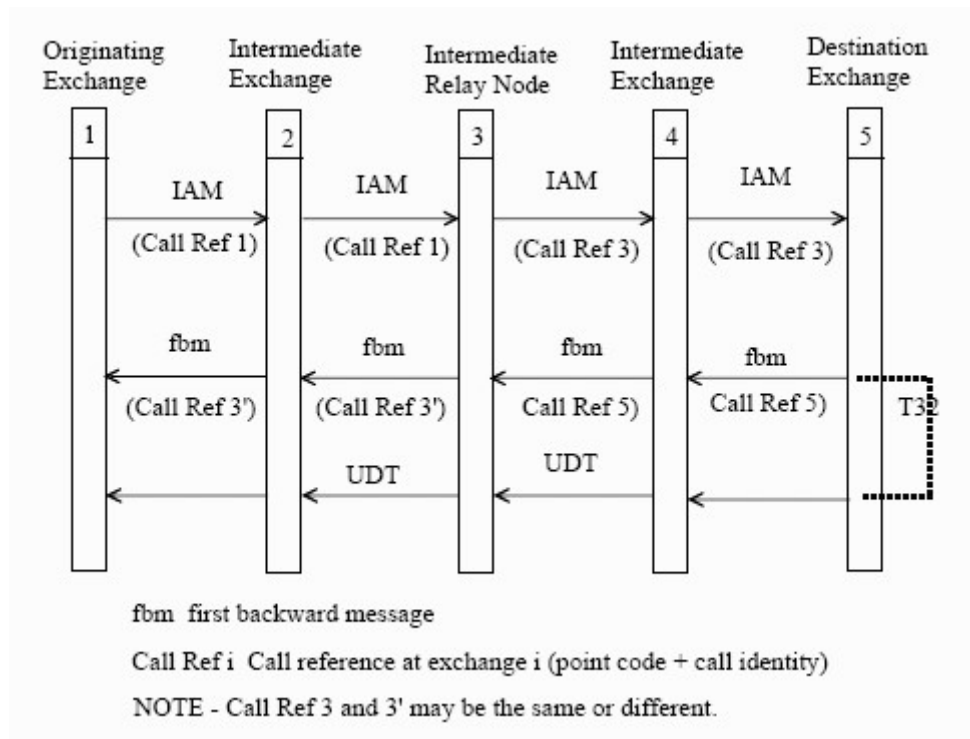


Figure 4.48 - Transfer of UDT message from the local exchange which has responded to the ISDN User Part signaling connection establishment request - ATIS-1000113.2015 – Chapter 4

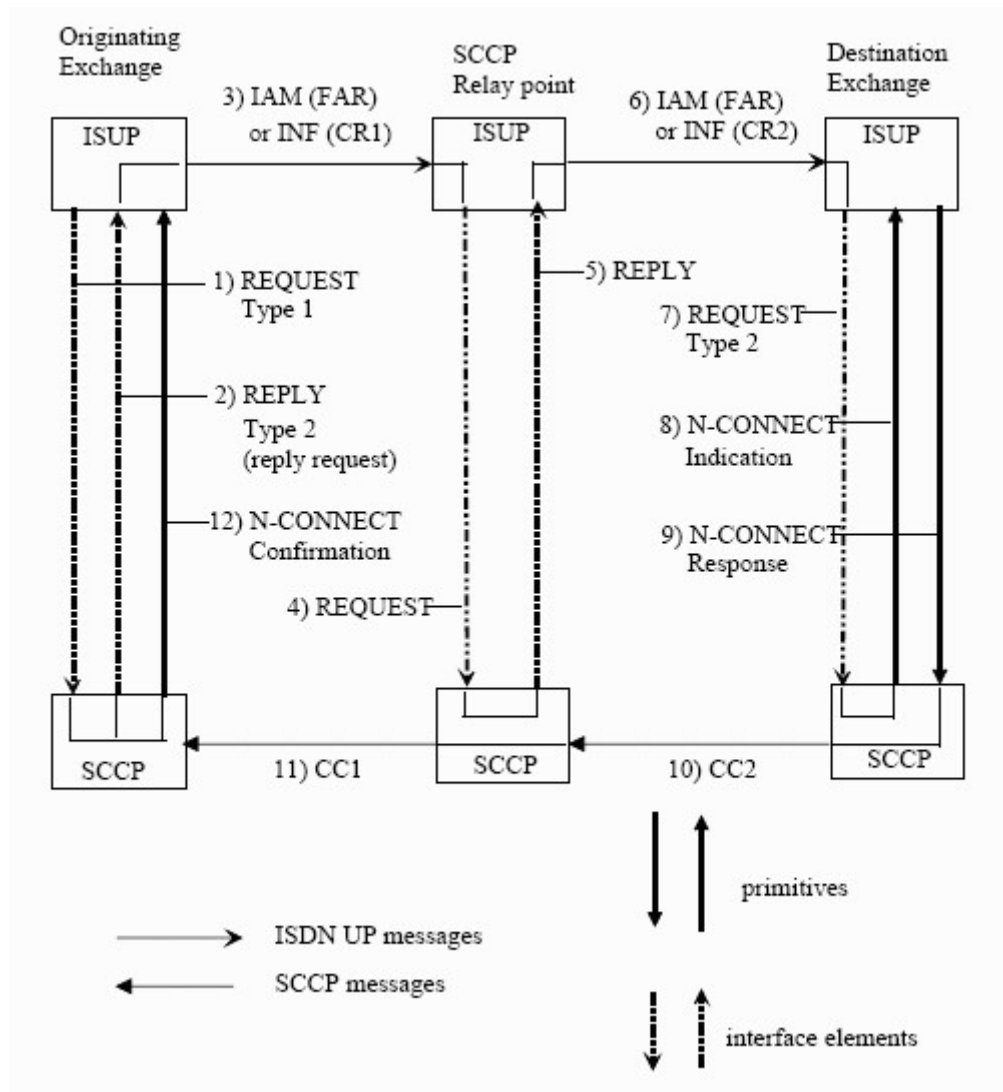


Figure 4.49 - Embedded transfer of connection request actions under successful setup of SCCP end-to-end connection - ATIS-1000113.2015 – Chapter 4

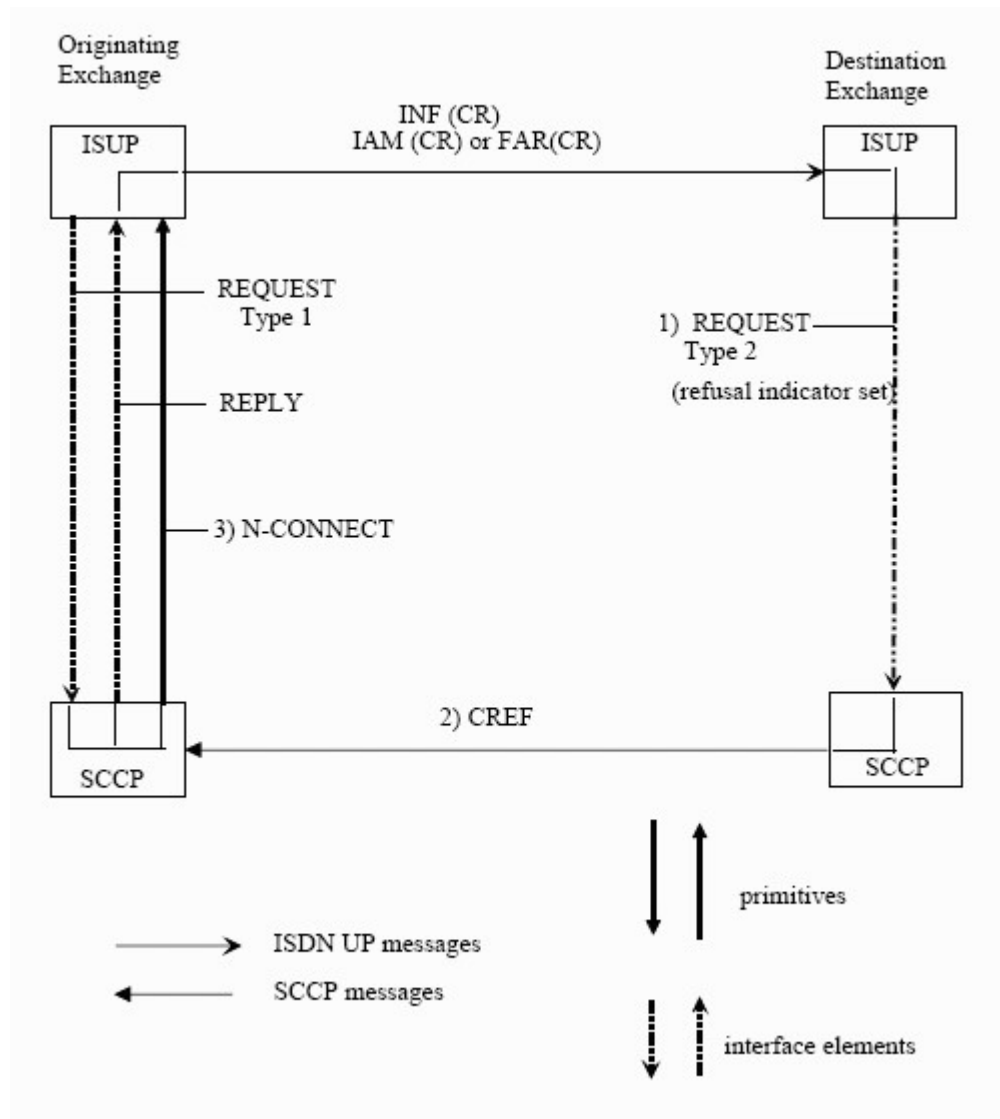


Figure 4.50 - Refusal of the connection request initiated by the ISDN User Part - ATIS-1000113.2015 – Chapter 4

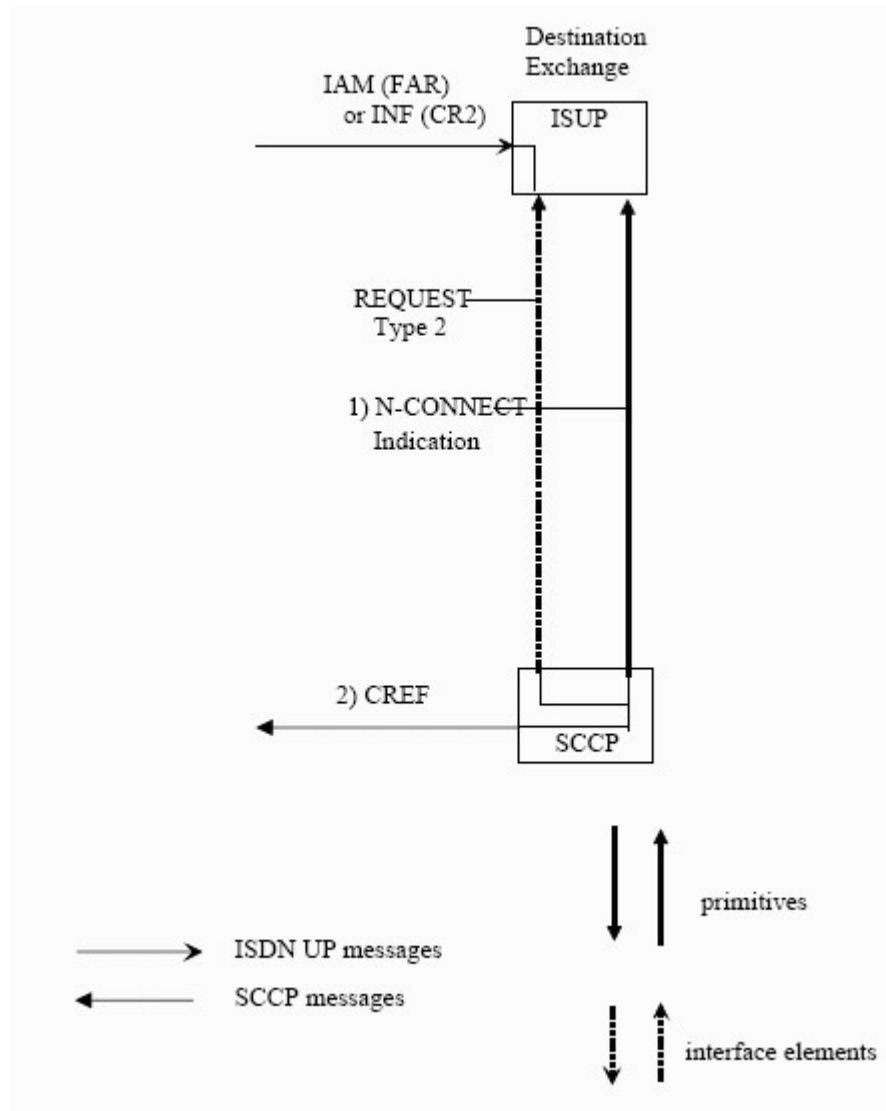


Figure 4.51 - Failure of the SCCP at the destination exchange to setup the requested end-to-end signaling connection - ATIS-1000113.2015 – Chapter 4

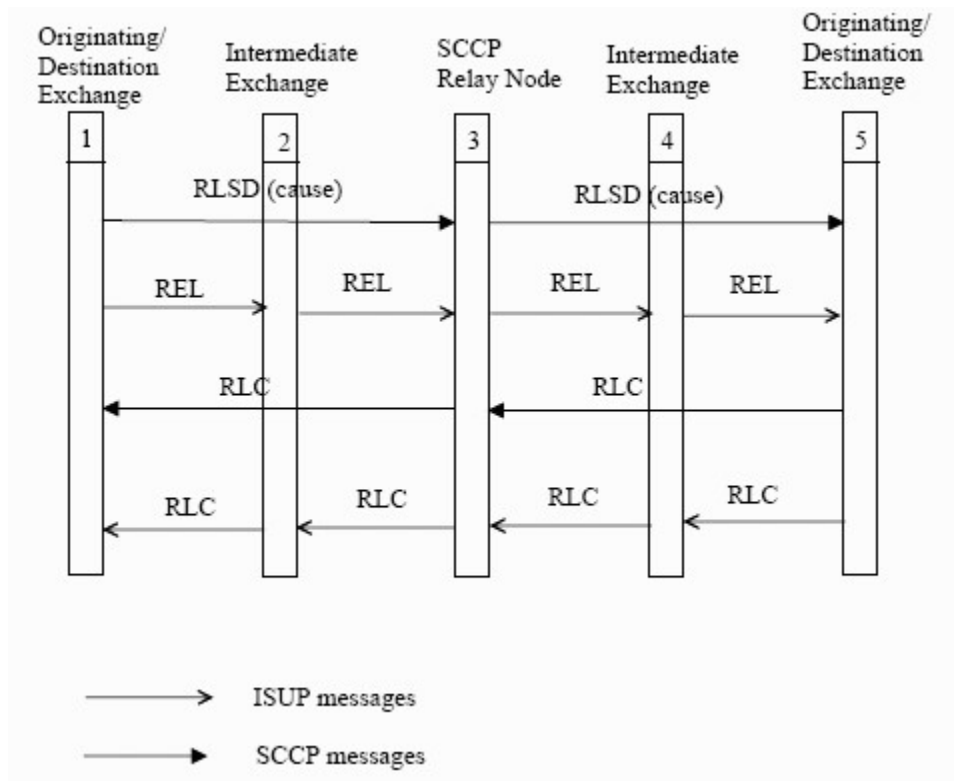
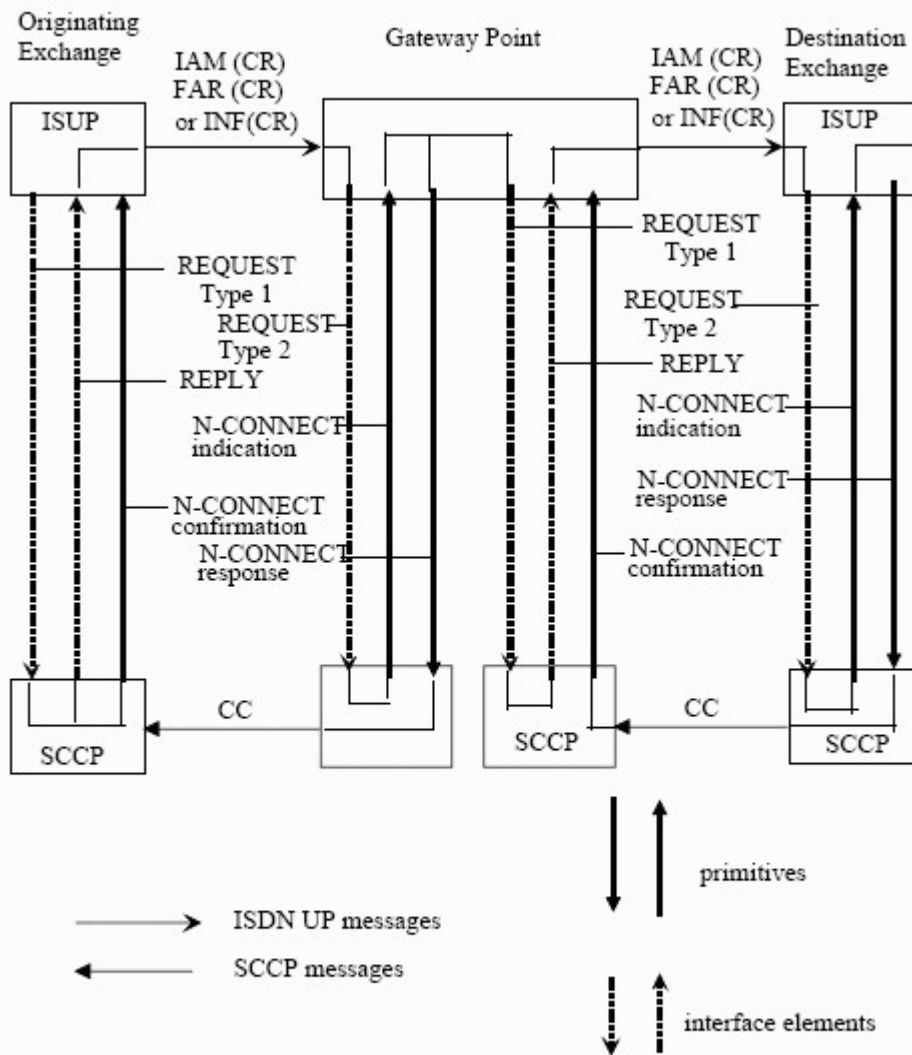


Figure 4.52 - Simultaneous release of bearer connection and an ISDN User Part end-to-end signaling connection based on SCCP connection-oriented class - ATIS-1000113.2015 – Chapter 4



The outgoing end-to-end connection is assumed to be the same type as the incoming end-to-end connection.

Figure 4.53 -Chaining of the end-to-end connections - ATIS-1000113.2015 – Chapter 4

Annex A³¹: Contents of Interface Elements between the ISDN User Part & the SCCP

(informative)

These interface elements are defined in the SCCP specification, ATIS-1000112, and are included here for information.

A.1 Contents of the Request Type 1

The Request Type 1 interface element may contain the following parameters:

- Connection identification (for further study);
- Receipt confirmation selection;
- Expedited data selection;
- Quality of service parameter set.

A.2 Contents of the Request Type 2

The Request Type 2 interface element may contain the following parameters:

- Network indicator (for further study);
- Protocol class;
- Credit;
- Connection identification (for further study);
- Source local reference;
- Originating signaling point code;
- Reply request;
- Refusal indicator.

A.3 Contents of the Reply

The Reply interface element may contain the following parameters:

- Source local reference;
- Protocol class;
- Credit;
- Connection identification (for further study).

³¹ This Annex corresponds to Appendix I in ITU-T Recommendation Q.730.

Annex B: Continuity check clauses

(informative)

The following clauses relative to the continuity check have been extracted from the Telephone User Part, Signaling Procedures, ITU-T Recommendation Q.724, Clauses 7 and 8, since these specifications are directly applicable to the ISDN User Part, Signaling Procedures, ATIS-1000113.2015 – Chapter 4.

B.1 Continuity-Check for 4-Wire Speech Circuits

B.1.1 General

This specification relates only to that part of a 4-wire connection served by Signaling System 7. The part of the speech path to be checked may include a circuit with speech interpolation. As the presence of active echo suppressors or cancellers in the circuit would interfere with the continuity-check, it is necessary to disable the suppressors or cancellers during the check and to re-enable them, if required, after the check has been completed.

The *transceiver* (check-tone transmitter and receiver) is connected to the *go* and *return* paths of the outgoing circuit at the first and each succeeding exchange, excluding the last exchange, in that part of the connection served by Signaling System 7. The *check-loop* should be connected to the *go* and *return* paths of the incoming circuit at each exchange except the first in that part of the connection served by Signaling System 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.

B.1.2 Transmission Requirements

B.1.2.1 Transmitting Equipment

The *check-tone* frequency will be 2010 Hz $\pm$ 8 Hz. For international and national applications the sending level of the check-tone will be $-12 \text{ dBm} \pm 1 \text{ dB}$.

B.1.2.2 Check-Loop

The check-loop will have a loss of $0 \text{ dB} \pm 0.1 \text{ dB}$, taking into account any difference between the relative levels of the two paths at the point of attachment.

B.1.2.3 Receiving Equipment

The check-tone receiver will have the following characteristics:

1) Operating requirements:

- Check-tone frequency: $2010 \text{ Hz} \pm 30 \text{ Hz}$;
- Check-tone level range for international and national applications: The absolute power level N of the check-tone should be within the limits $(-18 + n) \text{ dBm} \leq N \leq (-6 + n) \text{ dBm}$ where n is the relative power level at the receiver input;
- Recognition time: 30-60 ms;

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

2) Non-operating requirements:

- Signal frequency: outside the frequency band $2010 \text{ Hz} \pm 200 \text{ Hz}$;
- Signal level for international application: below or equal to $-22 \text{ dBm} + n \text{ dBm}$. 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 $(-18+n) \text{ dBm} \leq N \leq (-6+n) \text{ dBm}$ will serve as a Go/No-go check on the links in that part of the international connection served by Signaling System 7.

3) Release requirements: If the receiver is used to test for the removal of check-tone (see clause B.1.3)

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

B.1.3 Continuity-Check Procedure

See Clause 2.1.6 of chapter ATIS-1000113.2015 – Chapter 4.

B.1.4 Continuity-Check Timing

B.1.4.1 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 (T_{24}).

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

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

where

T_P	one-way propagation time of the speech circuit and the signaling link (where these times are the same);
T_{TC}	speech interpolation clip time for two speech interpolation systems in series (for connections not using speech interpolation $T_{TC} = 0$);
T_R	receiver response time;
T_L	loop connecting time (maximum);
T_T	transceiver connecting time (minimum);
T_{IAM}	emission time of the longest Initial Address Message.

If retransmission of an Initial Address Message is to be included in T_{CR} , the following formula may be used:

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

where

T_{FISU}	emission time of a fill-in signal unit (length of a fill-in signal unit);
T_X	time between receiving an Initial Address Message and emitting a signal unit containing an acknowledgment for that Initial Address Message, or time between receiving a signal unit asking for retransmission and emitting the Initial Address Message to be retransmitted.

B.1.4.2 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 or cancellers should be related to the following stages of progress in the establishment of the connection:

- 1) **Preparation at Signaling System 7 exchange applying the transceiver:** Action should be initiated when the Initial Address Message is available for transmission in the Message Transfer Part;
- 2) **Preparation at Signaling System 7 exchange connecting the check-loop:** Action should be initiated at the moment of recognition of the Initial Address Message received;
- 3) **Disconnection at Signaling System 7 exchange connecting the check-loop:** Action follows the receipt of the Continuity Message (success or failure indication) or the Release Message or the emission of messages containing information that the call cannot be established, for example, containing the cause value "no circuit available";
- 4) **Disconnection at Signaling System 7 exchange applying the transceiver:** Action should be initiated on the successful completion or the failure of the continuity-check.

Exceptionally, if disconnection has not previously occurred, action should be initiated at the moment of recognition of the Address Complete Messages, the Answer Messages, messages indicating that the call cannot be established, or on the emission of Release Message.

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

B.1.5 Continuity-Check Test Calls

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.

When the outgoing Signaling System 7 exchange intends to initiate the procedure, it sends to the following exchange a Continuity Check Request Message and it connects the transceiver to the outgoing speech circuit. On receipt of the Continuity Check Request Message, the following exchange connects the loop to the involved circuit. On detection of the backward tone within the time-out specified in clause B.1.4.1 the outgoing exchange will disconnect the transceiver and the circuit will be returned to idle with a Release/Release Complete Message sequence.

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 Clause 2.1.6 of ATIS-1000113.2015 – Chapter 4; the clause referring to the repeat attempt is not relevant in this case).

If an exchange receives an Initial Address Message relating to a circuit for which it has sent a Continuity Check Request Message (that is, in case of collision on a both-way operated circuit), it will abort the continuity-check test call, disconnect the transceiver and complete the incoming call.

An exchange receiving a Continuity Check Request Message after having sent an Initial Address Message, will ignore it and continue the call set-up procedure.

B.1.6 2-Wire Continuity Check Emulation on a 4-Wire Switch

An exchange terminating a 4-wire circuit is recommended to provide an additional procedure using two tone continuity check procedures. Optionally, by agreement between connecting 4-wire exchanges,

either

- a) Both exchanges emulate 2-wire exchanges in the continuity check procedure of Clause B.2 (Continuity-check for 2-wire speech circuits). Note, this requires an equipment upgrade of both exchanges to detect 1780 Hz tone.

or

- b) One of the exchanges terminating a 4-wire circuit may emulate operation of a 2-wire exchange in the continuity check procedure in clause B.3 (Continuity-check between a 2-wire and a 4-wire exchange), while the far-end exchange must furnish 4-wire to 2-wire procedure. Note, in this case, only one exchange requires an equipment upgrade, however, there is increased administration requirement to ensure correct 4-wire/2-wire configuration.

The use of two tone continuity check procedures will allow detection of inadvertent loops in the trunk facility between exchanges that terminate 4-wire circuits because different frequencies are transmitted and received.

B.2 Continuity-Check for 2-Wire Speech Circuits

In general the same procedure as described in B.1 is used for the continuity-check of 2-wire speech circuits except the check-loop has to be replaced by a transponder and in the backward direction the frequency 1780 Hz $\pm$ 20 Hz is used.

B.3 Continuity-Check Between a 2-Wire & a 4-Wire Exchange

At the exchange that terminates the 4-wire speech circuit, the transmitting frequency will be 1780 Hz $\pm$ 20 Hz and the receiving frequency will be 2010Hz $\pm$ 30 Hz. At the exchange that terminates the 2-wire speech circuit, the transmitting and receiving frequencies will be 2010 Hz $\pm$ 8 Hz and 1780 Hz $\pm$ 30 Hz, respectively.

Annex C³²: Circuit & Circuit Group Maintenance Requirements

(informative)

The following clauses relate to circuit and circuit group maintenance requirements.

C.1 Circuit Test Calls

Test Calls over Common Channel signaling circuits may be used to test the transmission quality of circuits.

C.1.1 Test Calls to a Test Termination

C.1.1.1 General

This procedure supports the establishment and release of calls to a test facility from a maintenance or circuit test position. Testing may be performed on idle or idle-and-blocked circuits. Test calls will not alter the blocked status of the circuits used in any part of the call.

The following test terminations are identified by the following codes:

100	balance and noise test termination (type 100 test line);
101	test board communication (type 101 test line);
102	milliwatt test (type 102 test line);
103	supervisory and signaling test circuit (type 103 test line) (for further study);
104	transmission measuring and noise checking (type 104 test line);
105	automatic transmission measuring test (type 105 test line);
106	spare;
107	data transmission test (type 107 test line);
108	digital circuit loopback test (type 108 test line);
109	echo canceller test (type 109 test line).

C.1.1.2 Successful Test Call Set-Up

- 1) **Actions at the test originating exchange:** Test calls may be initiated from maintenance positions, test frames, switchperson's desk cabinets, etc. and are set up using the procedures described in clause 2.1 of ATIS-1000113.2015 – Chapter 4. The Calling Party's Category is set to "test call." In the Called Party Number parameter, the Nature of Address Indicator is set to "test call" and the Numbering Plan Indicator is set to "unknown."
- 2) **Actions at the test terminating exchange:** On receipt of a test call Initial Address Message and if a test line is available, an Address Complete Message shall be returned with the Called Party's Category Indicator set to "no indication" and the Called Party's Status Indicator set to "subscriber free." When the test equipment is ready, the test terminating exchange sends an Answer Message and completes the connection between the test equipment and the circuit.

³² This Annex is not in ITU-T Recommendation Q.764.

- 3) **Actions during test call connection:** While a call is connected to a test line termination, all on-hook and off-hook supervisory signals should be passed from the test line termination via appropriate ISDN User Part messages (Suspend and Resume). The procedures in Clause 2.5 of ATIS-1000113.2015 – Chapter 4 apply.

C.1.1.3 Unsuccessful Test Call Set-Up

If on receipt of a test call Initial Address Message the test terminating exchange finds that the test termination is busy, a Release Message with cause value "user busy" shall be returned. If the test termination is out of service, a Release Message with cause value "destination out of service" shall be returned. If the test termination is not provided, a Release Message with cause value "unallocated number" shall be returned.

C.1.1.4 Test Call Release

For calls terminating to a test line, calling party control should be employed. The release procedures for test calls are identical to the release procedures in Clause 2.3.1 of ATIS-1000113.2015 – Chapter 4.

C.1.2 Continuity Check Test Calls

Continuity check test calls are initiated with a Continuity Check Request Message.

C.2 Semi-Automatic Circuit Turn-Up Procedure

C.2.1 Turn-Up Procedure in a Non-Control Exchange

The basic procedure for preparing a circuit for turn-up by the control exchange at the noncontrol exchange is described below:

- 1) The circuit should be placed in a local Circuit Administration - Disabled, or equivalent, state after circuit data is loaded at the near-end which will permit cross-exchange testing. Cross-exchange testing within the exchange and transmission facility line-up may be done when a circuit is in the Circuit Administration - Disabled state. While in this state, the Circuit Validation Test may be optionally performed to ensure that the translation data at the non-control exchange is consistent with the control end;
- 2) After the cross-exchange testing is completed, the near-end circuit maintenance state should be set to Circuit Administration - Locally Blocked state or equivalent state and a Blocking Message is sent to the far-end. This permits circuit turn-up tests to take place. Note that the circuit may be set to this state days or even weeks before the plant test date for testing. Since routine Circuit Query tests are performed daily, the maintenance state of a circuit may be changed even before the plant test date for testing. Prior to the plant test date and also as part of the tests, the non-control end should send a Circuit Query Message to assure that the circuit states are consistent with the control end. If an "idle, locally blocked, and remotely blocked" response is received no action is taken. If an "idle locally blocked" response is received, the non-control end should respond with a Blocking Message and expect a Blocking Acknowledgment Message in response. All other responses should be checked with the control exchange;
- 3) After tests are completed, the near-end will send an Unblocking Message to the control exchange and expect an Unblocking Acknowledgment Message from the control end. Thus, the circuit at the near-end is ready to be turned up by the control end.

C.2.2 Turn-Up Procedure in a Control Exchange

The basic procedure for turning up a circuit in a control exchange is described below:

- 1) It is similar to the procedure used by a non-control exchange up to the expected Circuit Query Response during testing of a circuit except that, prior to the plant test date (testing), a mandatory Circuit Validation Test is performed to ensure consistency of data at both ends of the circuit. The Circuit Query Response at the control exchange during testing must ensure that the far-end of the circuit is either "idle, remotely blocked" or "idle, remotely blocked, locally blocked";
- 2) A continuity check should be made to roughly ensure that nothing has happened to the circuit since plant testing was completed;
- 3) After tests are completed, the near-end Circuit Administration - Locally Blocked state is removed by sending an Unblocking Message to the non-control end. An Unblocking Acknowledgment Message must be received from the non-control end;
- 4) Circuit turn-up should be aborted if a Circuit Validation Test indicates inconsistency in circuit data or an inconsistent Circuit Query Response Message or a Continuity Check failure occurs at any point in the above procedure.

C.3 Circuit Validation Test

C.3.1 General

The purpose of a circuit validation test is to ensure that each exchange, having a circuit group between them, has sufficient and consistent translation data for placing a call on a specific circuit of the group. A circuit validation test may be initiated by either exchange on demand by maintenance or operations personnel. The test is particularly useful during circuit turn-up procedures, but is only performed after network routing has been validated.

C.3.2 Translations Tested

Both near-end and far-end checks are required to perform a complete circuit validation test. The initiating end starts the test by accessing the circuit, as identified by maintenance personnel with a COMMON LANGUAGE Circuit Identification (CLCI) code³³, and performing a translation test.

The translation check at the initiating end must perform adequate tests to ensure that translation data exists for:

- 1) Deriving a physical port for the circuit so that a transceiver may be connected to it; and
- 2) Deriving a Circuit Identification Code (CIC) and a routing label so that a Signaling System 7 circuit related signaling message may be generated.

If the near-end test fails, maintenance personnel are notified with the reason for near-end failure (e.g., failure reason - circuit unequipped) and a Circuit Validation Test Message is not generated for the circuit under test. If the near-end passes the test, a Circuit Validation Test Message is sent to the far-end exchange.

The far-end receiving the Circuit Validation Test Message must perform adequate tests to ensure that translation data exists for deriving a physical port from the received routing label and the CIC so that a loop or transceiver may be connected to the physical port. Additionally the far-end must also check that a COMMON LANGUAGE Circuit Identification code can be derived from the physical port. If the far-end translation check fails the Circuit Validation Response (CVR) Message will contain a failure indication in the test response indicator and should include a COMMON LANGUAGE Location Identification (CLLI) code when available. If the far-end checks pass, the Circuit Validation Response Message will contain a success indication in the circuit validation response indicator and the COMMON LANGUAGE Circuit Identification code when available. At the near-end a comparison of the near-end COMMON LANGUAGE Circuit Identification code with the far-end COMMON LANGUAGE Circuit

³³ COMMON LANGUAGE is a registered trademark and CLCI and CLLI are trademarks of Telcordia Technologies.

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Identification code may be made. The circuit validation test result should be reported to the maintenance personnel at the near-end.

The Circuit Validation Response Message will also contain data about the circuit with respect to the characteristics of the circuit group that it is part of. The circuit group characteristics will include whether:

- 1) The "odd/even" or "all/none" method is used to assign control in the case of double seizing and
 - For the "odd/even" method, whether odd or even CICs are controlled;
 - For the "all/none" method, whether all or none of the circuits in the circuit group are controlled.for bothway circuits, either method may be used. For oneway circuits, the "all/none" method shall be used (see Clause 2.9.1.4 of ATIS-1000113.2015 – Chapter 4);
- 2) The carrier group containing the circuit is processed by software carrier handling or hardware carrier handling;
- 3) The circuit group contains analog, digital, or a mix of analog and digital circuits;
- 4) The continuity check is required or not. If the continuity check is required, whether it is on a per call or statistical basis.

The circuit group characteristics, between exchanges, must be reported to maintenance.

C.3.3 Timing Constraints

The end initiating the test allows a maximum of 10 seconds (T_{CVT}) for the far-end to reply to a Circuit Validation Test Message with a Circuit Validation Response Message. If the timer expires, another Circuit Validation Test Message may be sent. If the timer expires again, this fact is reported to maintenance personnel.

C.4 Software Carrier Group Alarm

C.4.1 Facility Groups

Facility groups that do not have inherent fault indication features may use a Software Carrier Group Alarm (SCGA) to provide the fault indication necessary to remove the faulty group from service by inhibiting new seizures for as long as the fault condition persists.

C.4.2 Detection of the Carrier Failure

The carrier failure indication is based on the detection of two or more continuity check failures on a given carrier group. Normally the first failure occurs as a result of a continuity check failure in processing an ordinary call. When this occurs and the facility group is protected by SCGA, a demand continuity check is initiated within 5 seconds ($T_{SCGA,d}$) on another idle circuit in the same facility group. If a Loop Back Acknowledgment Message is received before timeout (T_{CCR}) and this check fails, it is assumed the entire group has failed. All circuits associated with the group are removed from service locally and two Circuit Group Blocking Messages³⁴ are sent to the far-end exchange (see Clause 2.8.2.2 of ATIS-1000113.2015 – Chapter 4). On receipt of the Circuit Group Blocking Message at the far-end exchange, the procedures in Clause 2.8.2.2 of ATIS-1000113.2015 – Chapter 4 apply. If the demand continuity check passes, if all circuits are busy in the facility group, or a Loop Back Acknowledgment Message is not received before timeout (T_{CCR}), it assumed the failure is a single circuit failure and the continuity repeat check (CRO) procedure is initiated on the failed circuit.

³⁴ Circuit group blocking type "without release" or "with immediate release" by bilateral agreement.

C.4.3 Detection of Carrier Restoral

The exchange initiates SCGA restoral procedures by periodically initiating a demand continuity check on one of the circuits in the failed group. The period between tests ($T_{SCGA,d}$) is increased as a function of the duration of the outage. If the failure persists, maintenance personnel should be notified within 2 minutes (T_{SCGA}) but restoral testing continues at the maximum reduced rate (provisionally 2 minutes) until maintenance intervention occurs. If a demand continuity check passes, the group blocked condition is removed on the circuits in the previously failed facility group. The exchange sends a Circuit Group Unblocking Message to the far-end exchange and that exchange responds with a Circuit Group Unblocking Acknowledgment Message subsequent to restoring the affected circuit to service. If maintenance was alerted as a consequence of the failure, maintenance is notified of the restoral.

C.5 Hardware Carrier Group Alarm

C.5.1 Detection of Carrier Failure

The loss of carrier for analog circuits reported by a data carrier failure detector or for digital circuits reported by a data channel failure detector will require special handling for Signaling System 7 circuits. The detecting exchange upon a carrier loss shall:

- 1) Locally block all the circuits for the group associated with the carrier;
- 2) Initiate two Circuit Group Blocking Messages (with immediate release) to the far-end exchange (see Clause 2.8.2.2 of ATIS-1000113.2015 – Chapter 4);
- 3) Wait for the failure detector to report the restoral of the carrier.

The notification to maintenance will not be made if the carrier restoral occurs within five minutes (T_{HGA}) of the failure detection.

When the far-end exchange receives the Circuit Group Blocking Message(s), the procedures in Clause 2.8.2.2 of ATIS-1000113.2015 – Chapter 4 apply.

C.5.2 Detection of Carrier Restoral

When the carrier restoral is reported, the detecting exchange shall restore the associated circuits to their previous states before the failure and shall initiate a Circuit Group Unblocking Message to the far-end exchange (see Clause 2.8.2.2 of ATIS-1000113.2015 – Chapter 4). Maintenance is informed of the carrier restoral if a failure notification was made.

When the far-end exchange receives the Circuit Group Unblocking Message the procedures in Clause 2.8.2.2 of ATIS-1000113.2015 – Chapter 4 apply.

C.6 Maintenance Processing Control State Transition Diagrams

(Deleted. Refer to Clause 2.11B of ATIS-1000113.2015 – Chapter 4.)

Annex D³⁵: Automatic Congestion Control System

(informative)

D.1 Automatic Congestion Control System

The Automatic Congestion Control (ACC) System allows a congested exchange to send a congestion indicator in a backward direction to the preceding exchange. The exchange receiving the congestion indication should respond by reducing the amount of traffic offered to the congested exchange.

The preferred method of conveying the congestion indication is via the relevant common channel signaling system.

D.1.1 Detection & Transmission of Congestion Status

An exchange should establish a critical operating system benchmark (e.g., the time required to perform a complete basic cycle of operations). The exchange should continuously monitor this benchmark and, when continued levels of nominal performance are not achieved, a state of congestion is declared. Thresholds should be established so that two levels of congestion can be identified, with congestion level 2 (CL2) indicating a more severe performance degradation than congestion level 1 (CL1). When any level of congestion is detected the exchange should have the capability to:

- 1) Code an ACC indication in the appropriate signaling messages; and
- 2) Notify its network management support system of its current congestion status.

The system can offer benefit however, by recognizing a single level of congestion. Where this situation exists it should be regarded as congestion level 2 (CL2). An exchange which recognizes a single level of congestion should only send indication of congestion level 2 (CL2), and treat receipt of indication of congestion level 1 (CL1) or congestion level 2 (CL2) identically.

An exchange may optionally support three levels of congestion. An exchange which supports three levels of congestion needs to have the ability to distinguish between far exchanges which support two levels of congestion and far exchanges which support three levels of congestion. The exchange shall not send an indication of congestion level 3 to an adjacent exchange which does not support three levels of congestion. A congestion level of 2 would be sent in this case.

D.1.2 ACC Control Operation

Exchanges receiving an ACC indication from an affected exchange or network operations center should have the capability to institute the appropriate ACC controls and to notify its network management support system of the receipt of an ACC indication.

An exchange receiving an ACC indication from a congested exchange should activate the assigned ACC controls and start a timer ($T_{ACC,r}$). (The provisional value of the timer is 5 seconds. For further study.) Subsequently received ACC indications restart the timer. When the timer expires, the ACC controls in the exchange are removed.

An exchange receiving an ACC indication should not re-transmit that indication to a preceding exchange.

³⁵ This Annex is based on Clause 5.5.2 of CCITT Blue Book (now ITU-T) Recommendation Q.542, "Digital Exchange Design Objectives - Operation and Maintenance."

D.1.3 ACC Response

An exchange should have the capability of assigning an ACC response category to individual circuit groups. One or more different response categories should be available from which to choose. Each category would specify how much traffic should be controlled in response to each of the received ACC indicators. The categories should be structured so as to present a wide range of response options to received ACC indicators.

An exchange should have the capability of inhibiting the response to received ACC parameters for specific circuit groups, i.e., not controlling future calls based on the receipt of an ACC parameter.

The control action options for further processing of calls denied access to the circuit group may be to SKIP or CANCEL. The SKIP response allows a call to alternate route to the next circuit group in the routing pattern (if any), while the CANCEL response blocks the call.

NOTE - ACC response categories can be set and ACC responses can be inhibited locally in the exchange or by input from a network management center.

Table D.18 of ATIS-1000113.2015 – Chapter 4 is an example of the flexibility that could be achieved in a control's response to an exchange that is experiencing congestion.

In this example, different control actions would be taken based upon the distinction between Alternate Routed To (ART) and Direct Routed (DR) traffic types. In the future other distinctions between traffic could be identified that would expand the number of traffic types in Table D.18 of ATIS-1000113.2015 – Chapter 4. These additional traffic types could be assigned different control percentages in order to give them different treatment during periods of congestion. It could also be possible to exclude priority calls from ACC control.

Methods used to achieve the percentages are implementation specific.

Additional response categories could also be added to Table D.18 of ATIS-1000113.2015 – Chapter 4 to give greater flexibility and more response options to the ACC control.

Table D.18 - An example of 3 congestion level ACC percentage control response table - ATIS-1000113.2015 – Chapter 4

CONGESTION LEVEL	TRAFFIC TYPE	RESPONSE CATEGORY		
		A	B	C
CL1	ART	25	50	75
	DR	0	0	0
CL2	ART	50	75	85
	DR	0	50	75
CL3	ART	75	100	100
	DR	50	75	100

Annex E: Hop Counter Procedure

(informative)

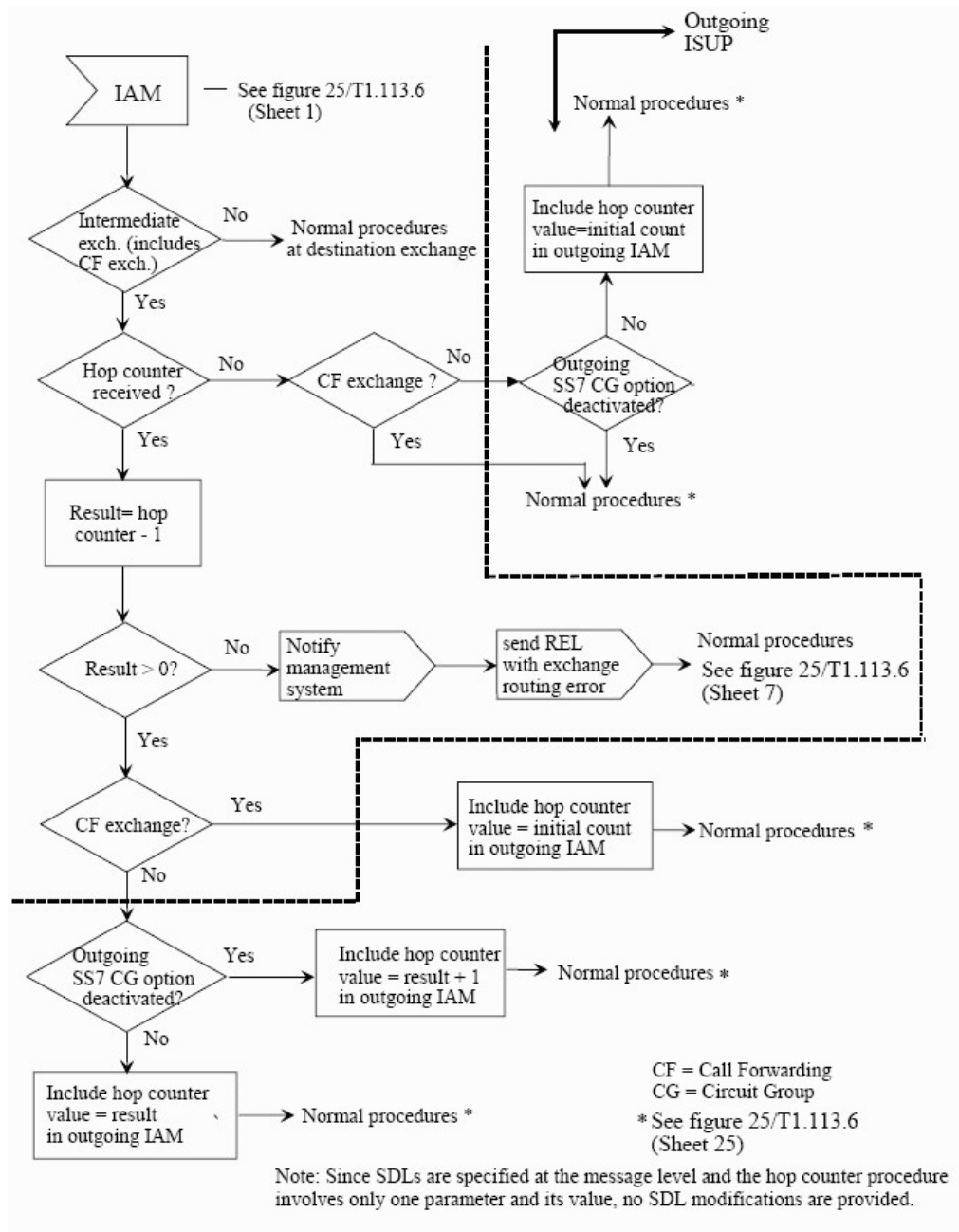


Figure E.1 - Hop counter logic diagram - ATIS-1000113.2015 – Chapter 4

Note - The new reference for T1.113.6 is ATIS-1000113.2015 – Chapter 6.

**Signaling System No. 7 (SS7) --
Integrated Services Digital Network (ISDN) User Part**

Chapter 5

Performance Objectives in the ISDN Application

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Signaling System No.7 (SS7) – Integrated Services Digital Network (ISDN) User Part

Chapter 5: Performance Objectives in the ISDN Application

1 Scope, Purpose, & Application

This chapter gives the requirements of the Integrated Services Digital Network (ISDN) application call control service supported by Signaling System 7.

In ATIS-1000111 – Chapter 6, the Message Transfer Part performance is described. The Message Transfer Part supports the ISDN application of Signaling System 7 and provision of a signaling network to support the ISDN application must take account of the performance of the Message Transfer Part and the requirements of the ISDN application. For example, taking account of the message transfer times in ATIS-1000111 – Chapter 6 and the requirements for message transfer times between two ISDN exchanges, a figure may be derived for the total permissible number of signaling links in tandem for a particular call.

This chapter may contain requirements that reference other American National Standards. If so, when the American National Standards referenced in the requirements are superseded by revisions approved by the American National Standards Institute, Inc., the revisions shall apply.

2 Signaling Availability

2.1 *Signaling Route Set Availability*

The availability of a signaling route set is determined by the availability of the individual components of the signaling network (signaling links and the signaling points) and by the structure of a signaling network.

The availability of a signaling route set should not be less than 0.99998, corresponding to a downtime of 10 minutes per year for a user signaling relation.

2.2 *Signaling Network Availability*

The availability of the signaling network should be sufficiently high as to meet the signaling route set downtime objectives stated in clause 2.1. The signaling network architecture selected will strongly influence the availability. In general, the greater the number of link sets in tandem in a signaling route set the more redundant signaling paths that will be needed to meet the availability objective for the signaling route set or user signaling relation.

3 Signaling Dependability

3.1 General

The ISDN application is different from other applications, such as telephony and data, in that there may be multiple paths involved for any given ISDN call. There may be several circuits (for example, telephone conferencing) for either telephony or data and non-circuit related connections for access to databases or for terminal-to-terminal control. This diverse set of uses may require closer control of the signaling network resources than might be required for other more simple applications.

3.1.1 Probability of False Operation

By means of error detection (see Clause 4.2 in ATIS-1000111 – Chapter 3) as well as transmission fault indication (see ITU-T Recommendations G.732 and G.733), it is ensured that, overall, not more than one in 10^8 of all signal units received will cause false operation, due to errors.

3.1.2 Probability of Signaling Malfunction

Unsuccessful calls may be caused by undetected errors, loss of messages, or messages delivered out of sequence (caused by emergency situations within the signaling network), and may result in:

- Incomplete call set-up;
- Misrouted calls (for example, connection of wrong numbers);
- Calls routed correctly but mishandled (for example, false clearing);
- Inability to access a database.

Considering the above conditions and the performance of the Message Transfer Part, no more than 2 in 10^5 (provisional value) of all ISDN calls should be unsuccessful due to signaling malfunction.

NOTE - No more than 1 in 10^5 of all ISDN *circuit connections* should be unsuccessful due to signaling malfunction.

4 Signaling Delay

4.1 Functional Reference Points & Transfer Time Components

A functional diagram of the cross-office transfer time is shown in Figure 5.1 of ATIS-1000113.2015 – Chapter 5.

4.2 Delays

4.2.1 Cross-Office Transfer Time, T_{cu}

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

4.2.2 User Handling Time, T_{hu}

T_{hu} is the period that starts when the last bit of the message has entered the upper layer functions and ends when the last bit of the derived message has left the upper layer functions.

4.2.3 Objectives for Cross-Office Transfer Time, T_{cu}

The figures in Table 5.1 of ATIS-1000113.2015 – Chapter 5 are the objectives for the cross-office transfer time T_{cu} for the ISDN signaling points in the signaling network. Values are given for both simple and processing intensive messages. These figures are related to a signaling bit rate of 56 kbit/s.

A processing intensive message is one that arrives at an exchange and requires detailed examination (and possibly modification) before it is transmitted to the next exchange.

A simple message is one that requires little or no examination or modification (typically only label translation) before it is transmitted immediately to the next exchange.

4.3 Effect of Retransmission

As a consequence of correction by retransmission, not more than one in 10^4 of all signals (transmitted and retransmitted) should be delayed more than 300 ms as a long-term average. This requirement refers to each signaling link.

This requirement is laid down in order to ensure satisfactory answer delays.

5 Signaling System Limitations

5.1 Labeling Potential

5.1.1 Signaling Points

The label of the Signaling System 7 for the ISDN application provides the potential to identify 2^{24} signaling points.

5.1.2 Number of Circuits in a User Signaling Relation

There may be up to 16,384 circuits (16,384 channels in each direction) for each user signaling relation.

5.1.3 Number of SCCP Connections in a User Signaling Relation

There may be up to 2^{24} (16,777,216) virtual circuits available at an ISDN signaling point. All of these may be available for any given user signaling relation, but must be shared over all signaling relations.

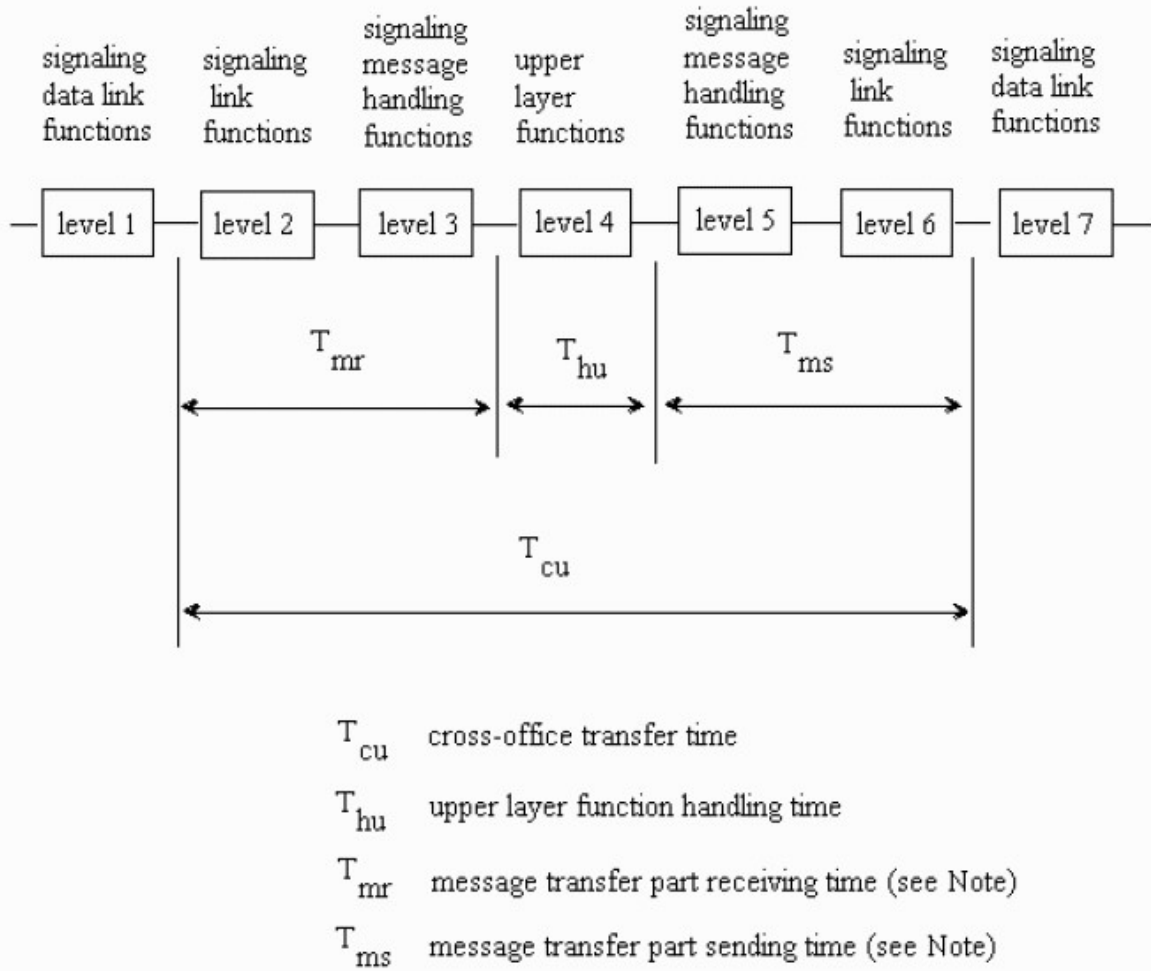
5.2 Number of ISDN Call Identities at a Signaling Point

There may be up to 2^{24} (16,777,216) simultaneous ISDN calls at a signaling point with the 2^{24} (16,777,216) call identities available. The use of ISDN call identities is for further study.

Table 5.1 - Objectives for cross-office transfer time - ATIS-1000113.2015 – Chapter 5¹

Message Type	Exchange Call Attempt Loading	Cross-Office Transfer Time T_{CU} (ms)	
		Mean	95%
Simple (e.g., answer)	Normal	110	220
	+15%	165	330
	+30%	275	550
Processing intensive (e.g., IAM)	Normal	180	360
	+15%	270	540
	+30%	450	900

¹ Provisional values.



NOTE - The definitions of these times are given in T1.111.6-1996.

Figure 5.1 - Functional diagram of the cross-office transfer time - ATIS-1000113.2015 – Chapter 5

Note - The new reference for T1.111.6 is ATIS-1000111 – Chapter 6.

**Signaling System No. 7 (SS7) --
Integrated Services Digital Network (ISDN) User Part**

Chapter 6

State Transition Diagrams

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Signaling System No.7 (SS7) – Integrated Services Digital Network (ISDN) User Part

Chapter 6: State Transition Diagrams

1 Scope, Purpose, & Application

This chapter provides the state transition diagrams for the ISDN User Part. The state transition diagrams for the ISDN User Part are provided by ITU-T Recommendations (formerly CCITT Specification) and Description Language (SDL) diagrams that depict the signaling procedures covered in Clause 2 of ATIS-1000113.2015 – Chapter 4.

NOTE - If any difference is found between the procedures described in the text and the procedures described in the Specification and Description Language (SDL) diagrams, the text shall take precedence.

2 State Transition Diagrams

2.1 Organization

The state transition diagrams for the ISDN User Part are organized such that a main signaling procedure control (SPRC) message dispenser acts as the interface for Common Channel Signaling (CCS) message reception and transmission. Signaling procedure control (SPRC) is covered in 2.2. Call processing control (CPC) is covered in 2.3. Maintenance process control (MPC) is covered in clause 2.4. Figure 2.1 of ATIS-1000113.2015 – Chapter 6 shows a functional block diagram indicating the relationship between the various controlling modules.

Note that in the SDL diagrams, functional blocks other than SPRC are considered internal, and SPRC is considered to be external to these functions. Messages between functional blocks other than SPRC are thus shown as internal messages; messages to and from SPRC are shown as external messages.

The abbreviations used in the functional block diagram and the SDL diagrams are listed in Table 2.1 of ATIS-1000113.2015 – Chapter 6 and Table 2.2 of ATIS-1000113.2015 – Chapter 6. A list of the timers used in the SDL diagrams as given in Table 2.1 of ATIS-1000113.2015 – Chapter 6.

2.2 Signaling Procedure Control

The SPRC SDL diagrams are shown in Figure 2.2 of ATIS-1000113.2015 – Chapter 6. The distribution of received messages by the SPRC is shown in Table 2.3 of ATIS-1000113.2015 – Chapter 6.

2.3 Call Processing Control

Call processing control (CPC) receives and transmits messages to SPRC, and performs the appropriate call processing actions necessary. The CPC SDL diagrams have been divided into incoming and outgoing circuit states and actions, to facilitate the later specifications for interworking with other protocols. The CPC SDL

diagrams are shown in Figures 2.3 through 2.5 of ATIS-1000113.2015 – Chapter 6. The ISDN User Part states used in the CPC SDL diagrams are shown in Table 2.4 of ATIS-1000113.2015 – Chapter 6.

2.4 Maintenance Processing Control

Maintenance processing control (MPC) receives and transmits messages to SPRC, and performs the appropriate maintenance recovery actions necessary. The MPC SDL diagrams are shown in Figures 2.6 through 2.25 of ATIS-1000113.2015 – Chapter 6. The ISDN User Part states used in the MPC SDL diagrams are shown in Table 2.5 of ATIS-1000113.2015 – Chapter 6.

With regard to circuit group operations, a normal ISDN User Part circuit group is any arbitrary size group not exceeding 24 circuits arranged in the order of consecutive Circuit Identification Codes (CICs), sharing a common facility and destined to the same exchange. The range and status subfields provided in the ISDN User Part message will be used to indicate how many and what circuits within the consecutive order are affected. A range field of zero is interpreted to mean a predefined group. The definition and uses of a predefined group are still under study.

Table 2.1 - Functional block diagram and SDL abbreviations - ATIS-1000113.2015 – Chapter 6

General	
CCH	Continuity Check Indicator
CIC	Circuit Identification Code
ICC	Incoming Trunk Circuit
OGC	Outgoing Trunk Circuit
TRD	Timed Release Disconnect
VPA	Voice Path Assurance
Messages	
ACM	Address Complete Message
ANM	Answer
BLA	Blocking Acknowledgement
BLO	Blocking
CCR	Continuity Check Request
CFN	Confusion
CGB	Circuit Group Blocking
CGBA	Circuit Group Blocking Acknowledgement
CGU	Circuit Group Unblocking
CGUA	Circuit Group Unblocking Acknowledgement
COT	Continuity
CPG	Call Progress
CQM	Circuit Query
CQR	Circuit Query Response
CRA	Circuit Reservation Acknowledgement
CRM	Circuit Reservation
CVR	Circuit Validation Response
CVT	Circuit Validation Test
FOT	Forward Transfer
GRA	Group Reset Acknowledgement
GRS	Group Reset
IAM	Initial Address Message
INF	Information
LPA	Loop-back Acknowledgement
REL	Release
RES	Resume
RLC	Release Complete
RSC	Reset Circuit
SUS	Suspend
UBA	Unblocking Acknowledgement
UBL	Unblocking
UCIC	Unequipped Circuit Identification Code

Table 2.2 - SDL function blocks - ATIS-1000113.2015 – Chapter 6

Block	Description	Figure
BLR	Blocking/Unblocking Signal Reception	6/ATIS-1000113.2015 – Chapter 6
BLS	Blocking/Unblocking Signal Sending	7/ATIS-1000113.2015 – Chapter 6
CCI	Continuity Check Incoming	4/ATIS-1000113.2015 – Chapter 6
CCO	Continuity Check Outgoing	5/ATIS-1000113.2015 – Chapter 6
CGRR	Circuit Group Reset Reception	16/ATIS-1000113.2015 – Chapter 6
CGRS	Circuit Group Reset Sending	15/ATIS-1000113.2015 – Chapter 6
CPC	Call Processing Control	3/ATIS-1000113.2015 – Chapter 6
CQR	Circuit Query Reception	22/ATIS-1000113.2015 – Chapter 6
CQS	Circuit Query Sending	21/ATIS-1000113.2015 – Chapter 6
CRI	Continuity Recheck Incoming	9/ATIS-1000113.2015 – Chapter 6
CRO	Continuity Recheck Outgoing	8/ATIS-1000113.2015 – Chapter 6
CRR	Circuit Reset Reception	11/ATIS-1000113.2015 – Chapter 6
CRS	Circuit Reset Sending	10/ATIS-1000113.2015 – Chapter 6
CVTR	Circuit Validation Test Reception	24/ATIS-1000113.2015 – Chapter 6
CVTS	Circuit Validation Test Sending	23/ATIS-1000113.2015 – Chapter 6
DCO	Demand Continuity Outgoing	14/ATIS-1000113.2015 – Chapter 6
EAMF	Exchange Access Multifrequency Signaling (Note)	-
GBNR	Circuit Group Blocking without Release	20/ATIS-1000113.2015 – Chapter 6
GBR	Circuit Group Blocking with Release	19/ATIS-1000113.2015 – Chapter 6
GBUR	Circuit Group Blocking/Unblocking Reception	18/ATIS-1000113.2015 – Chapter 6
GBUS	Circuit Group Blocking/Unblocking Sending	17/ATIS-1000113.2015 – Chapter 6
HGA	Hardware Carrier Group Alarm	13/ATIS-1000113.2015 – Chapter 6
L3	Level 3 (Signaling network functions)	-
L4	Level 4 (ISDN User Part)	-
MPC	Maintenance Process Control	-
SCGA	Software Carrier Group Alarm	12/ATIS-1000113.2015 – Chapter 6
SPRC	Signaling Procedure Control	2/ATIS-1000113.2015 – Chapter 6
UCIC	Unequipped Circuit Identification Code Reception	25/ATIS-1000113.2015 – Chapter 6

NOTE - Non-Signaling System 7 interface.

Table 2.3 - SPRC distribution of received signaling messages - ATIS-1000113.2015 – Chapter 6

Message	Function
ACM	CPC (Note)
ANM	CPC (Note)
BLA	BLS
BLO	BLR
CCR	CRI
CFN	SPRC
CGB	GBUR
CGBA	GBUS
CGU	GBUR
CGUA	GBUS
COT	CPC (Note) or CRI; whichever is active
CPG	CPC (Note)
CQM	CQR
CQR	CQS
CRA	CPC (Note)
CRM	CPC (Note)
CVR	CVTS
CVT	CVTR
FOT	CPC (Note)
GRA	CGRS
GRS	CGRR
IAM	CPC (Note) CRO, or CRI; whichever is active
INF	CPC (Note)
LPA	DCO
REL	CPC (Note), CRO, CRI, or CRS; whichever is active
RES	CPC (Note)
RLC	CPC (Note), CRO, or CRS; whichever is active
RSC	CRR
SUS	CPC (Note)
UBA	BLS
UBL	BLR
UCIC	UCIC

NOTE - CPC (Incoming) is the default if no function is active.

Table 2.4 - Call processing control states - ATIS-1000113.2015 – Chapter 6

State Name	State Number
Incoming States	
Idle	0
(Unused)	1
Wait for COT and IAM	1A
Wait for IAM	1B
Wait for OGC Selection	2
Wait for COT	3
Wait for OGC Complete	4
Wait for Answer	5
ICC Answered	6
ICC Suspended	7
(Unused)	8
Wait for RLC	9
Outgoing States	
Idle	0
Wait for Continuity Reports	1
Wait for Continuity Reports and CRA	1A
Wait for Continuity Reports (Have CRA)	1B
Wait for CRA	1C
Wait for Digits	1D
Wait for Address Complete	2
Wait for Answer	3
OGC Answered	4
OGC Suspended	5
(Unused)	6
Wait for RLC	7

Table 2.5 - MPC states - ATIS-1000113.2015 – Chapter 6

Function	State Name	State Number
BLR	Idle	0
BLS	Idle	0
	Wait for BLA	1
	Wait for UBA	2
CRO	Idle	0
	Wait for Timeout	1
	Wait for SCGA	2
	Wait for Continuity	3
	Wait for RLC	4
CRI	Idle	0
	Wait for CCR	1
	Wait for COT	2
CRS	Idle	0
	Wait for RLC	1
CRR	Idle	0
CQS	Idle	0
	Wait for CQR	1
CQR	Idle	0
	Wait for Circuit Status	1
CVTS	Idle	0
	Wait for CVR	1
CVTR	Idle	0
SCGA	Idle	0
	Wait for Initial DCO	1
	Wait for SCGA Restoral	2
	Wait for Subsequent DCO	3
HGA	Idle	0
	Wait for HGA Restoral	1
DCO	Idle	0
	Wait for LPA	1
	Wait for Tone	2
	Wait for Tone Disappearance	3
CGRS	Idle	0
	Wait for GRA	1
CGRR	Idle	0
	Wait for Second GRS	1
GBUS	Idle	0
	Wait for CGBA (no release)	1
	Wait for CGBA (release)	2
	Wait for CGUA (no release)	3
	Wait for CGUA (release)	4
GBUR	Idle	0
	Wait for Second CGB	1

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Function	State Name	State Number
GBR	Idle	0
	Group Blocked and Released	1
GBNR	Idle	0
	Group Blocked	1
UCIC	Idle	0

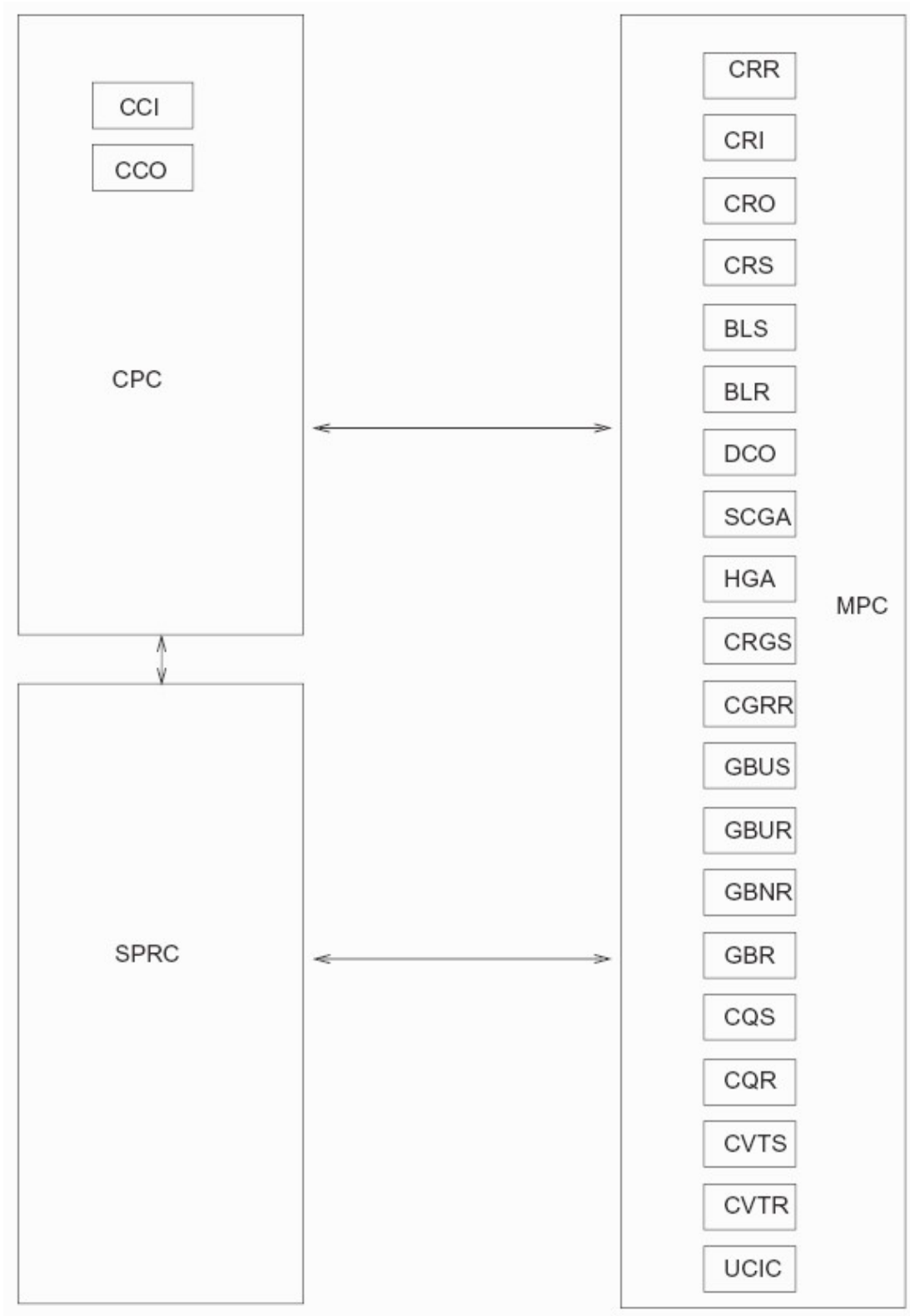


Figure 2.1 - Functional block diagram - ATIS-1000113.2015 – Chapter 6

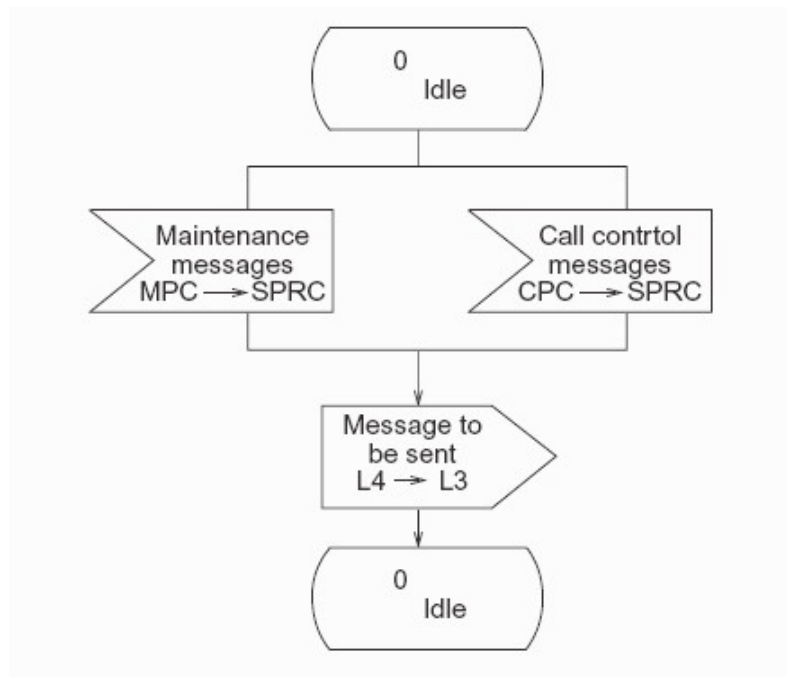


Figure 2.2 - Signaling process control (SPRC) (Sheet 1 of 3) - ATIS-1000113.2015 – Chapter 6

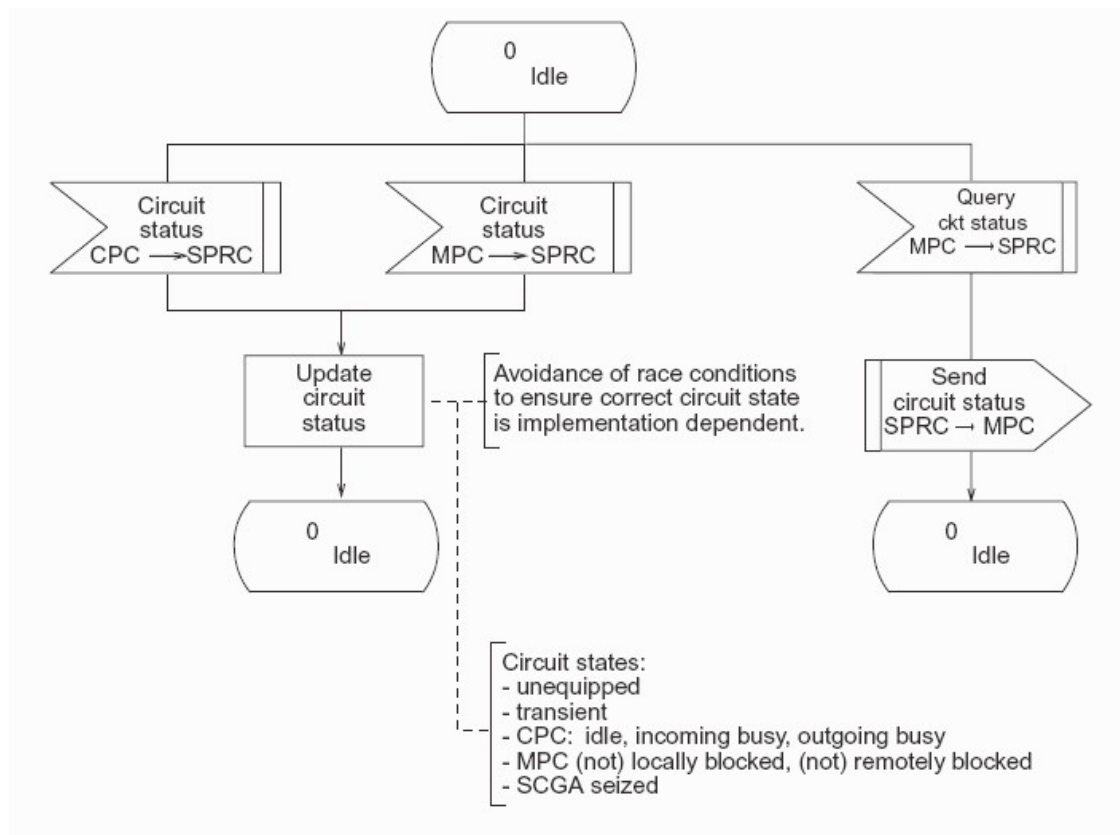


Figure 2.2 - Signaling process control (SPRC) (Sheet 2 of 3) – ATIS-1000113.2015 – Chapter 6

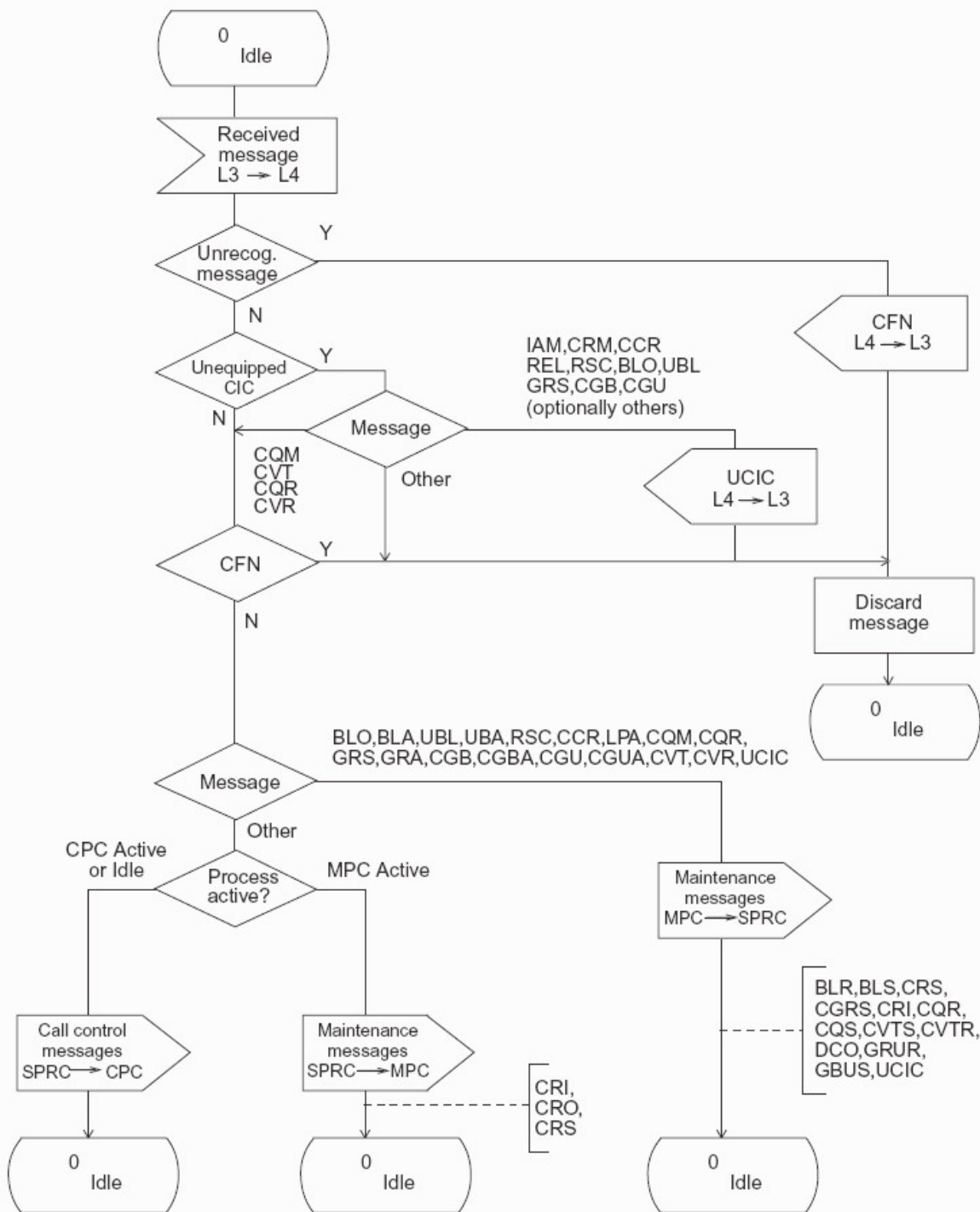


Figure 2.2 – Signaling process control (SPRC) (Sheet 3 of 3) – ATIS-1000113.2015 – Chapter 6

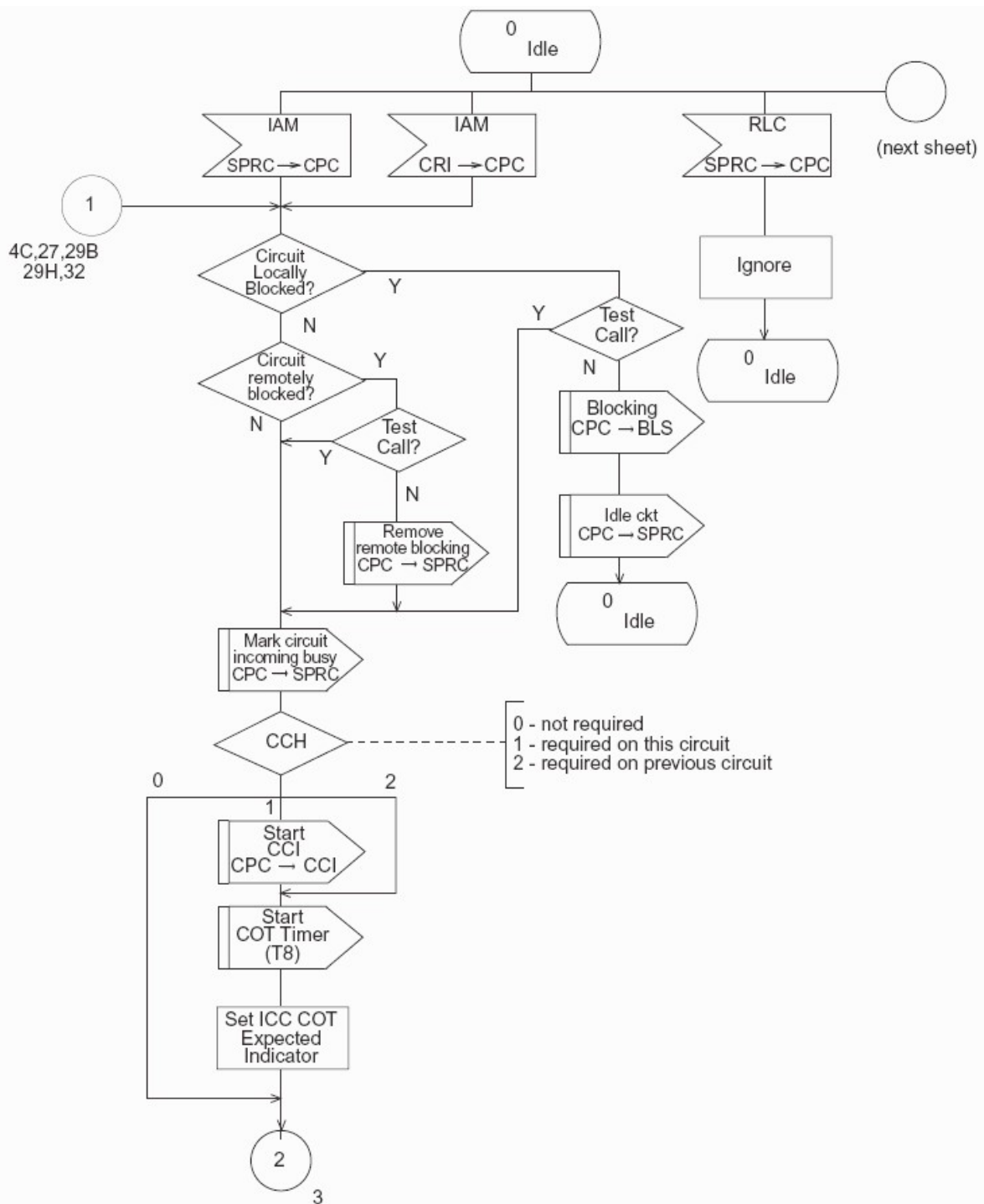


Figure 2.3 - Call processing control (CPC) incoming (Sheet 1 of 41) - ATIS-1000113.2015 – Chapter 6

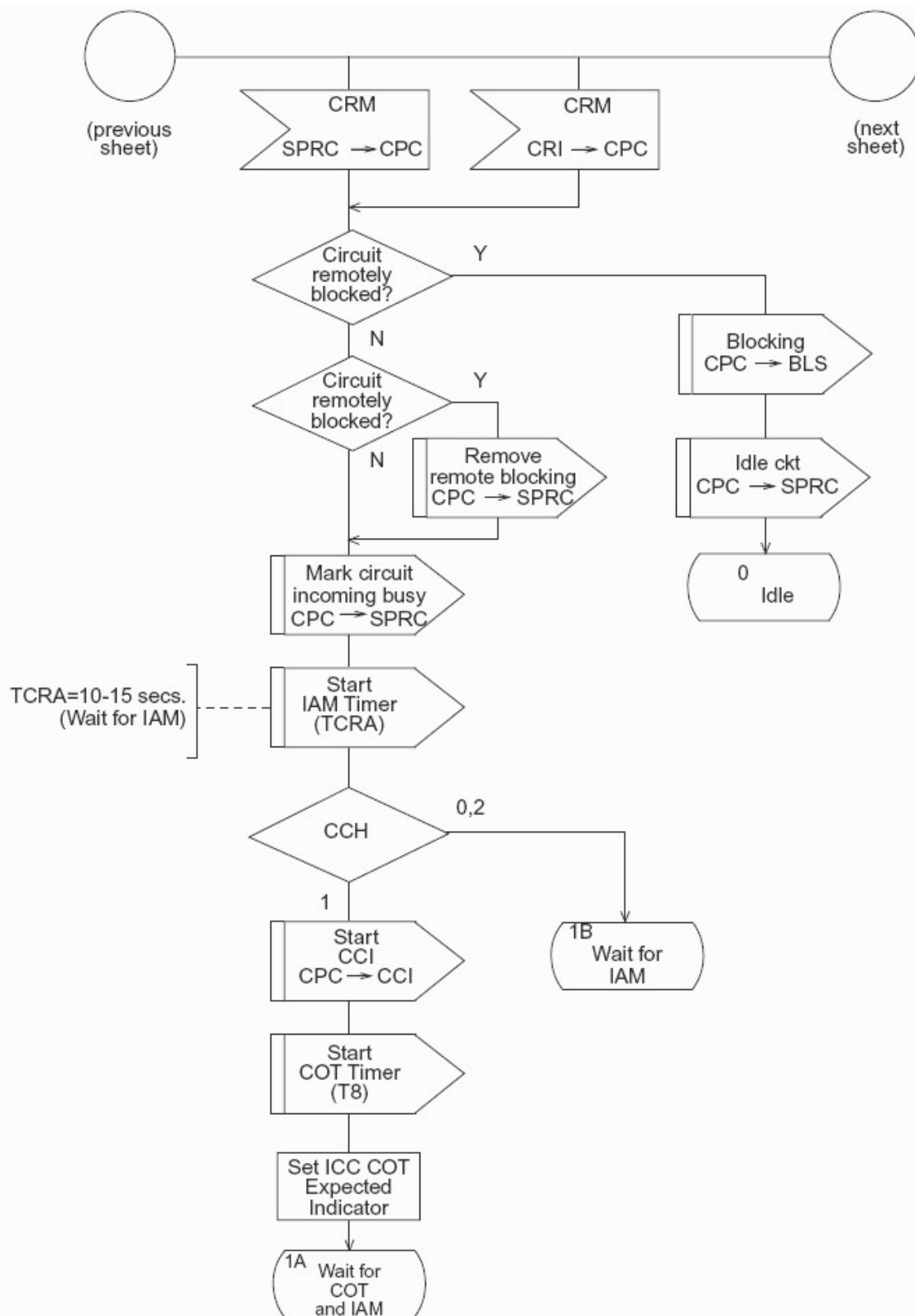


Figure 2.3 – Call processing control (CPC) incoming (Sheet 1A of 41) - ATIS-1000113.2015 – Chapter 6

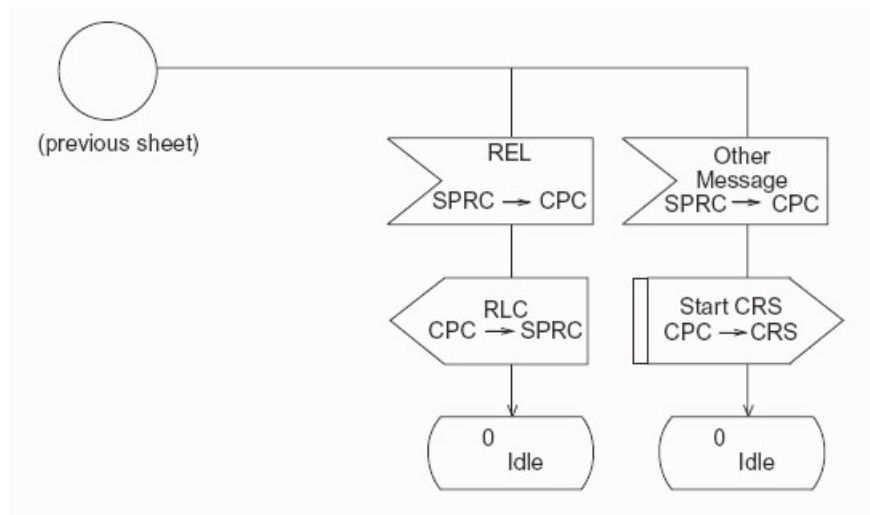


Figure 2.3 – Call processing control (CPC) incoming (Sheet 2 of 41) - ATIS-1000113.2015 – Chapter 6

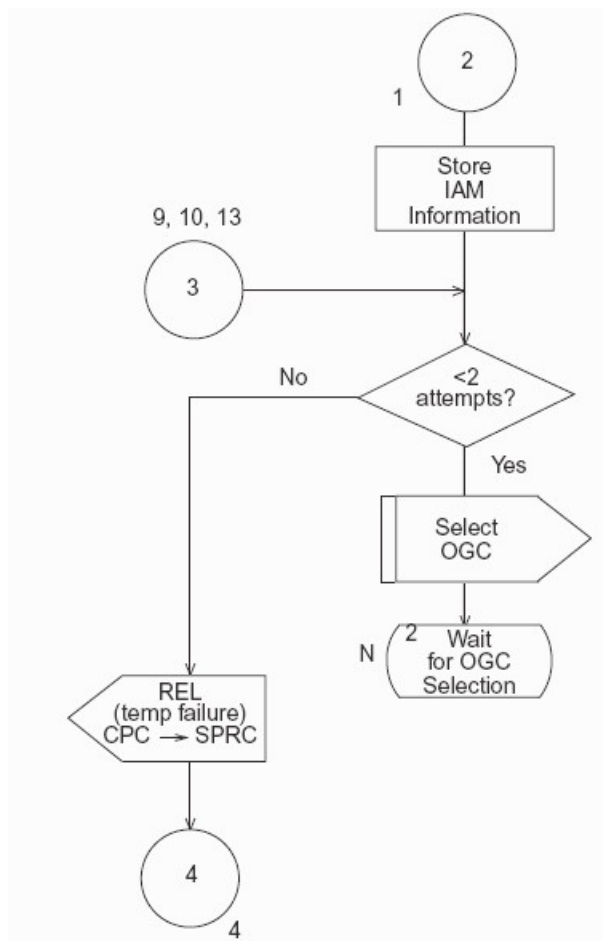


Figure 2.3– Call processing control (CPC) incoming (Sheet 3 of 41) - ATIS-1000113.2015 – Chapter 6

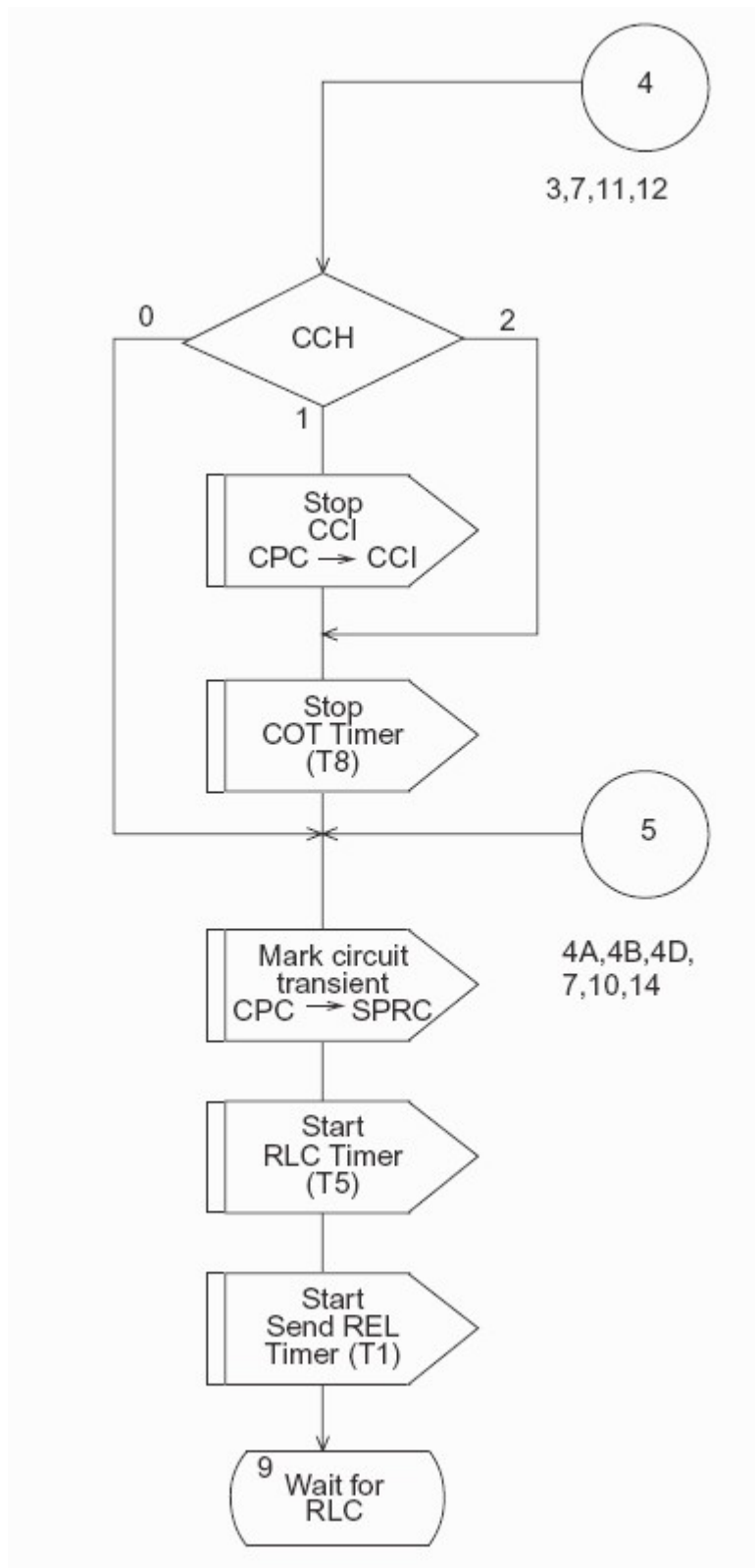


Figure 2.3 – Call processing control (CPC) incoming (Sheet 4 of 41) - ATIS-1000113.2015 – Chapter 6

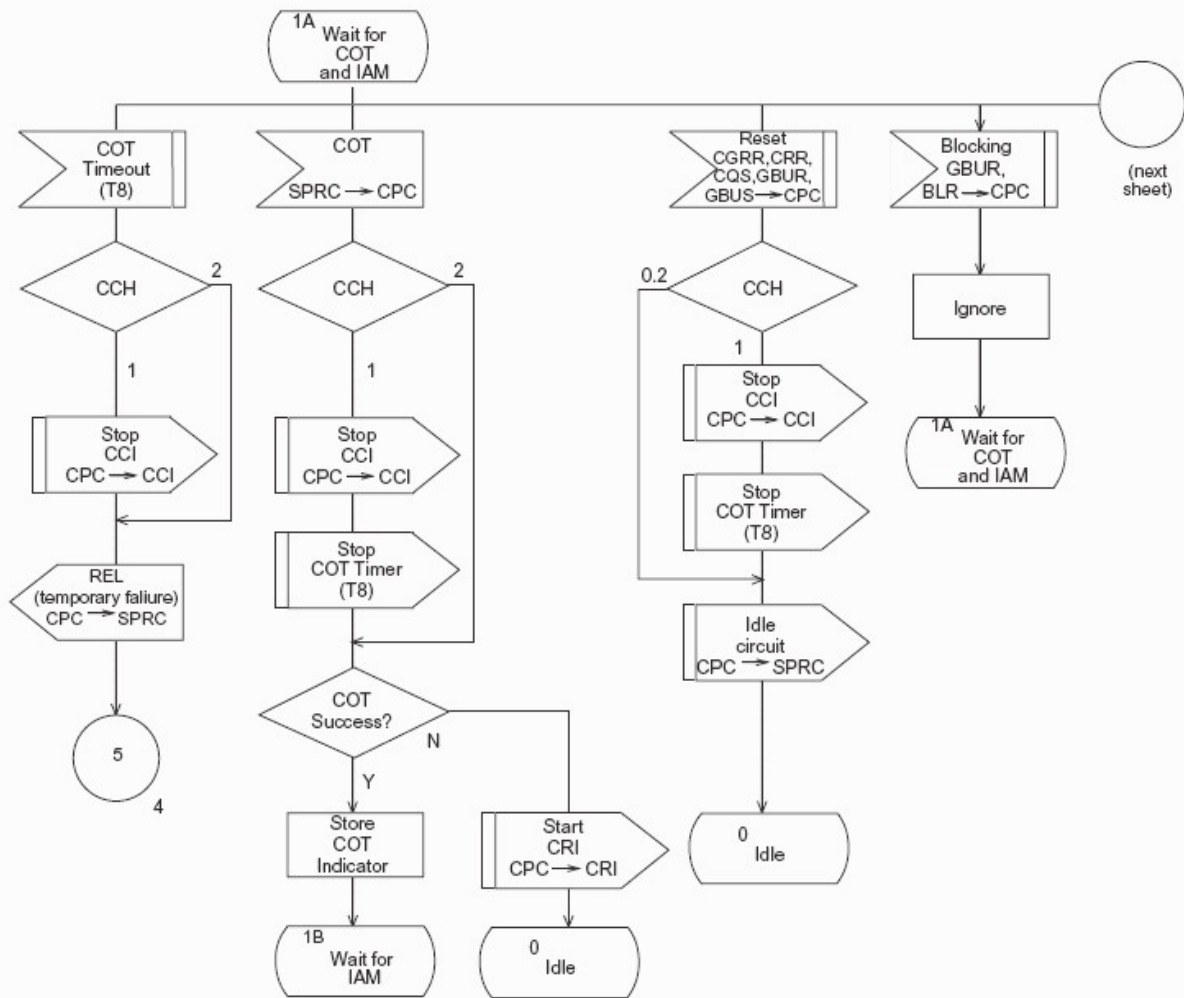


Figure 2.3 – Call processing control (CPC) incoming (Sheet 4A of 41) - ATIS-1000113.2015 – Chapter 6

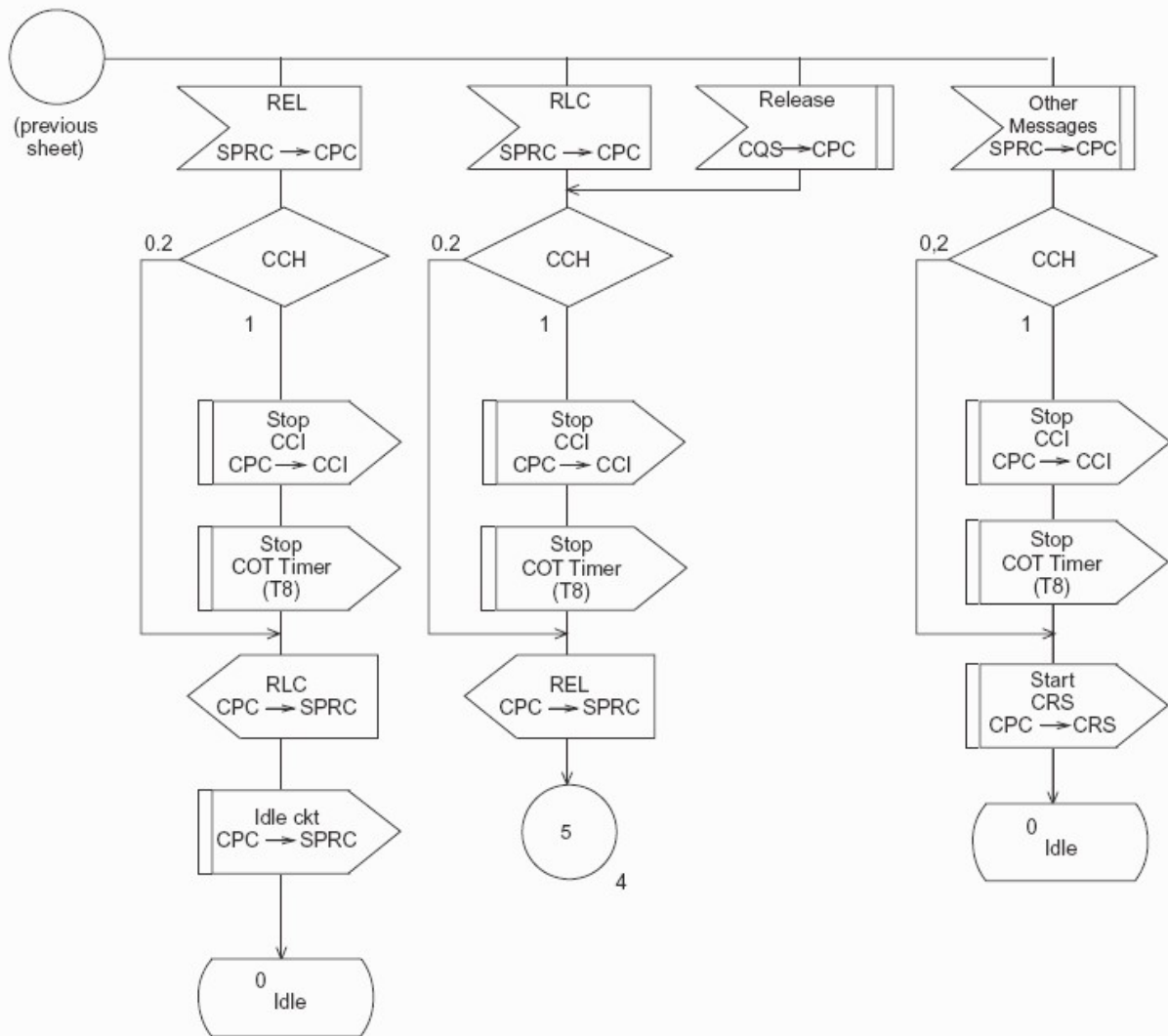


Figure 2.3 – Call processing control (CPC) incoming (Sheet 4B of 41) - ATIS-1000113.2015 – Chapter 6

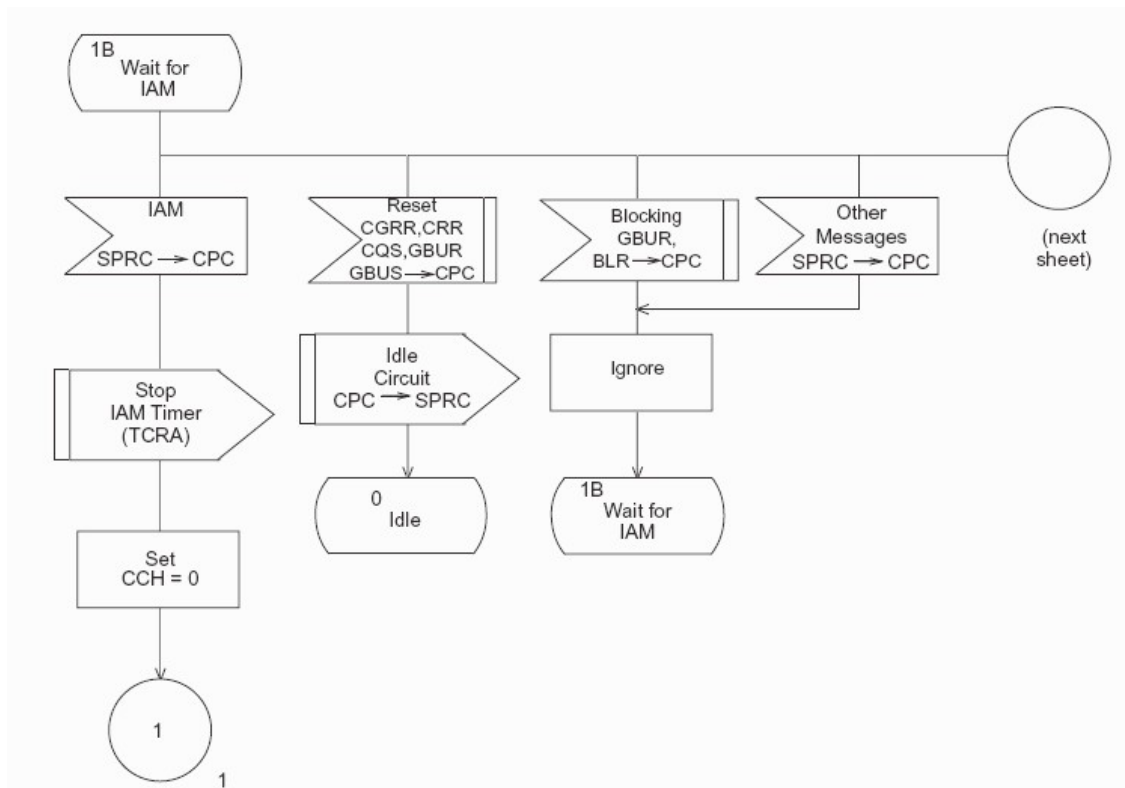


Figure 2.3 – Call processing control (CPC) incoming (Sheet 4C of 41) - ATIS-1000113.2015 – Chapter 6

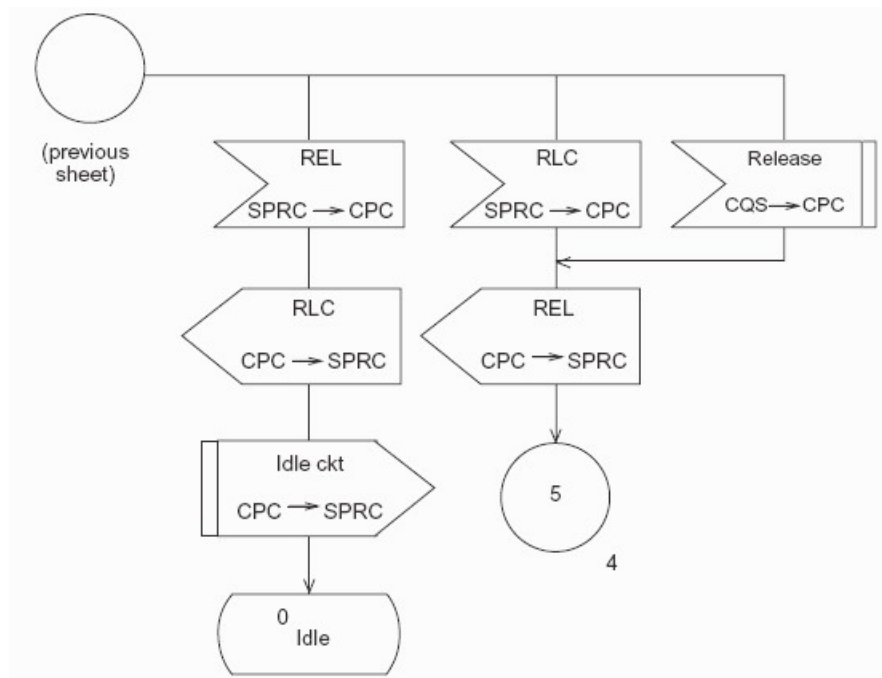


Figure 2.3 – Call processing control (CPC) incoming (Sheet 4D of 41) - ATIS-1000113.2015 – Chapter 6

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Figure 2.3 – Call processing control (CPC) incoming (Sheet 5 of 41) - ATIS-1000113.2015 – Chapter 6

Deleted. (No procedure specified for U.S. networks)

Figure 2.3 – Call processing control (CPC) incoming (Sheet 6 of 41) - ATIS-1000113.2015 – Chapter 6

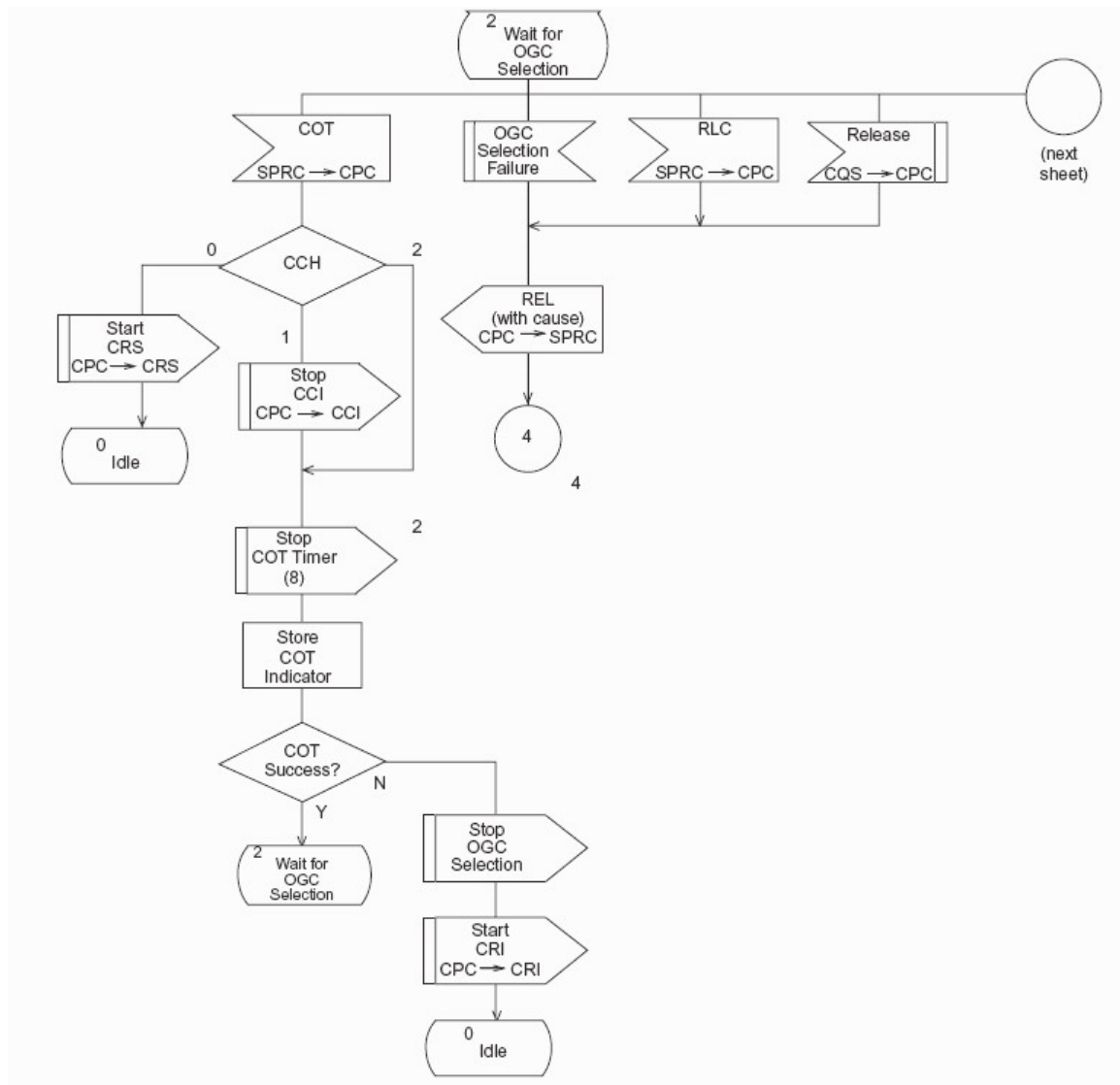


Figure 2.3 – Call processing control (CPC) incoming (Sheet 7 of 41) - ATIS-1000113.2015 – Chapter 6

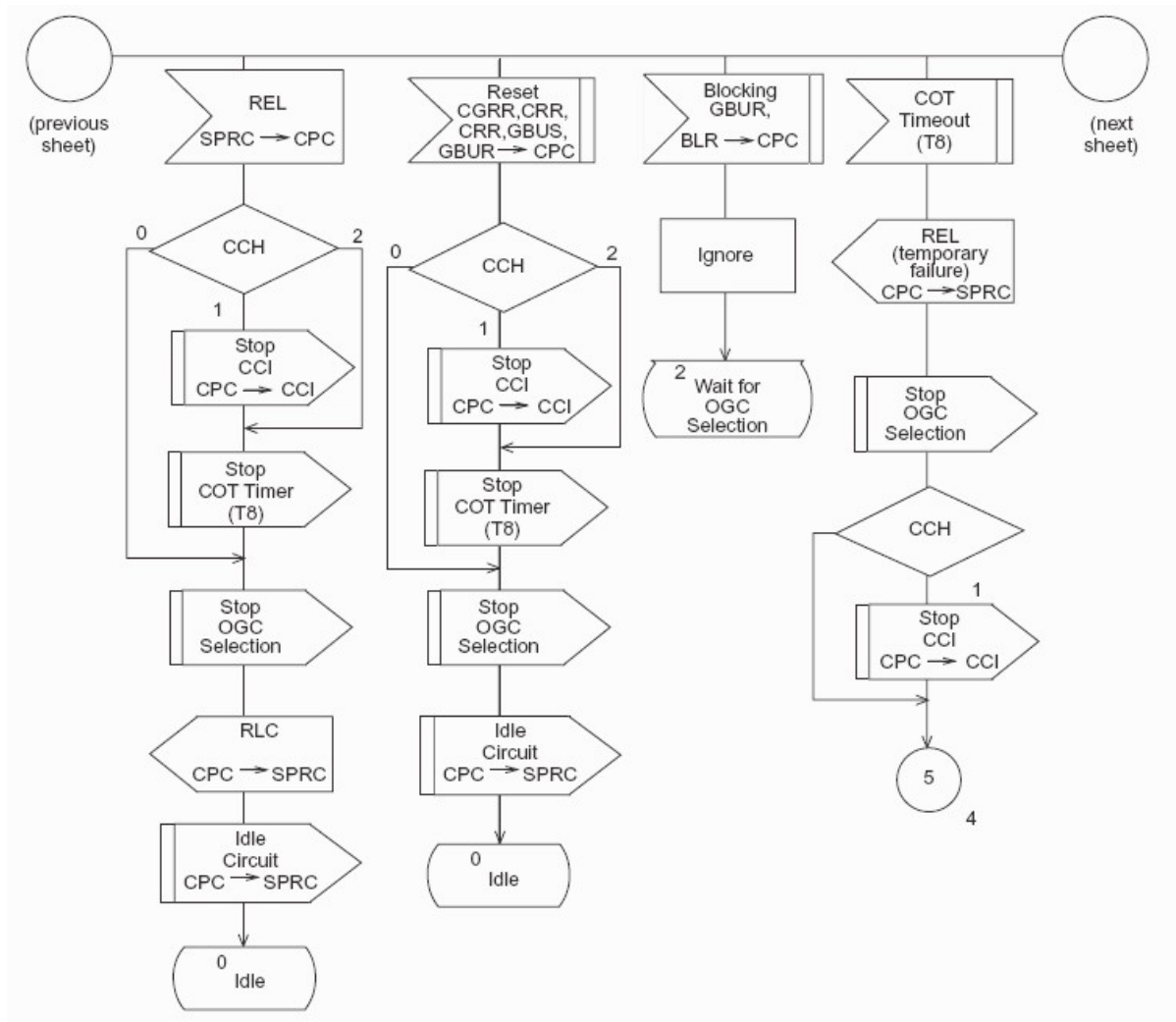


Figure 2.3 – Call processing control (CPC) incoming (Sheet 8 of 41) - ATIS-1000113.2015 – Chapter 6

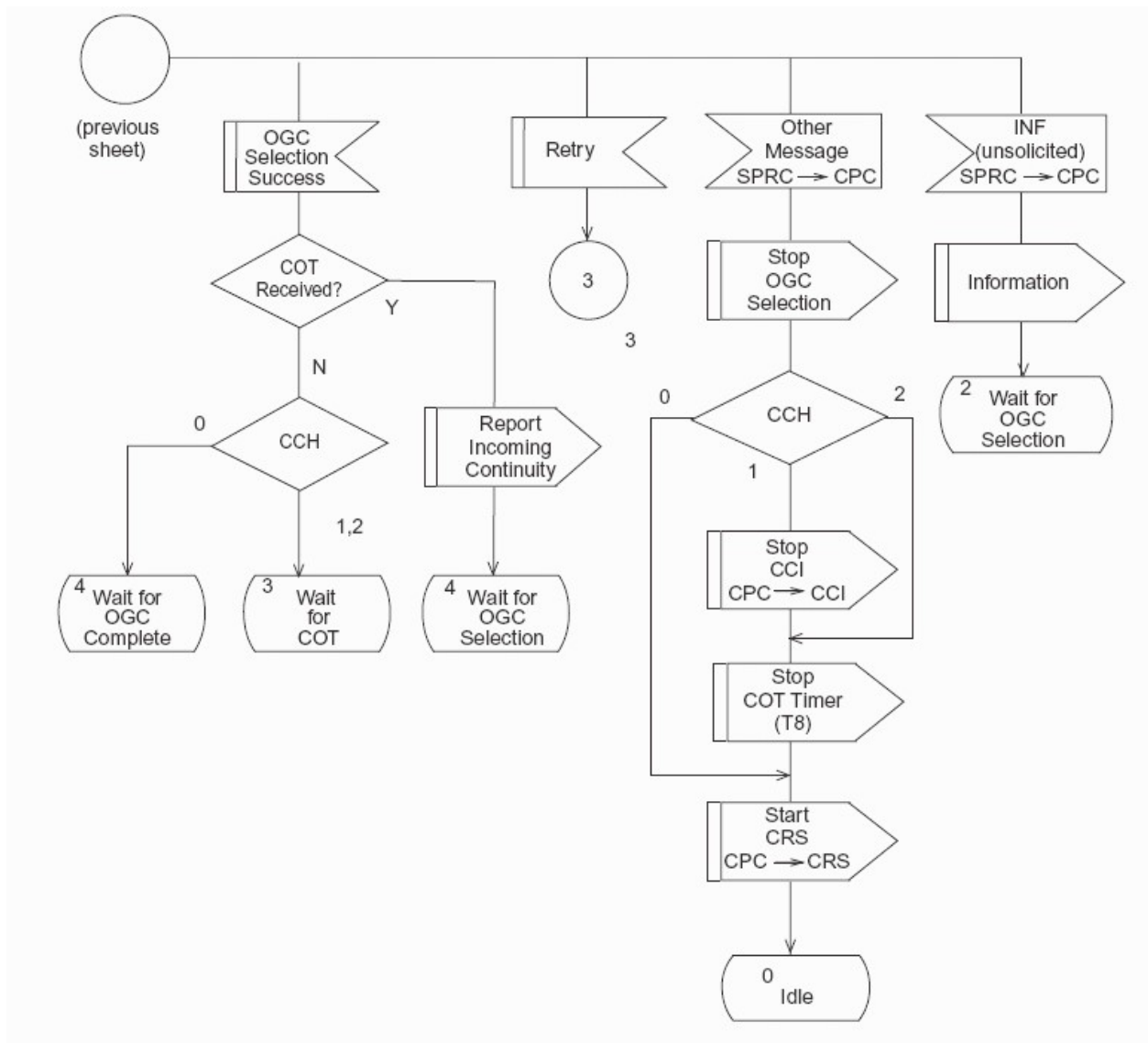


Figure 2.3 – Call processing control (CPC) incoming (Sheet 9 of 41) - ATIS-1000113.2015 – Chapter 6

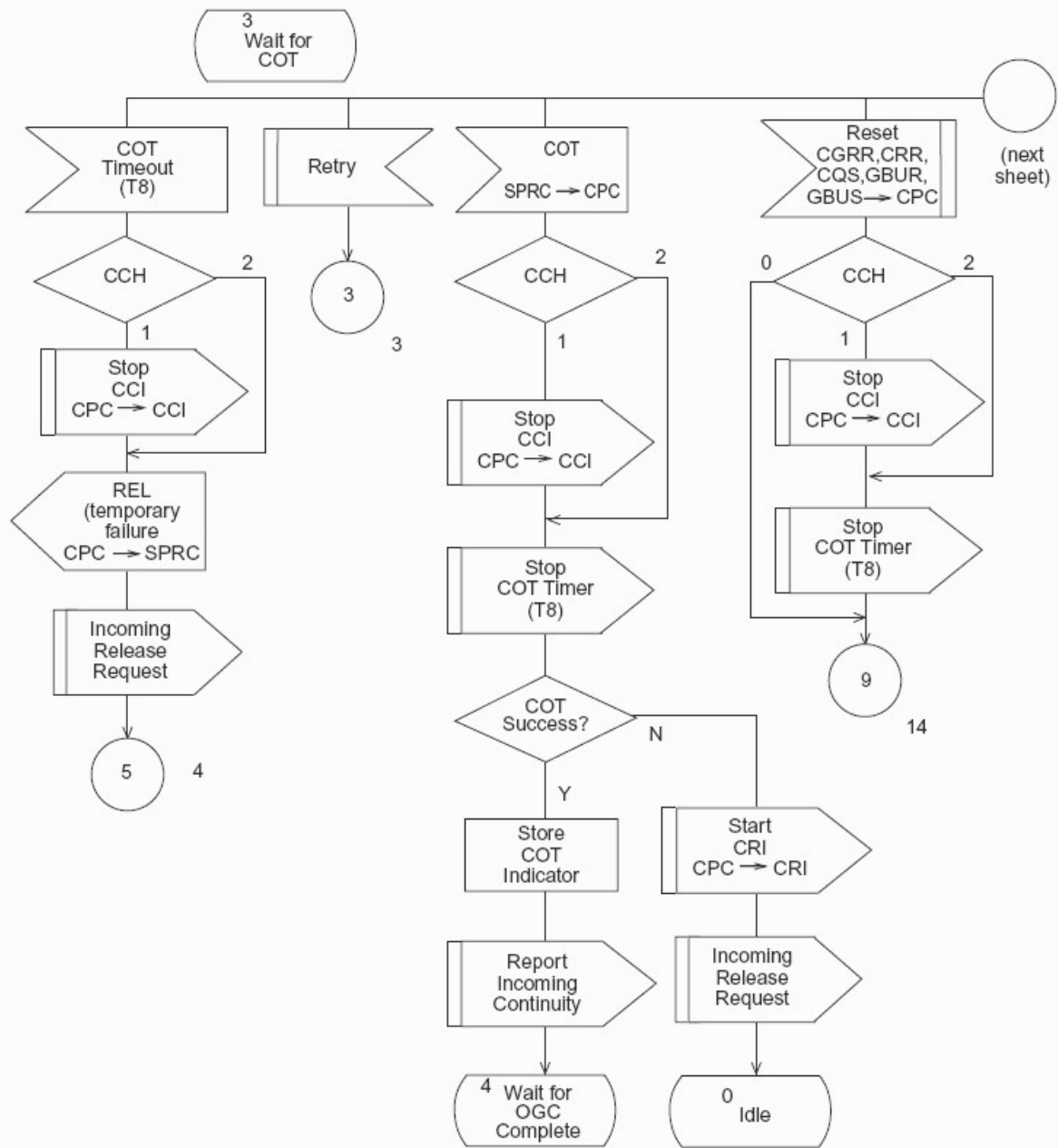


Figure 2.3 – Call processing control (CPC) incoming (Sheet 10 of 41) - ATIS-1000113.2015 – Chapter 6

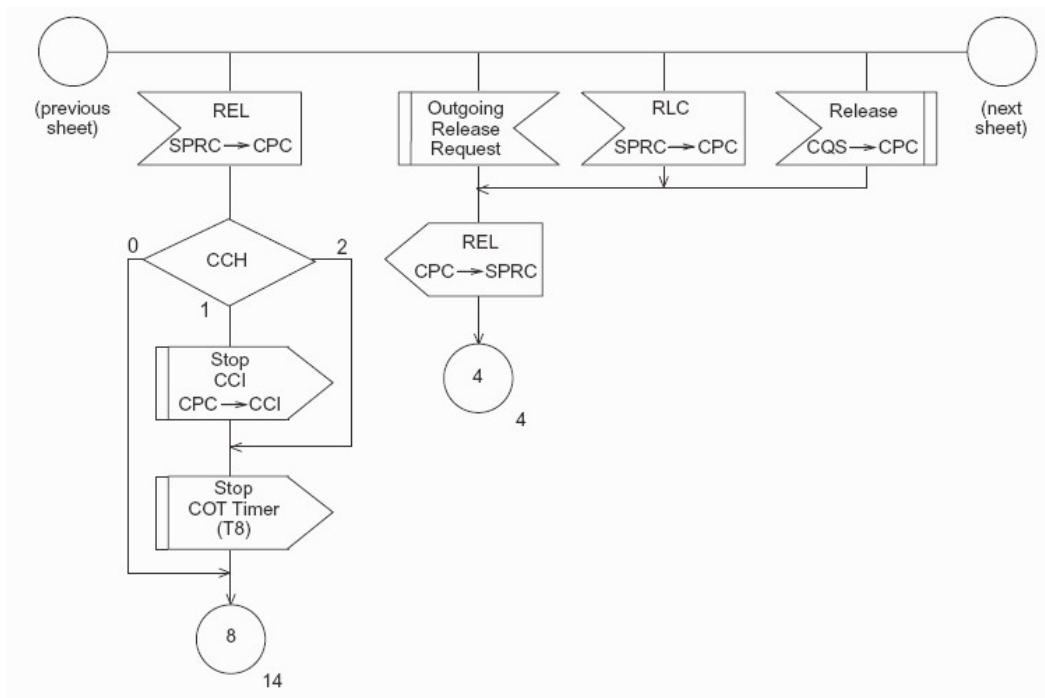


Figure 2.3 – Call processing control (CPC) incoming (Sheet 11 of 41) - ATIS-1000113.2015 – Chapter 6

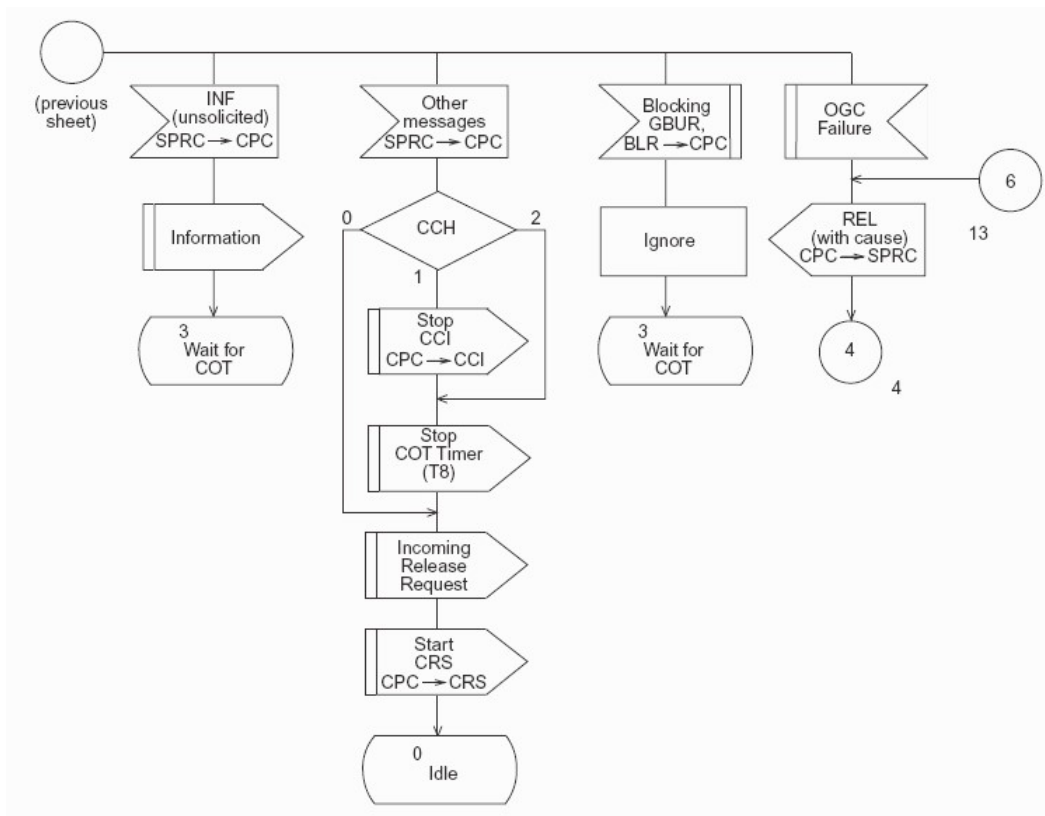


Figure 2.3 – Call processing control (CPC) incoming (Sheet 12 of 41) - ATIS-1000113.2015 – Chapter 6

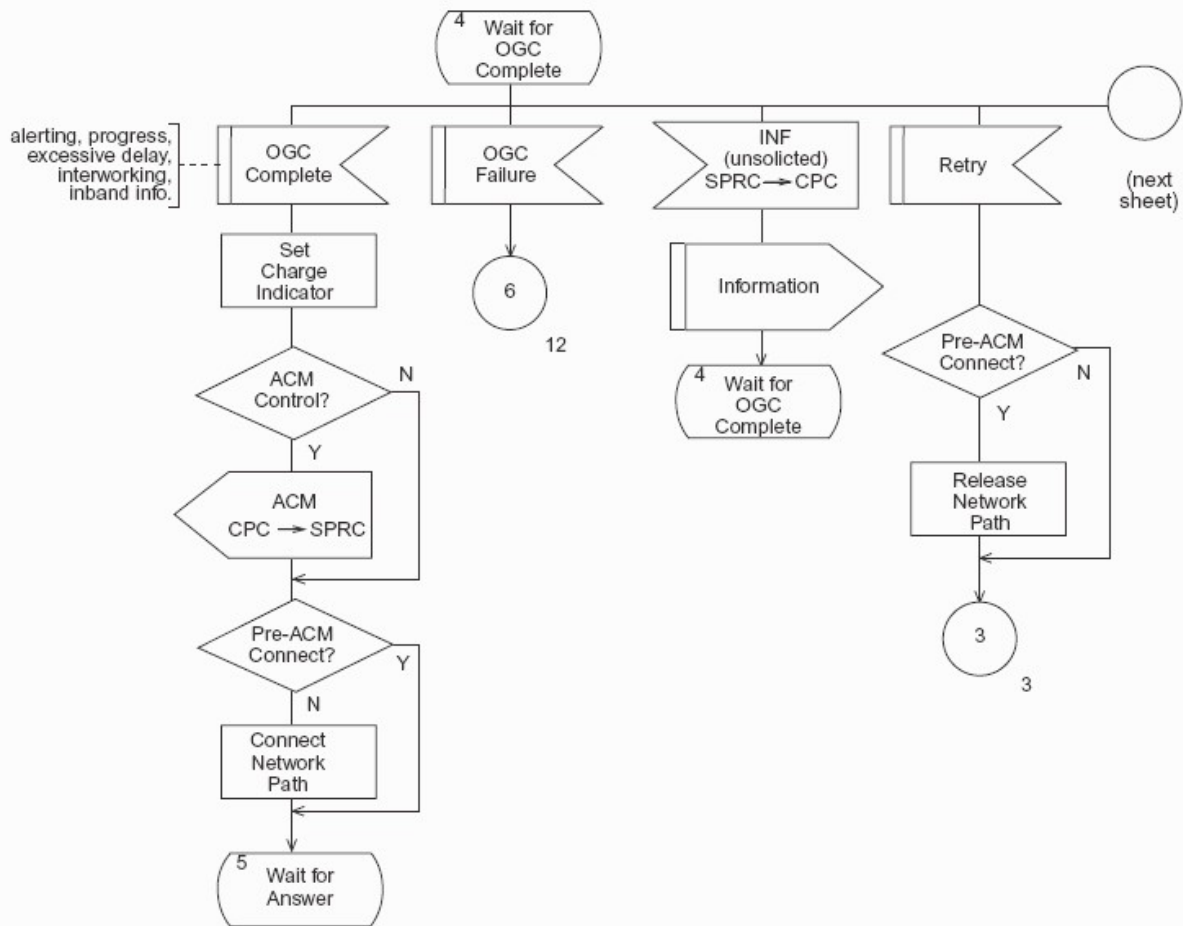


Figure 2.3 – Call processing control (CPC) incoming (Sheet 13 of 41) - ATIS-1000113.2015 – Chapter 6

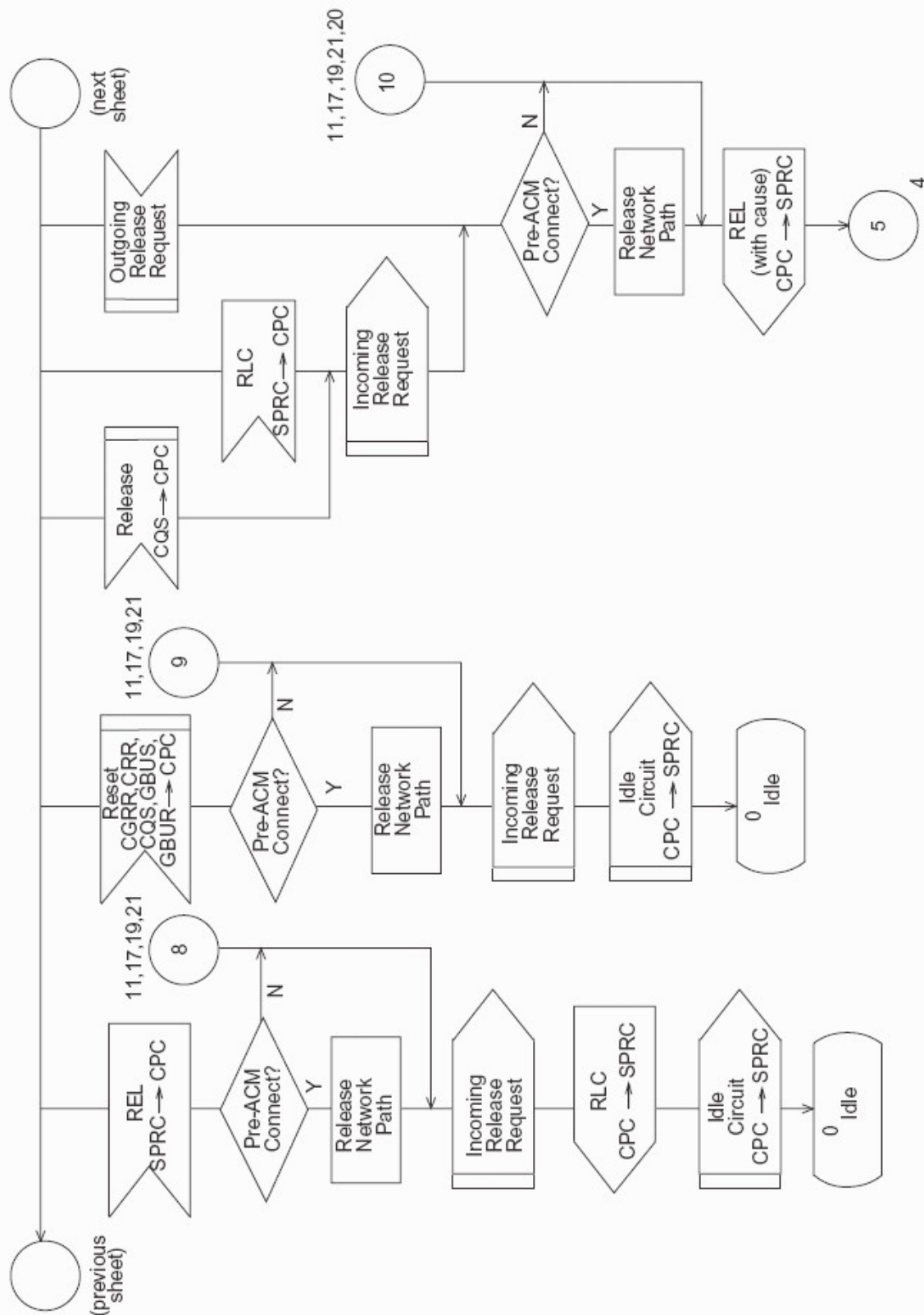


Figure 2.3 – Call processing control (CPC) incoming (Sheet 14 of 41) - ATIS-1000113.2015 – Chapter 6

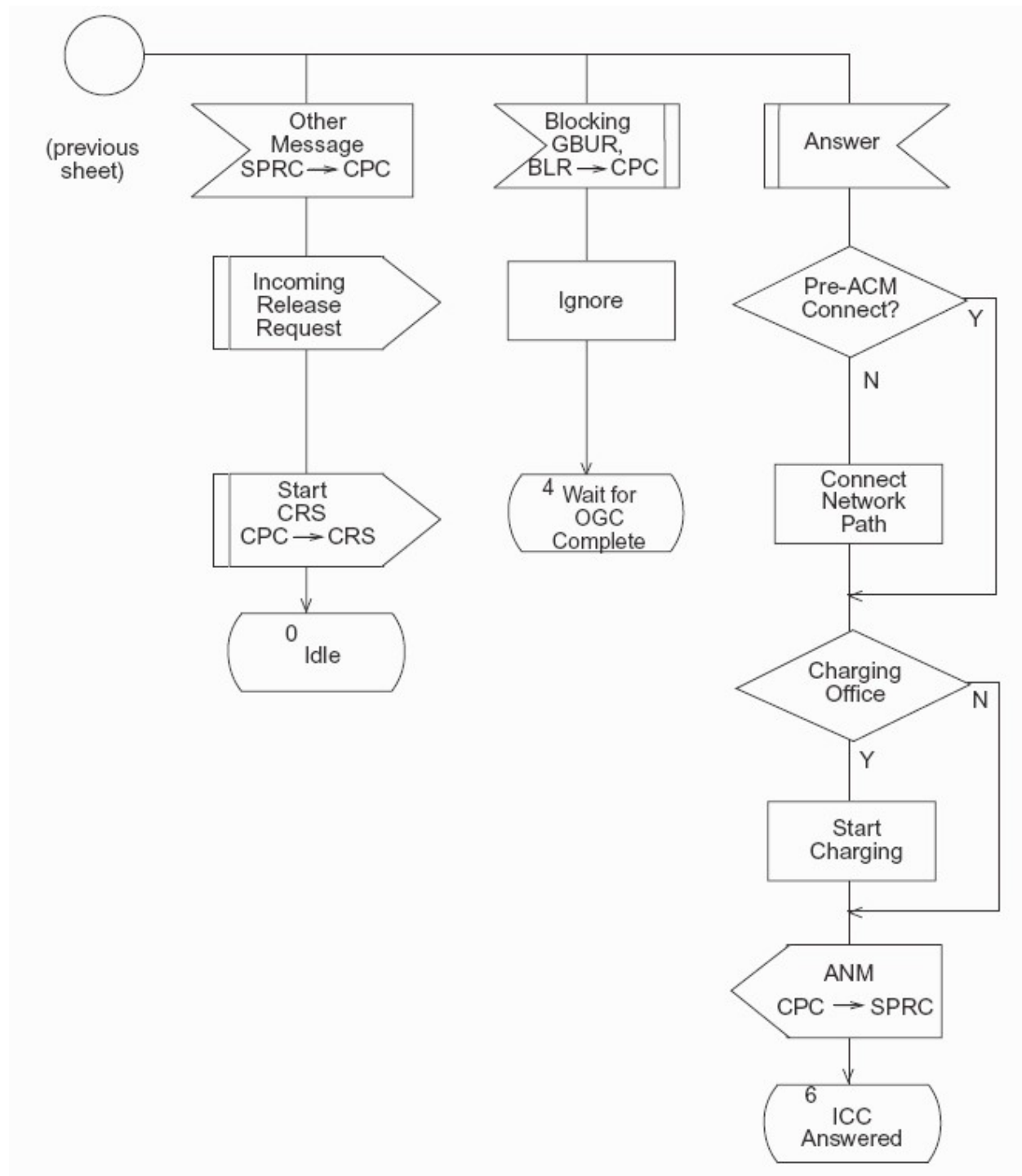


Figure 2.3 – Call processing control (CPC) incoming (Sheet 15 of 41) - ATIS-1000113.2015 – Chapter 6

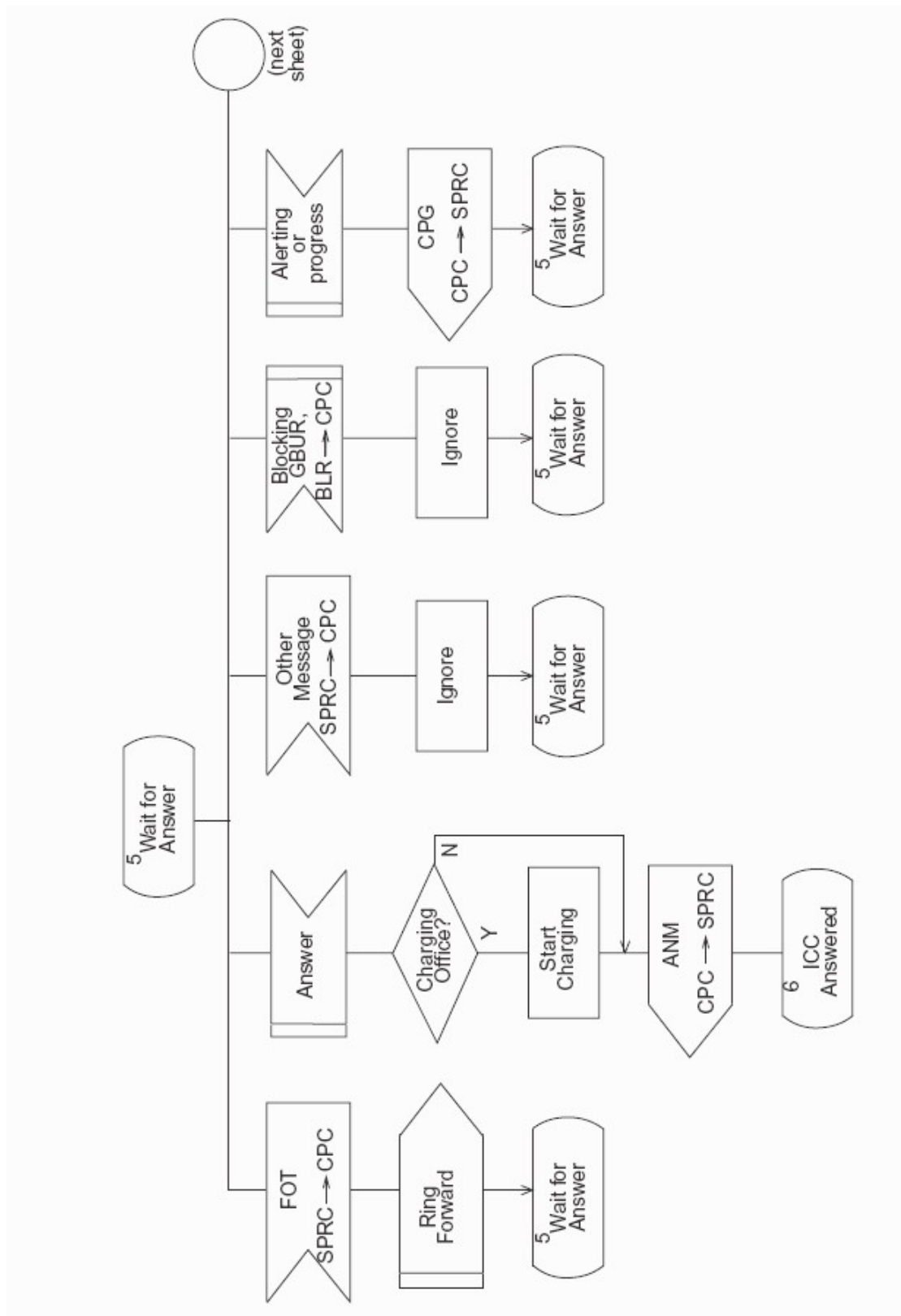


Figure 2.3 – Call processing control (CPC) incoming (Sheet 16 of 41) - ATIS-1000113.2015 – Chapter 6

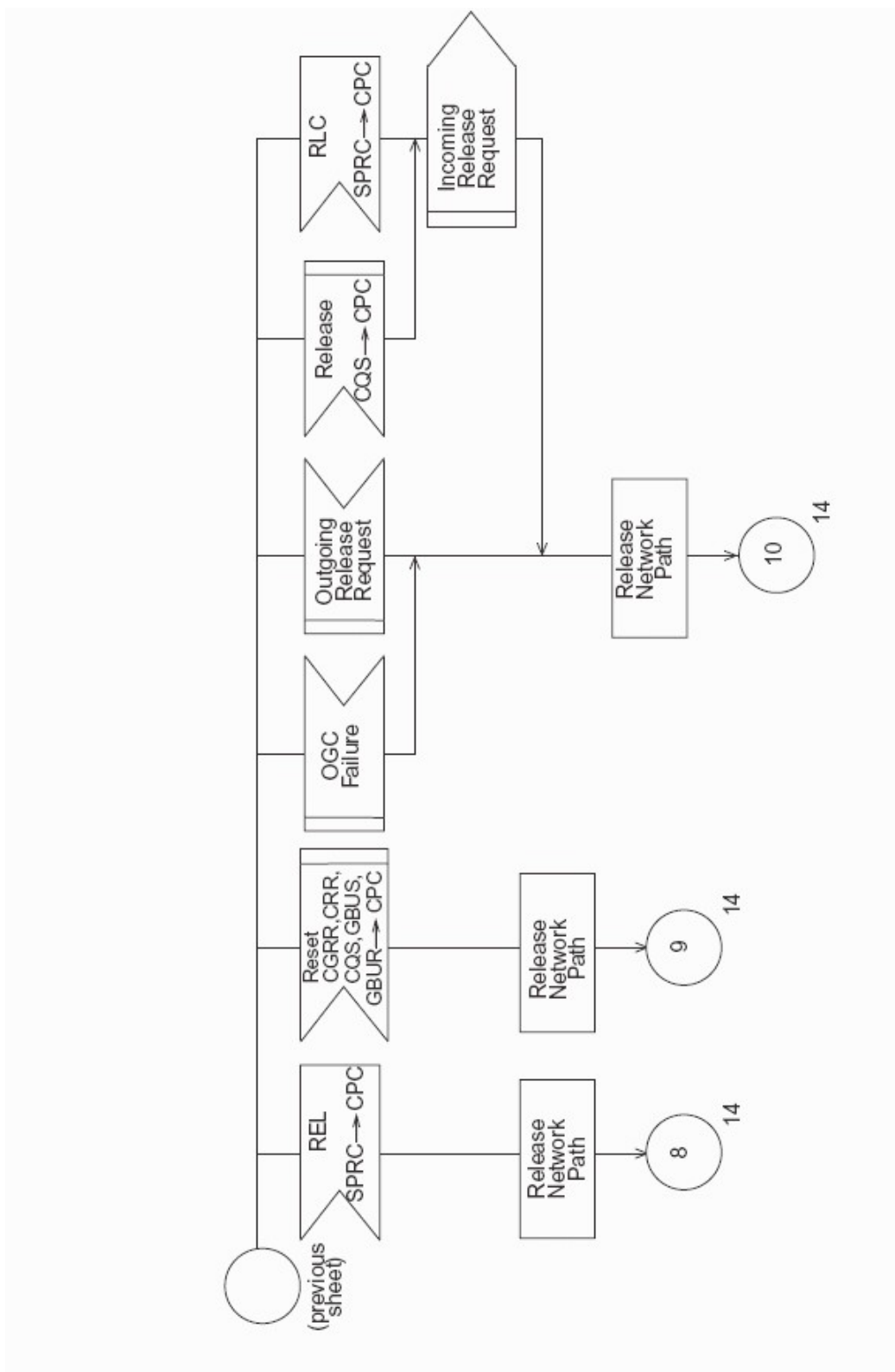


Figure 2.3 – Call processing control (CPC) incoming (Sheet 17 of 41) - ATIS-1000113.2015 – Chapter 6

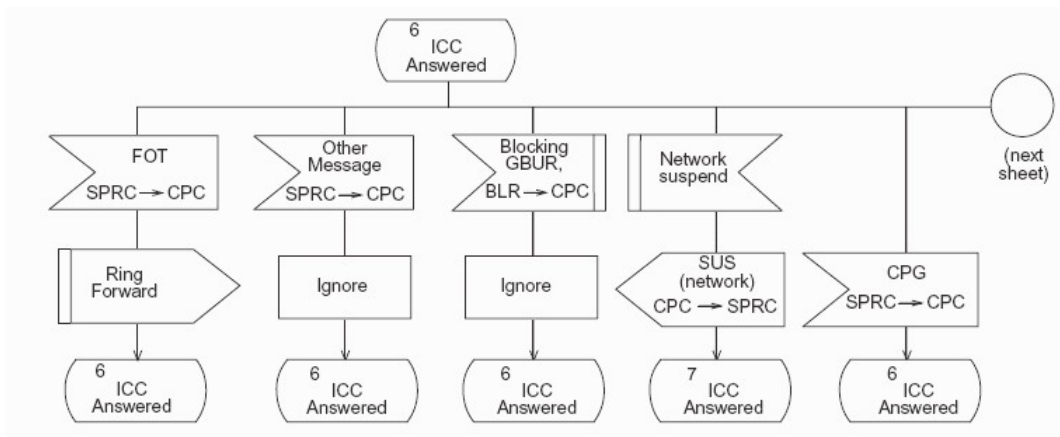


Figure 2.3 – Call processing control (CPC) incoming (Sheet 18 of 41) - ATIS-1000113.2015 – Chapter 6

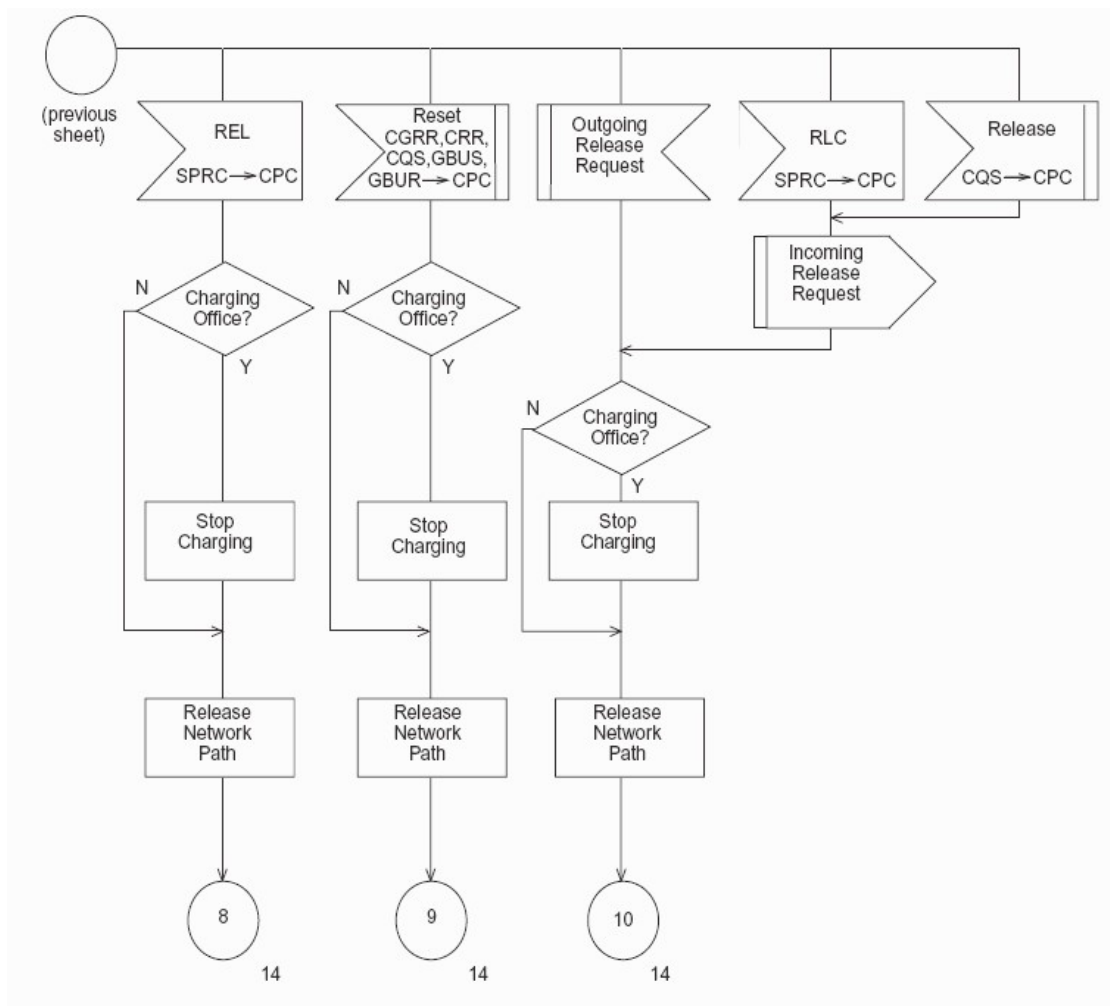


Figure 2.3 – Call processing control (CPC) incoming (Sheet 19 of 41) - ATIS-1000113.2015 – Chapter 6

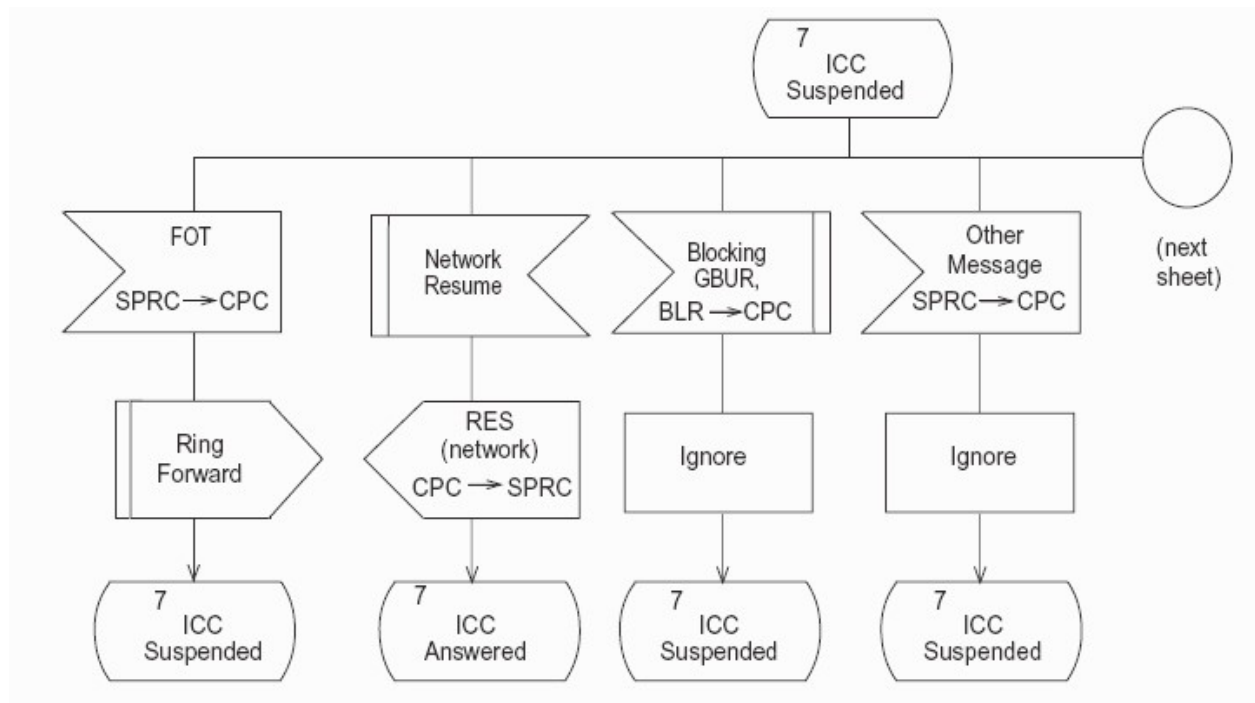


Figure 2.3 – Call processing control (CPC) incoming (Sheet 20 of 41) - ATIS-1000113.2015 – Chapter 6

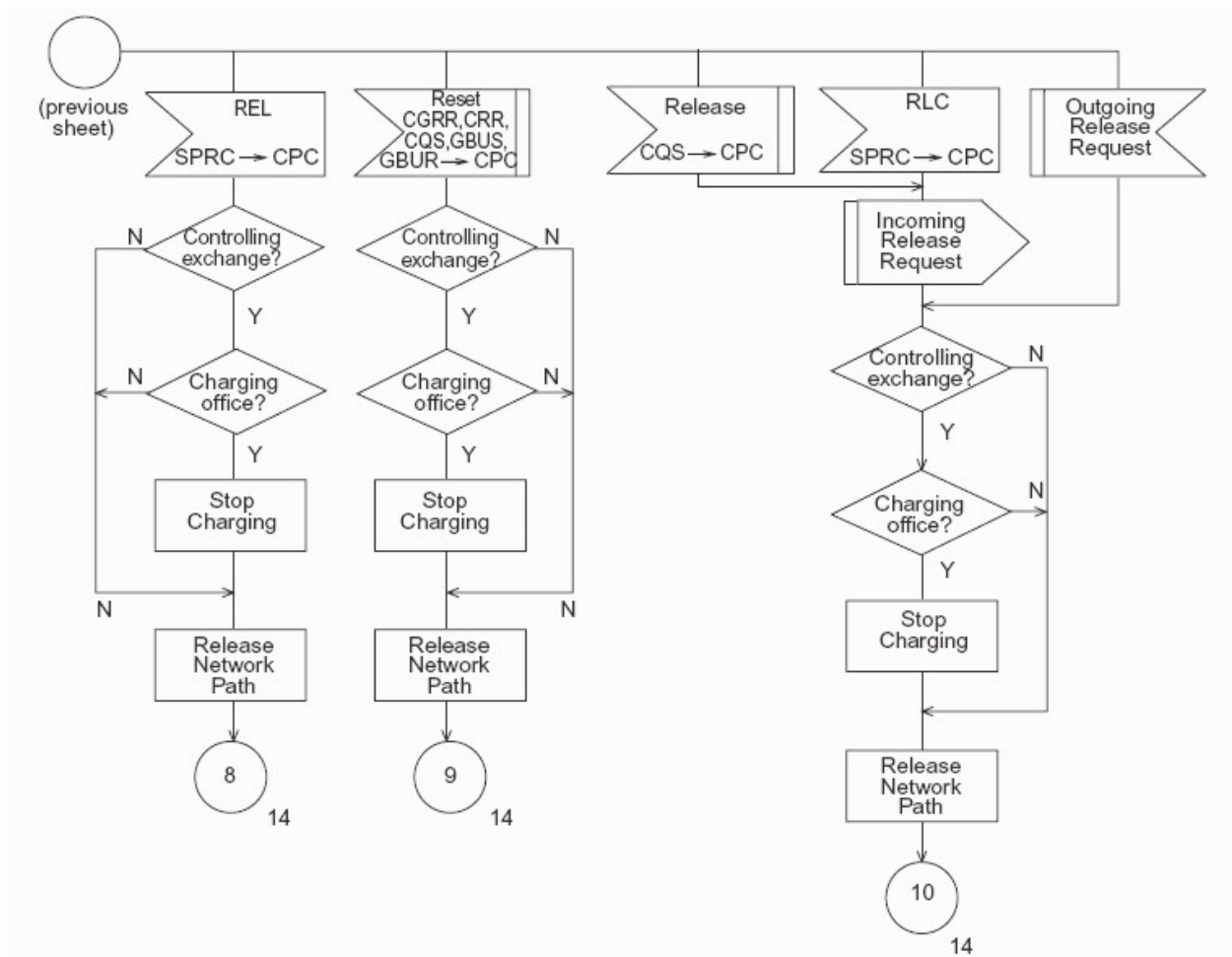


Figure 2.3 – Call processing control (CPC) incoming (Sheet 21 of 41) - ATIS-1000113.2015 – Chapter 6

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Figure 2.3 – Call processing control (CPC) incoming (Sheet 22 of 41) - ATIS-1000113.2015 – Chapter 6

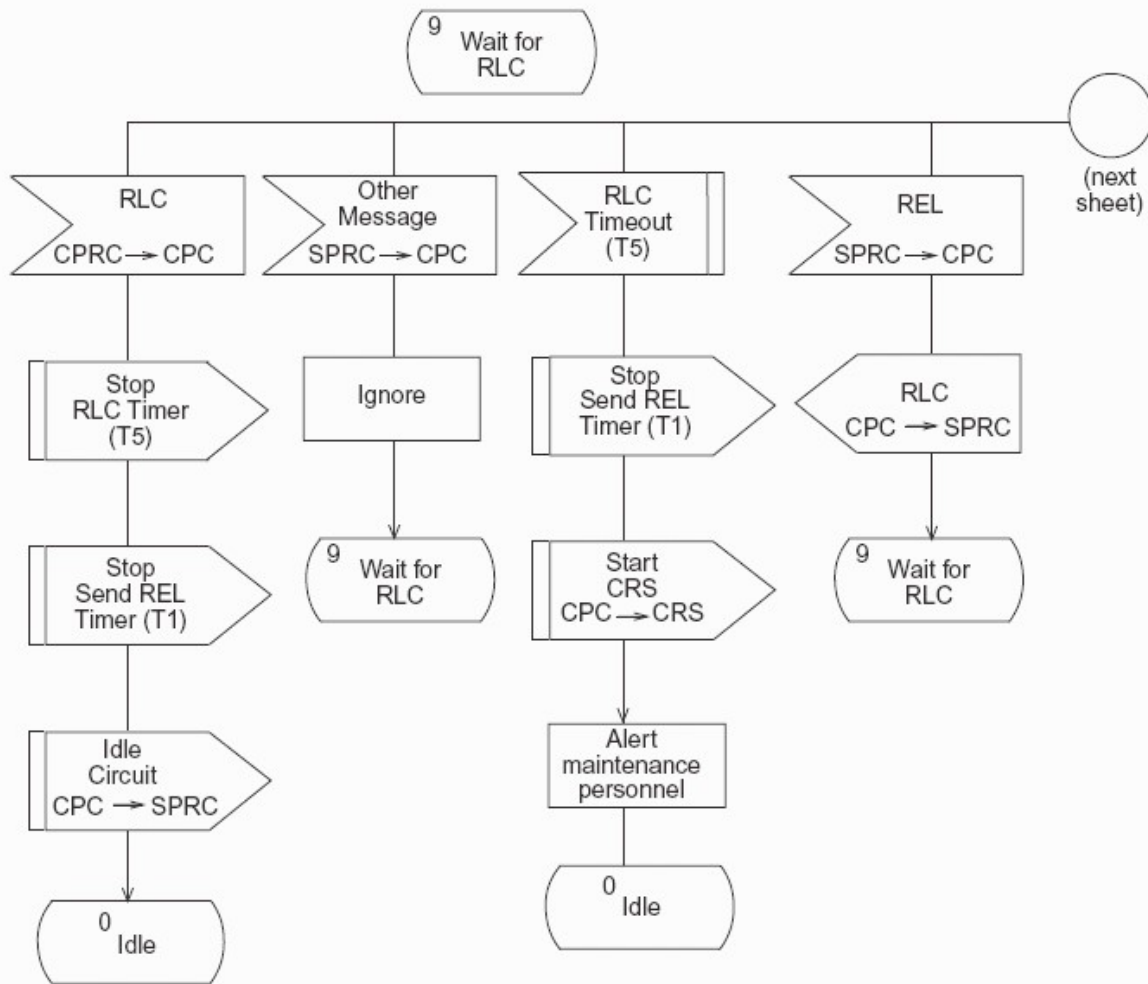


Figure 2.3 – Call processing control (CPC) incoming (Sheet 23 of 41) - ATIS-1000113.2015 – Chapter 6

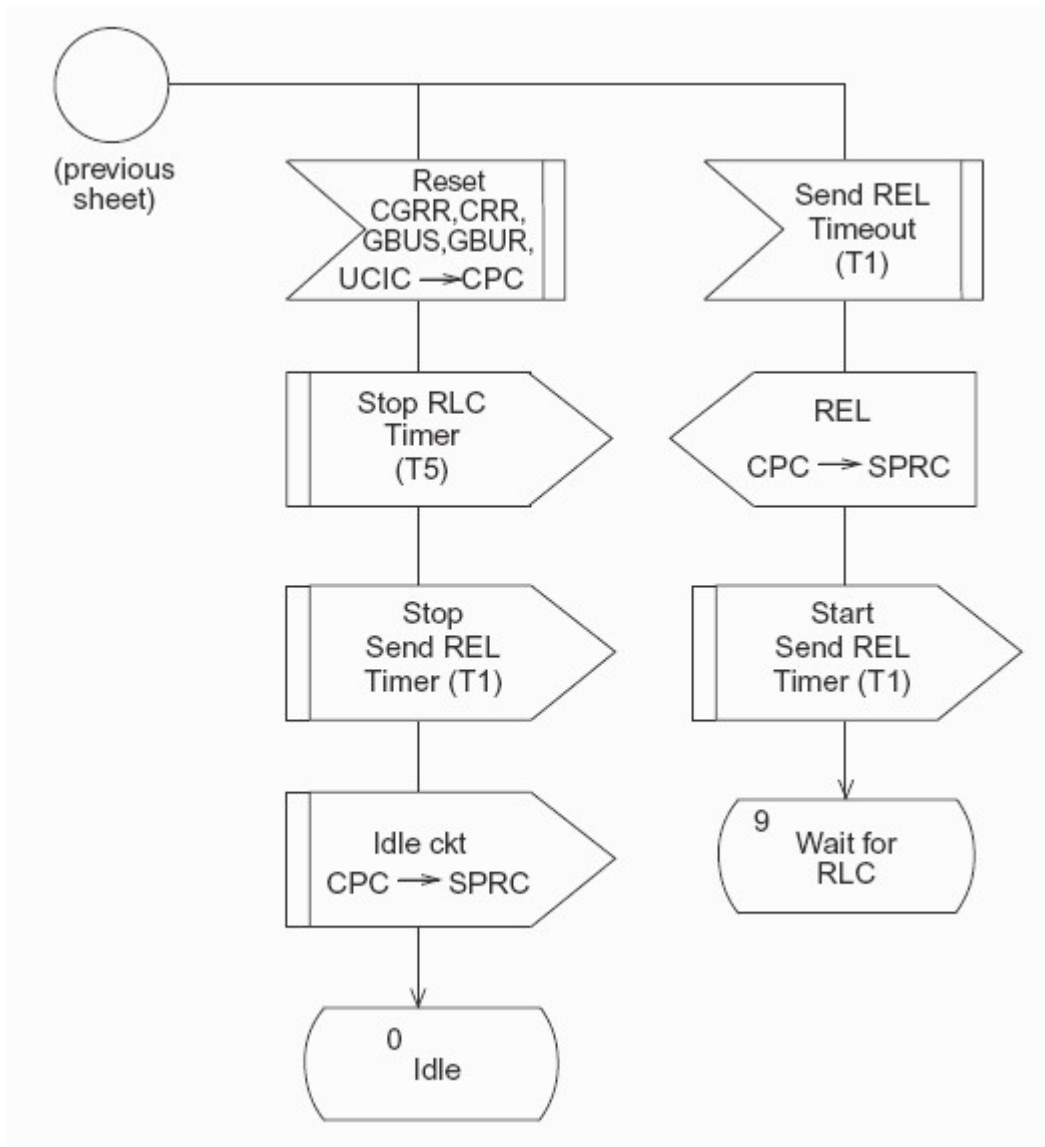


Figure 2.3 – Call processing control (CPC) incoming (Sheet 24 of 41) - ATIS-1000113.2015 – Chapter 6

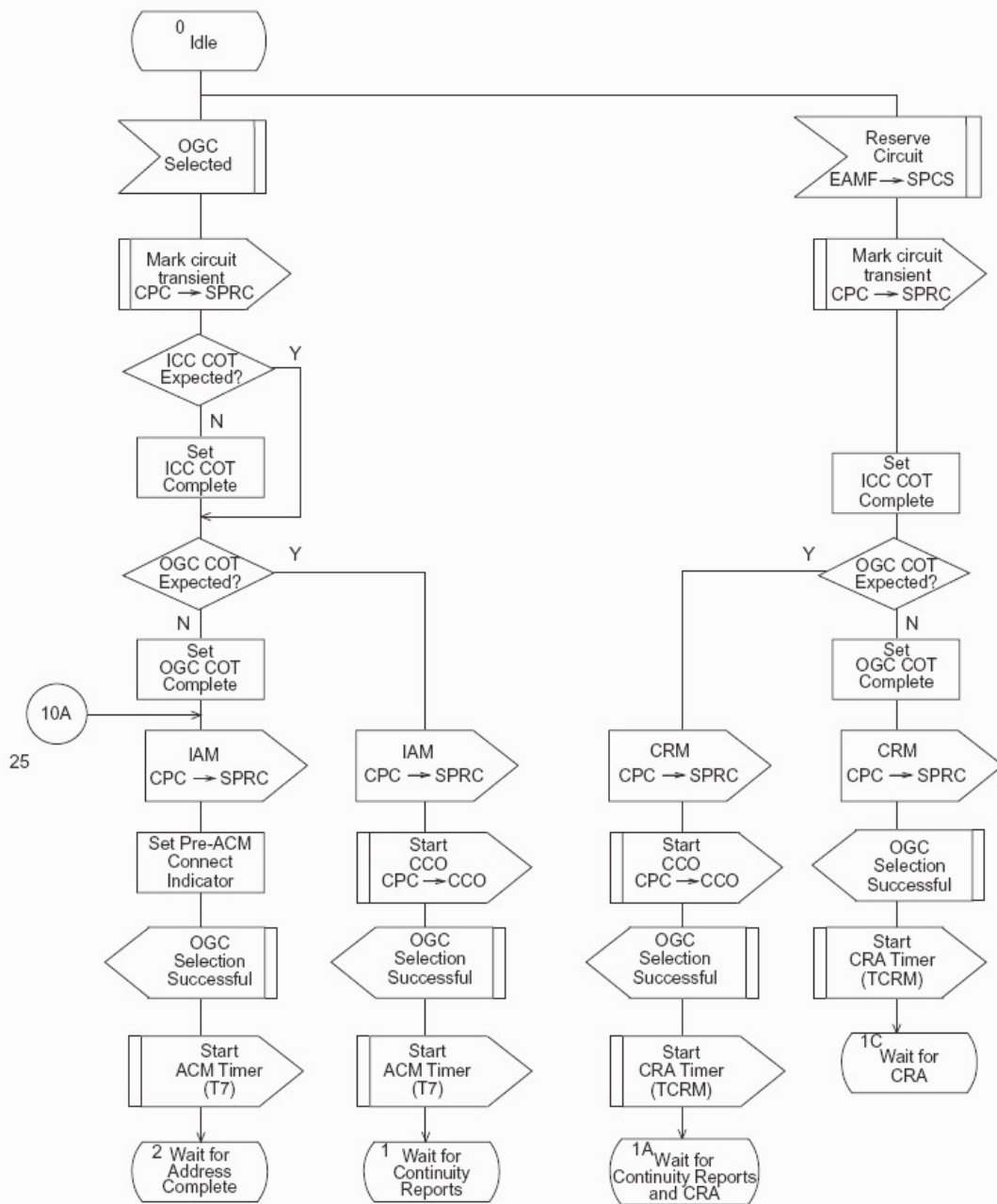


Figure 2.3 – Call processing control (CPC) incoming (Sheet 25 of 41) - ATIS-1000113.2015 – Chapter 6

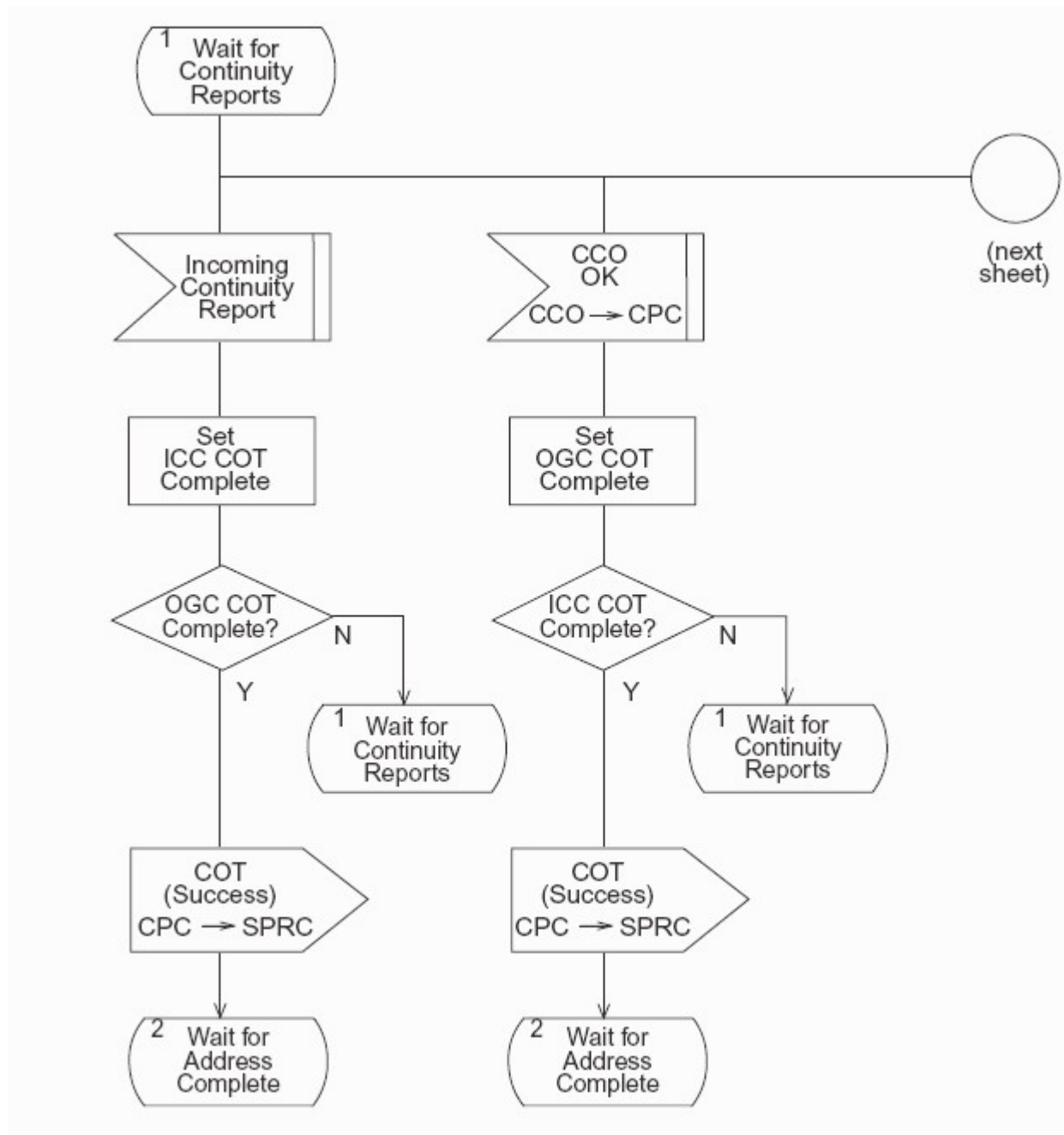


Figure 2.3 – Call processing control (CPC) incoming (Sheet 26 of 41) - ATIS-1000113.2015 – Chapter 6

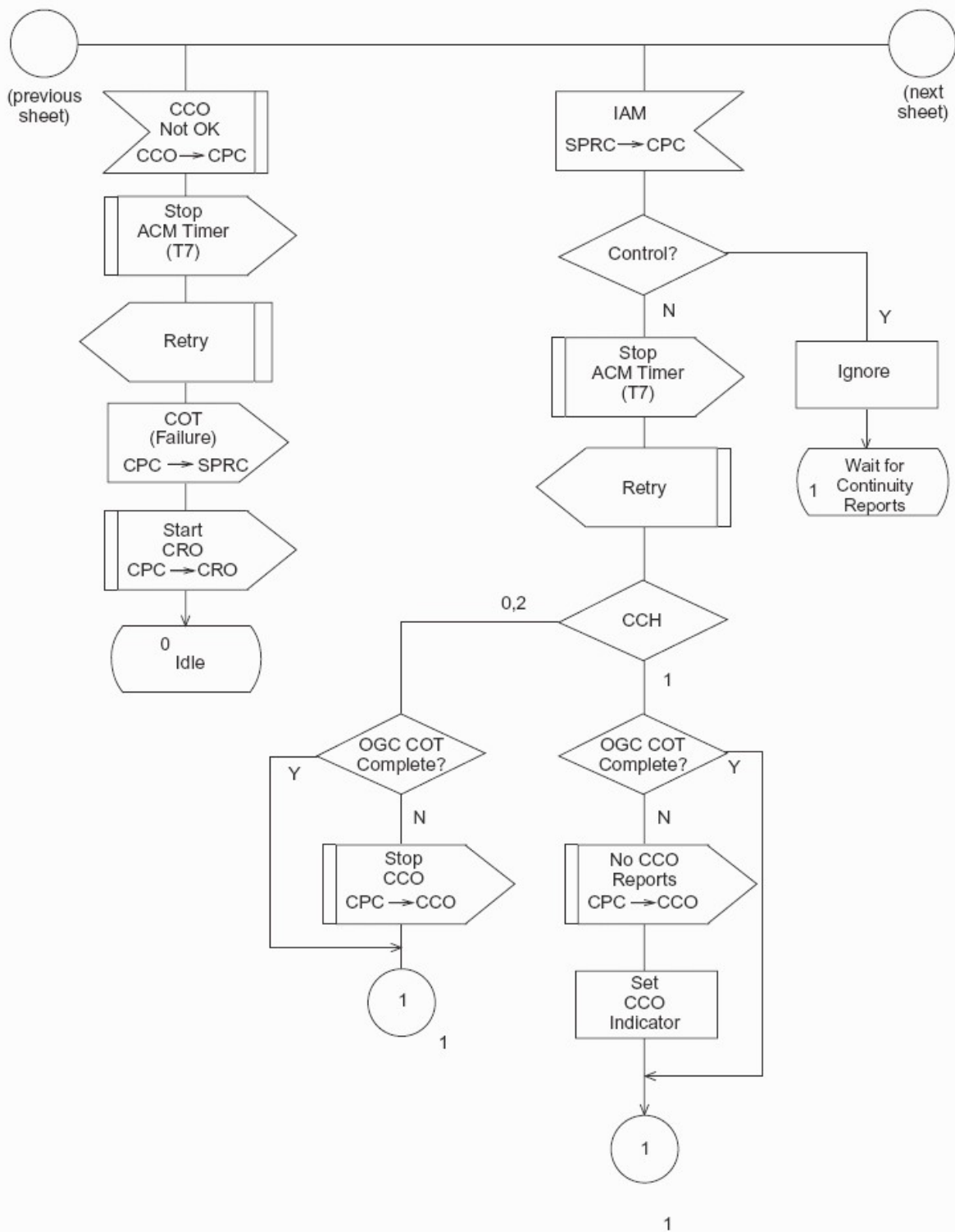


Figure 2.3 – Call processing control (CPC) incoming (Sheet 27 of 41) - ATIS-1000113.2015 – Chapter 6

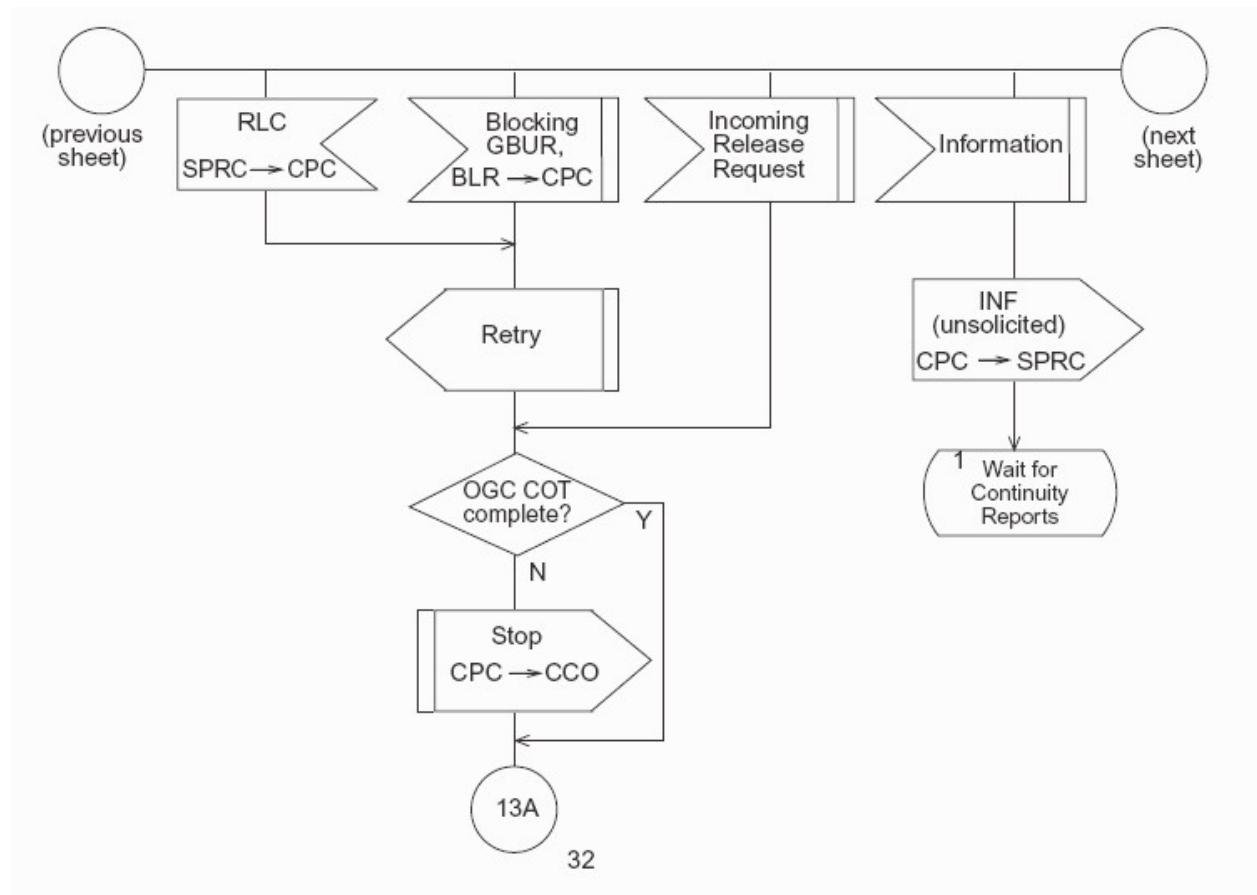


Figure 2.3 – Call processing control (CPC) incoming (Sheet 28 of 41) - ATIS-1000113.2015 – Chapter 6

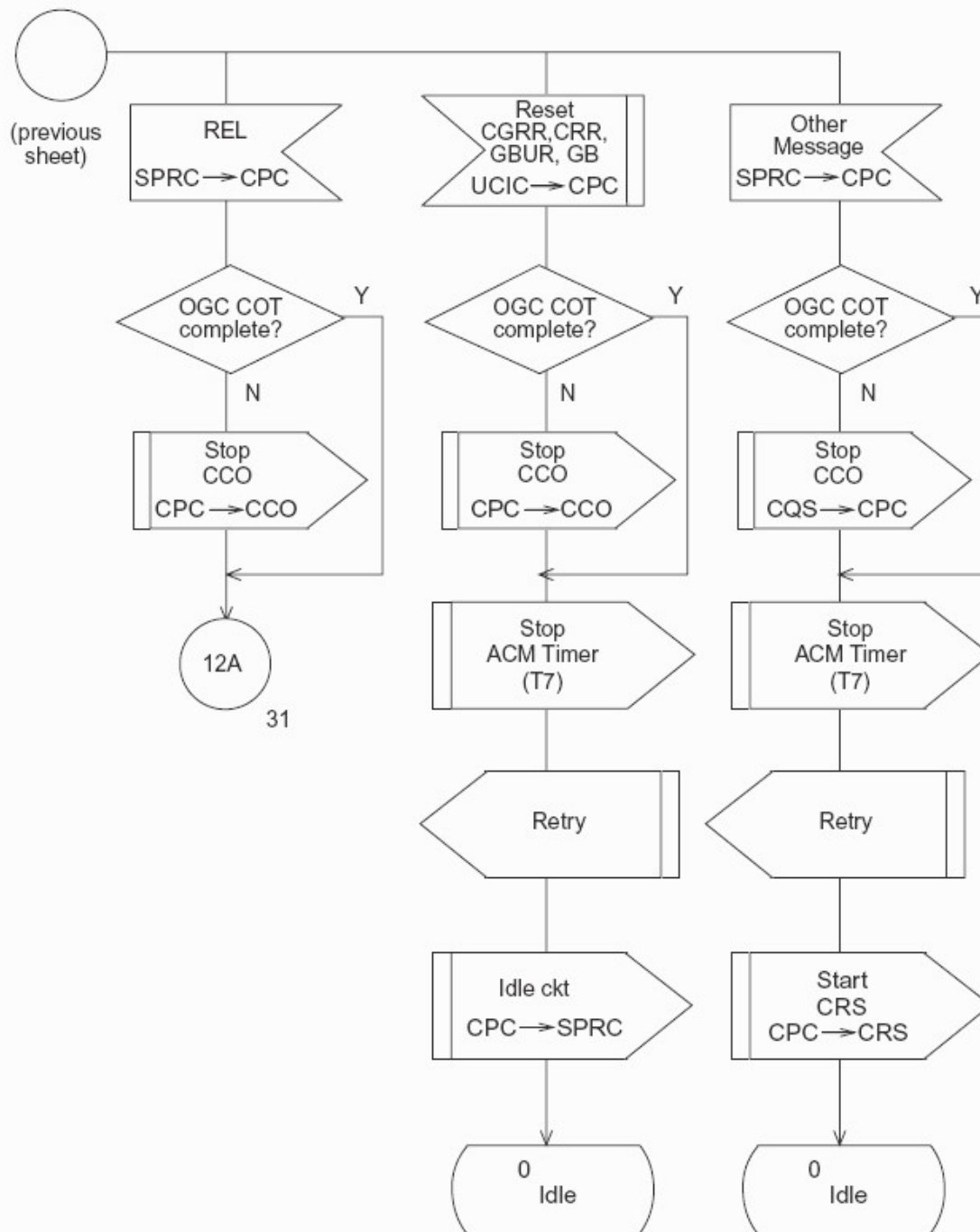


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29 of 41) - ATIS-1000113.2015 – Chapter 6

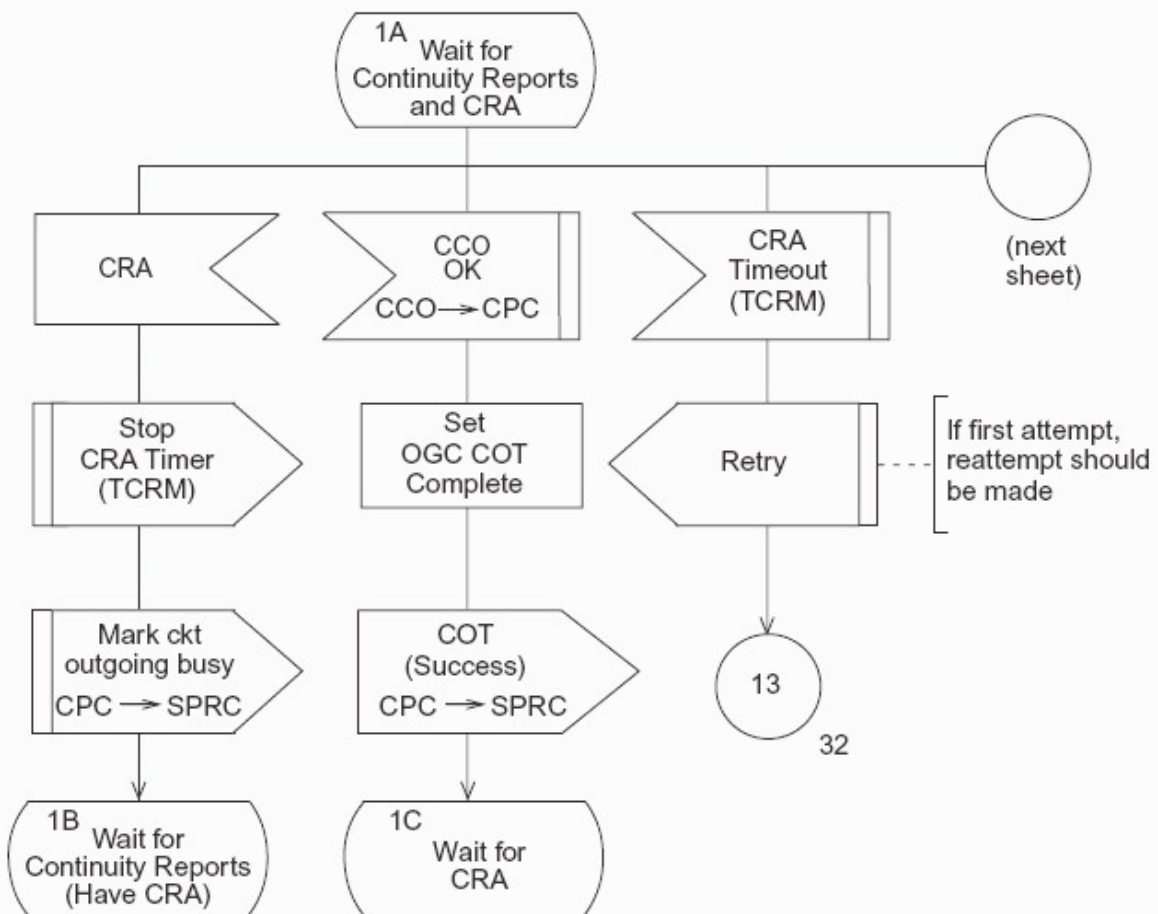


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29A of 41) - ATIS-1000113.2015 – Chapter 6

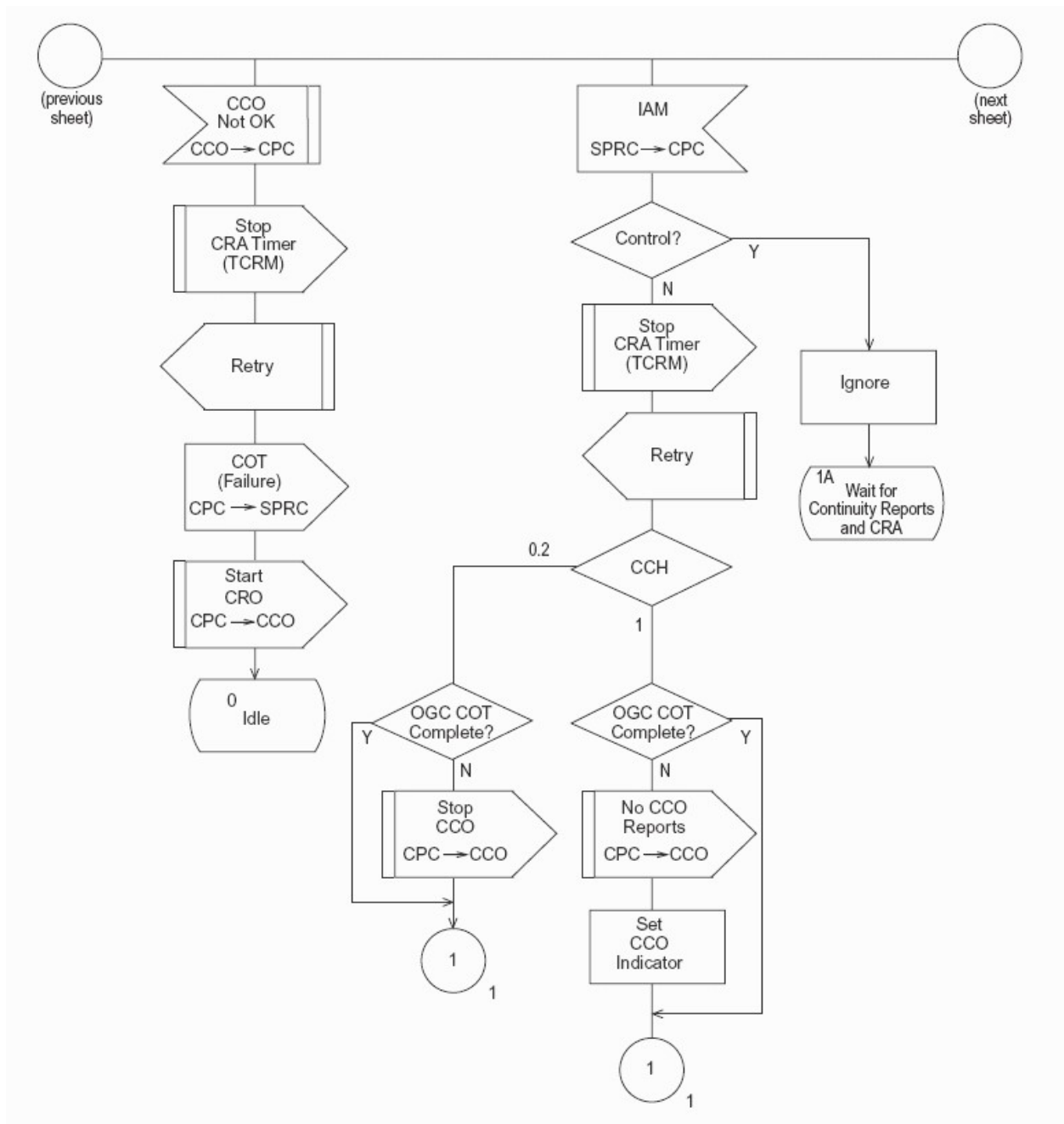


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29B of 41) - ATIS-1000113.2015 – Chapter 6

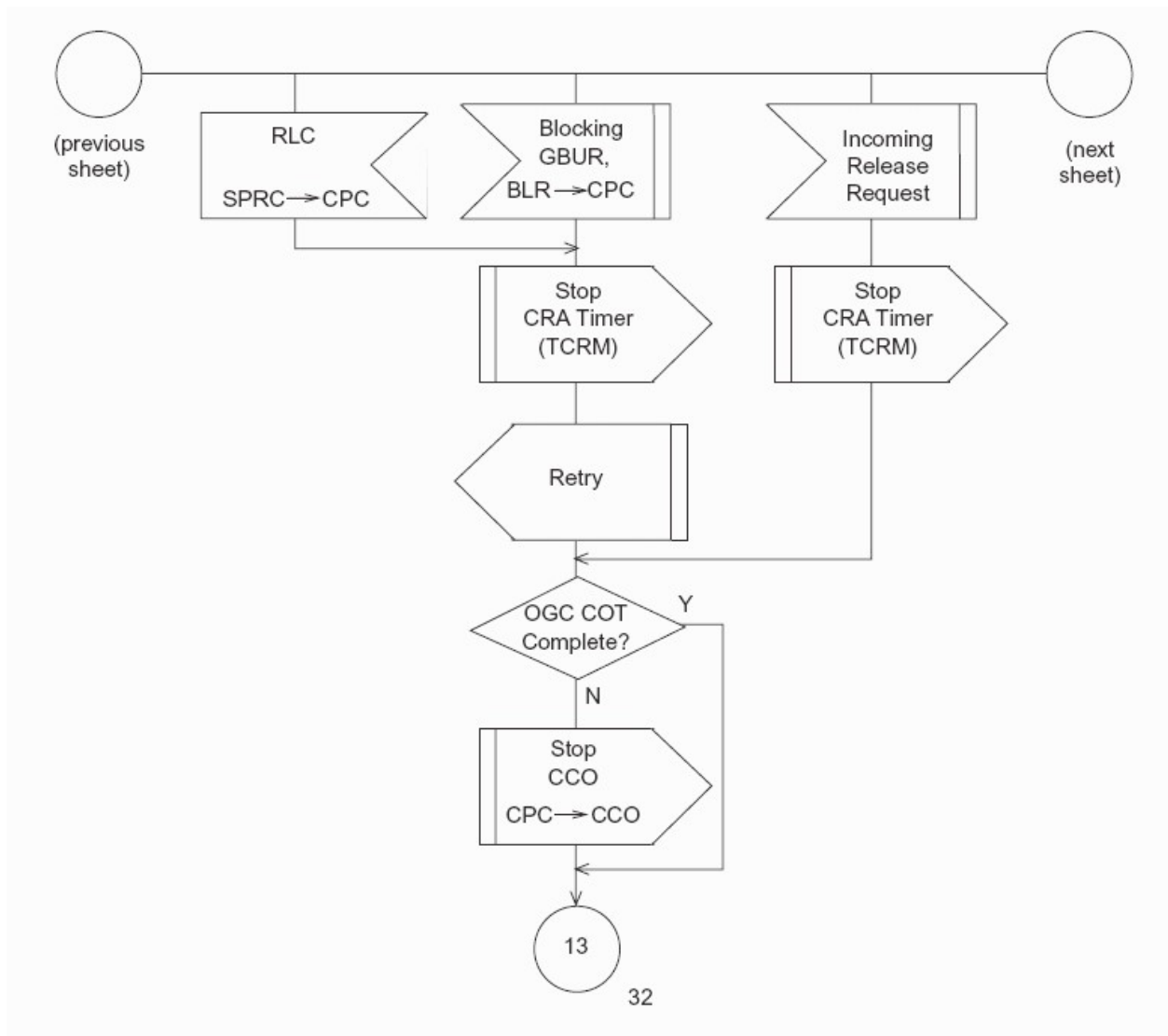


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29C of 41) - ATIS-1000113.2015 – Chapter 6

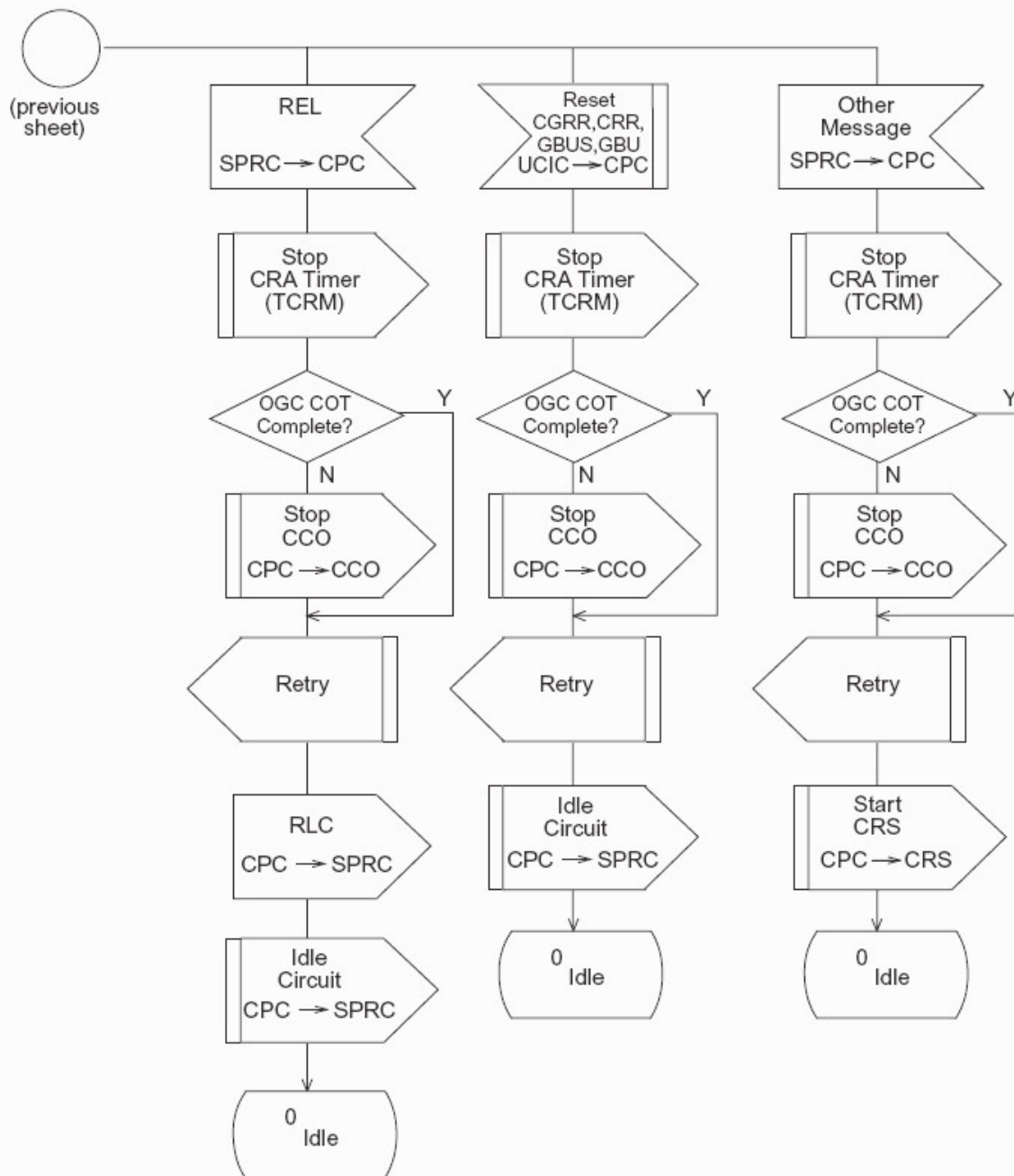


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29D of 41) - ATIS-1000113.2015 – Chapter 6

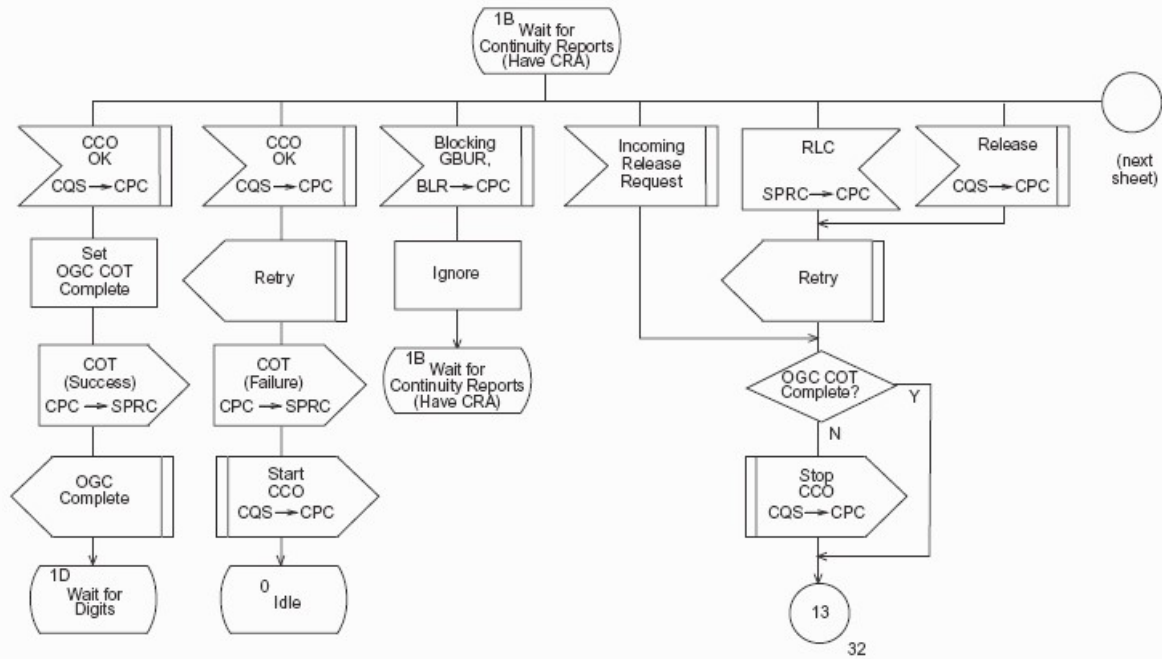


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29E of 41) - ATIS-1000113.2015 – Chapter 6

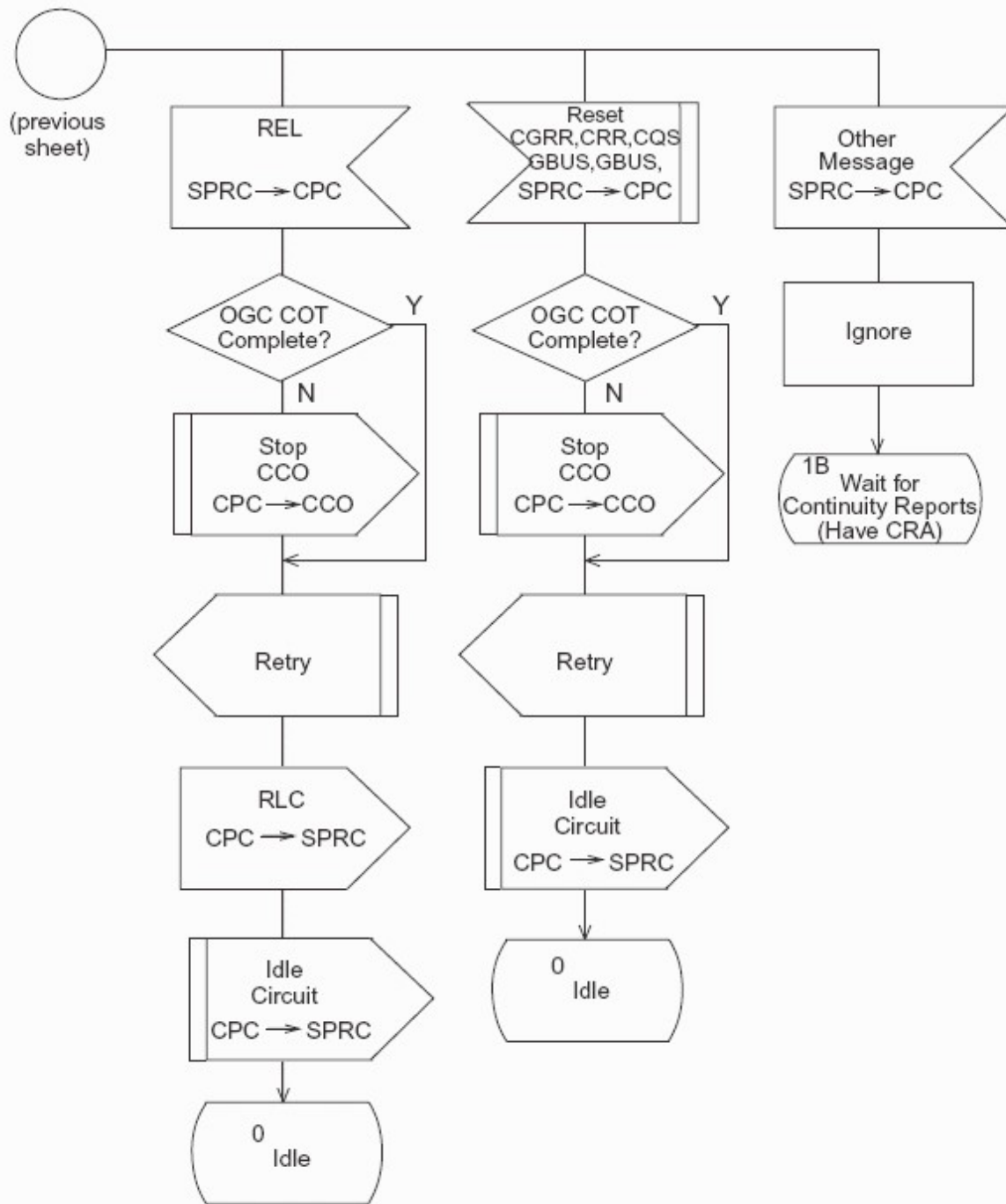


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29F of 41) - ATIS-1000113.2015 – Chapter 6

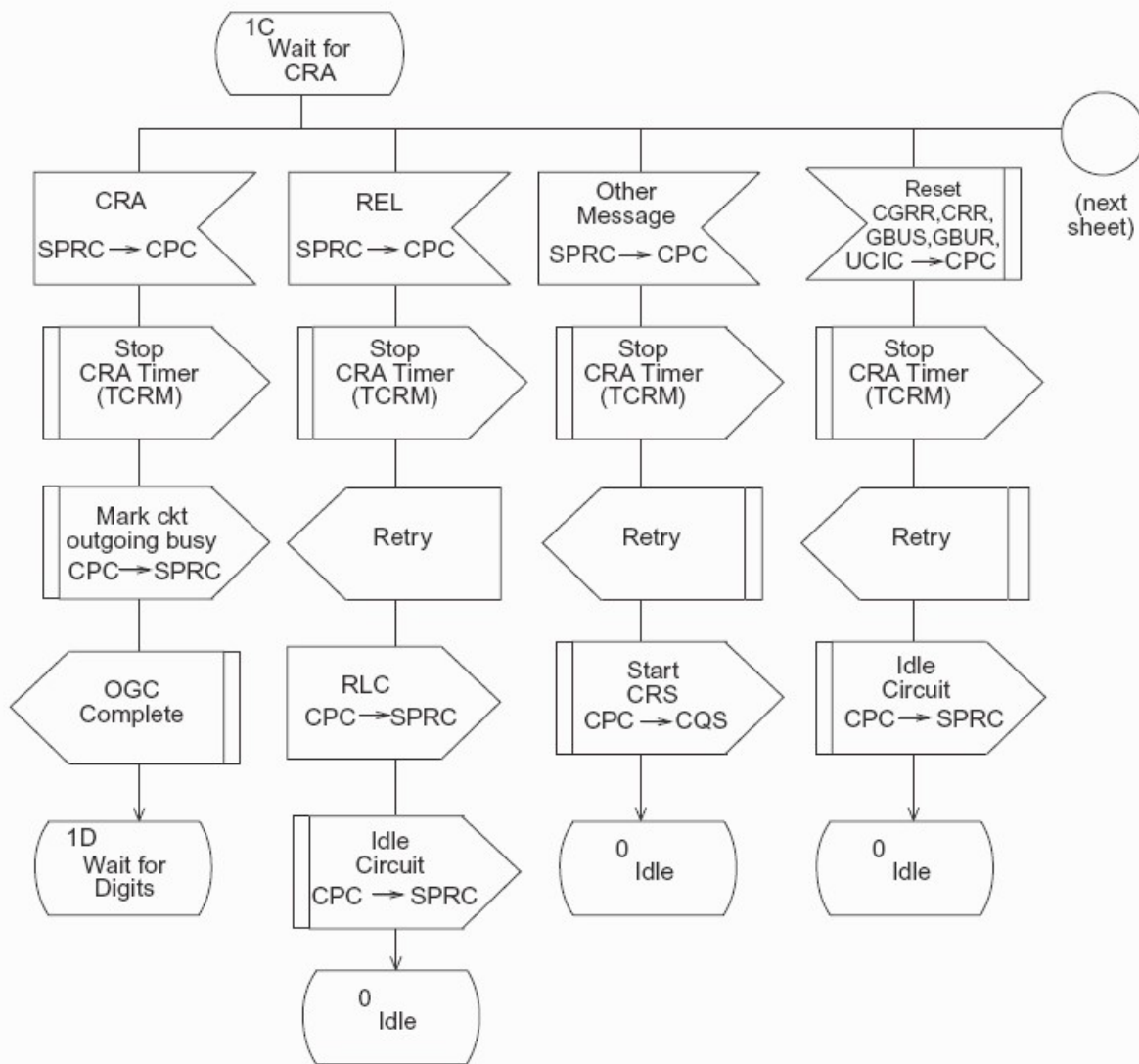


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29G of 41) - ATIS-1000113.2015 – Chapter 6

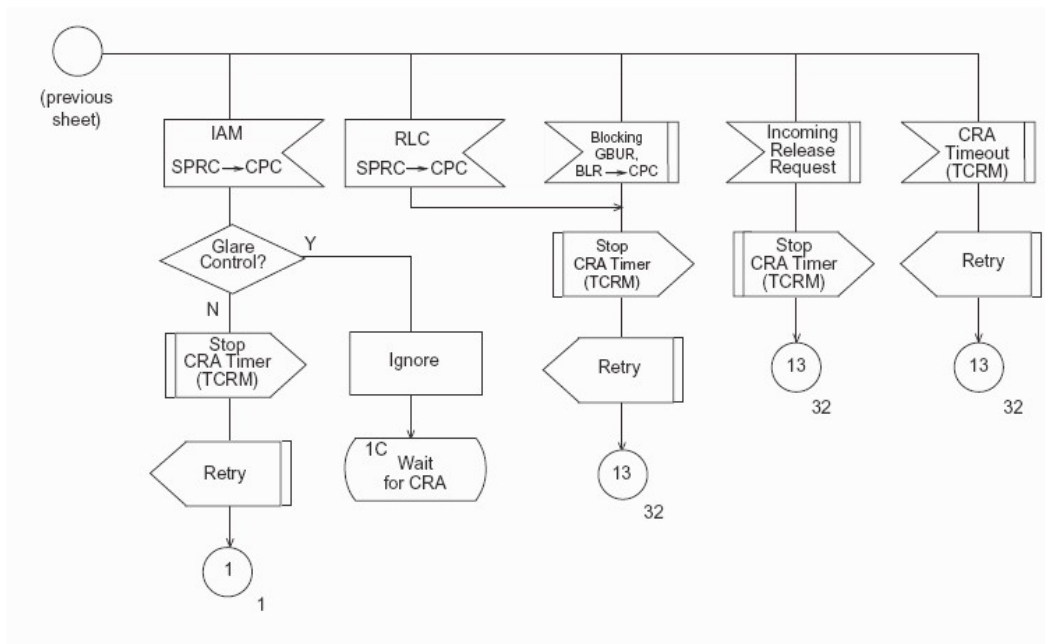


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29H of 41) - ATIS-1000113.2015 – Chapter 6

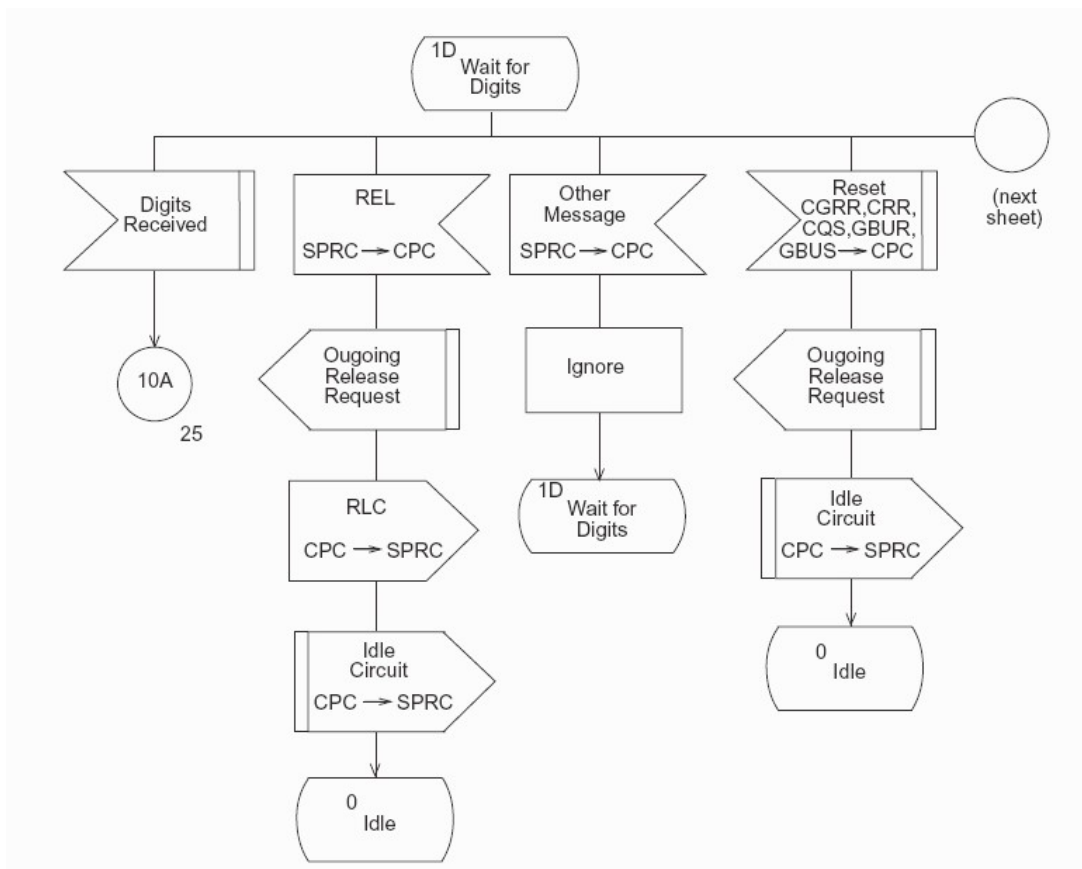


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29I of 41) - ATIS-1000113.2015 – Chapter 6

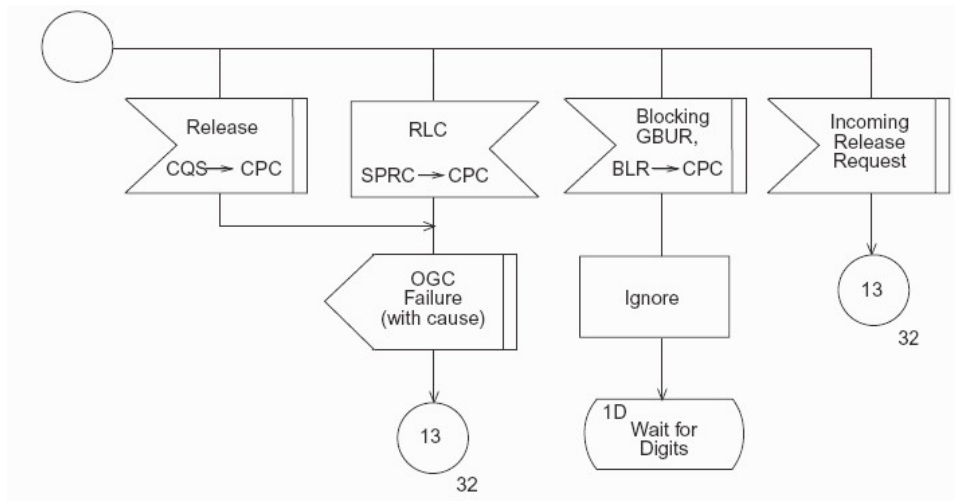


Figure 2.3 – Call processing control (CPC) incoming (Sheet 29J of 41) - ATIS-1000113.2015 – Chapter 6

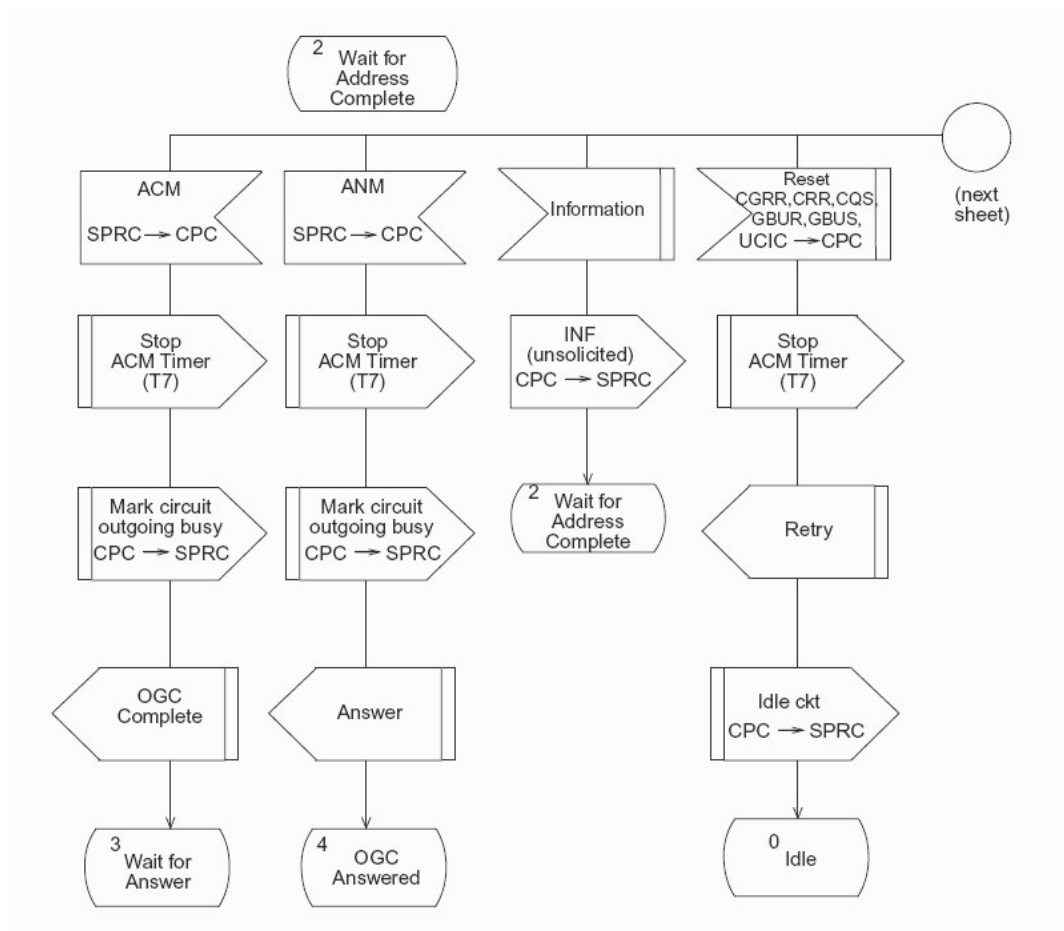


Figure 2.3 – Call processing control (CPC) incoming (Sheet 30 of 41) - ATIS-1000113.2015 – Chapter 6

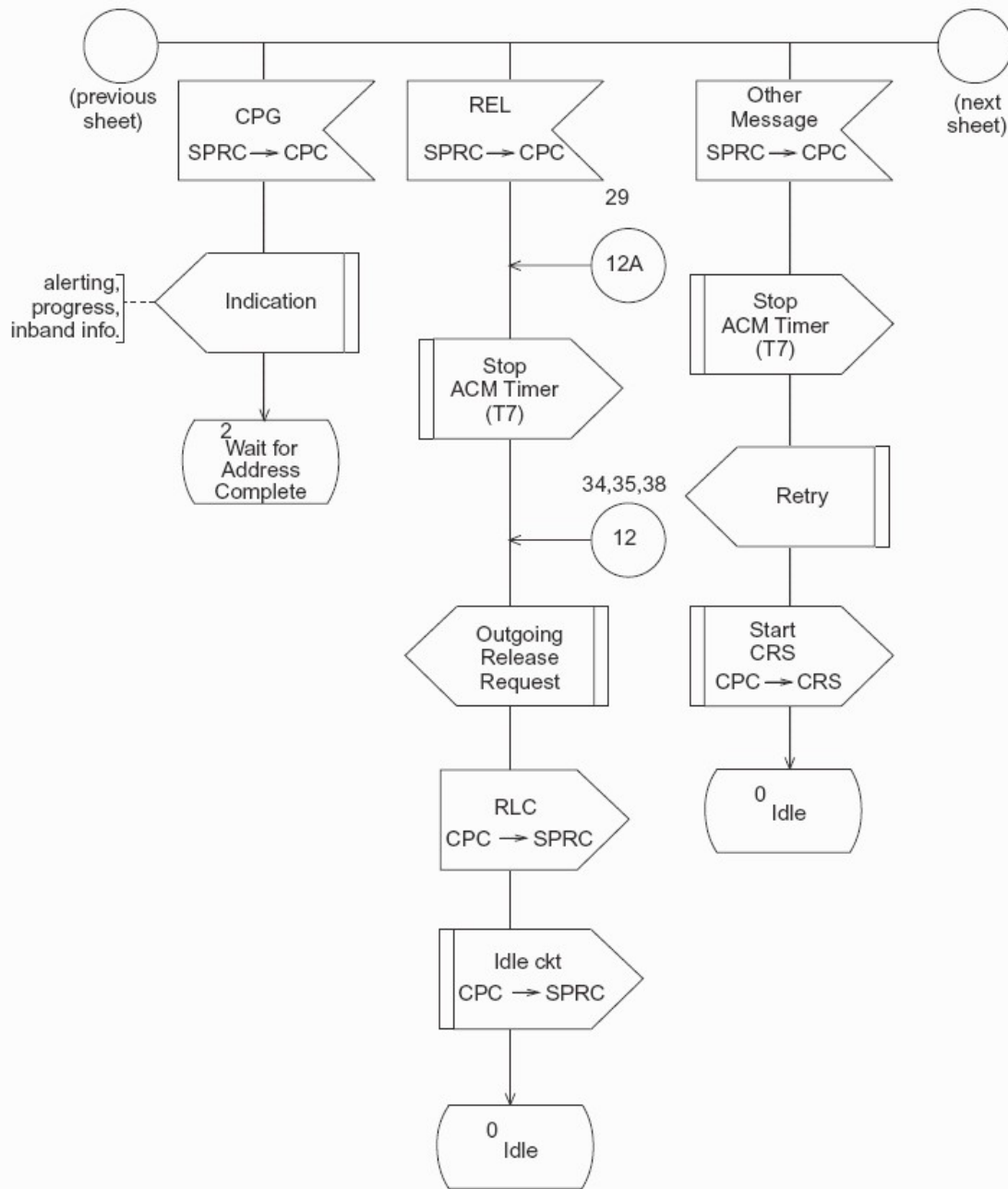


Figure 2.3 – Call processing control (CPC) incoming (Sheet 31 of 41) - ATIS-1000113.2015 – Chapter 6

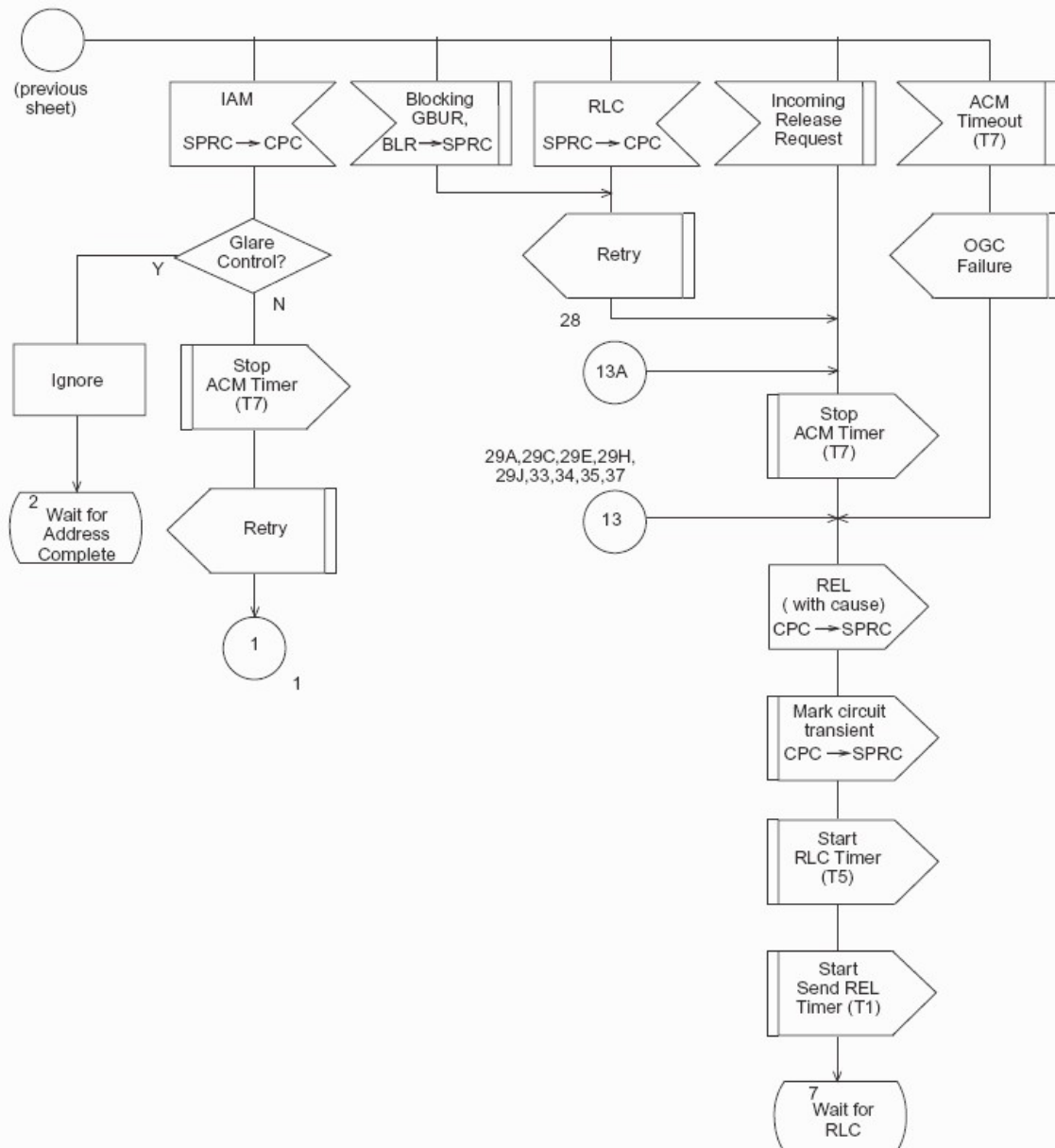


Figure 2.3 – Call processing control (CPC) incoming (Sheet 32 of 41) - ATIS-1000113.2015 – Chapter 6

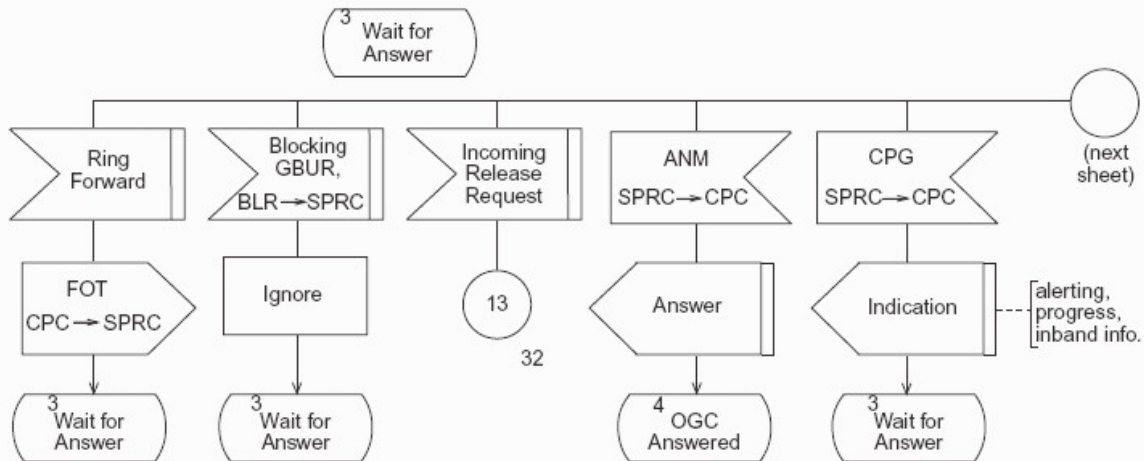


Figure 2.3 – Call processing control (CPC) incoming (Sheet 33 of 41) - ATIS-1000113.2015 – Chapter 6

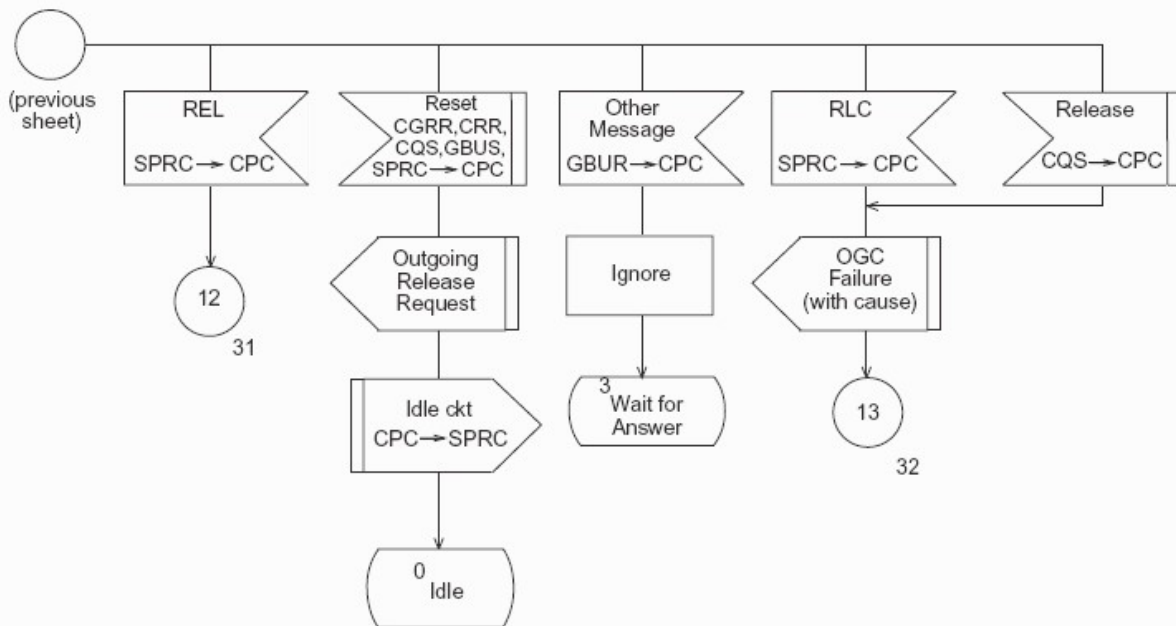


Figure 2.3 – Call processing control (CPC) incoming (Sheet 34 of 41) - ATIS-1000113.2015 – Chapter 6

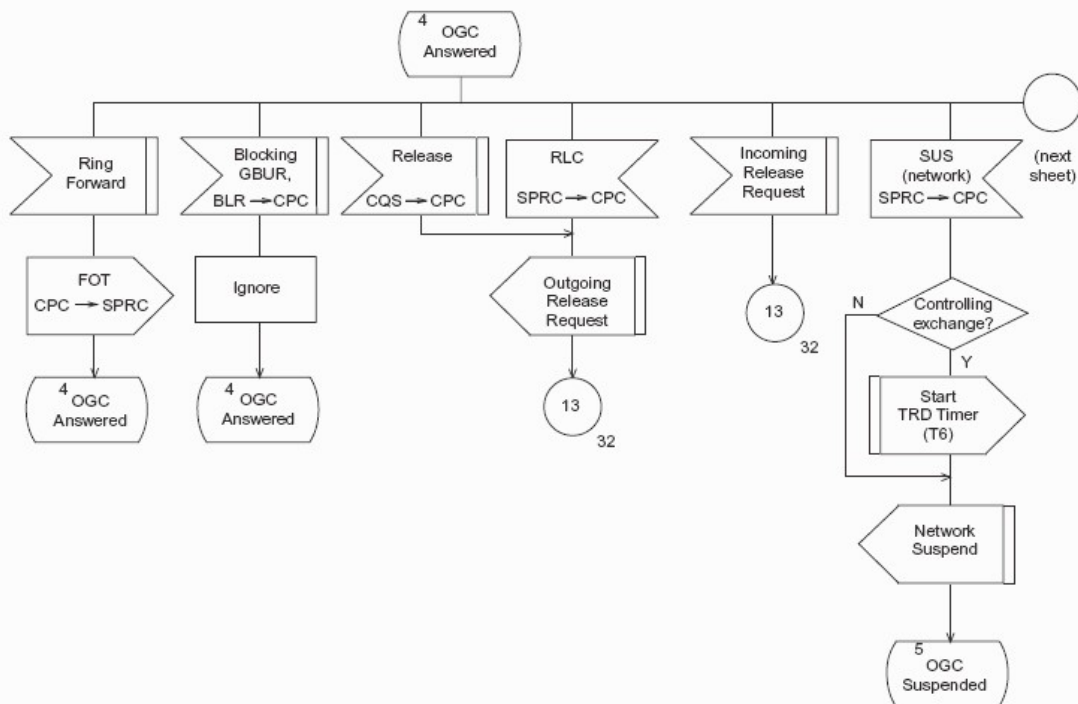


Figure 2.3 – Call processing control (CPC) incoming (Sheet 35 of 41) - ATIS-1000113.2015 – Chapter 6

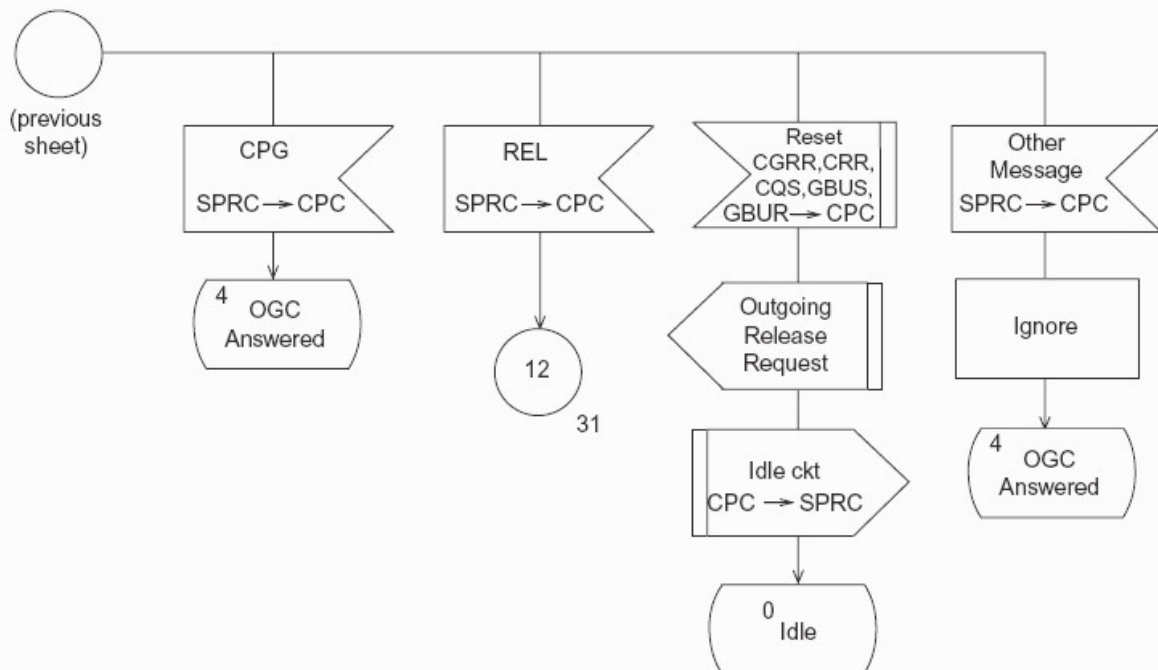


Figure 2.3 – Call processing control (CPC) incoming (Sheet 36 of 41) - ATIS-1000113.2015 – Chapter 6

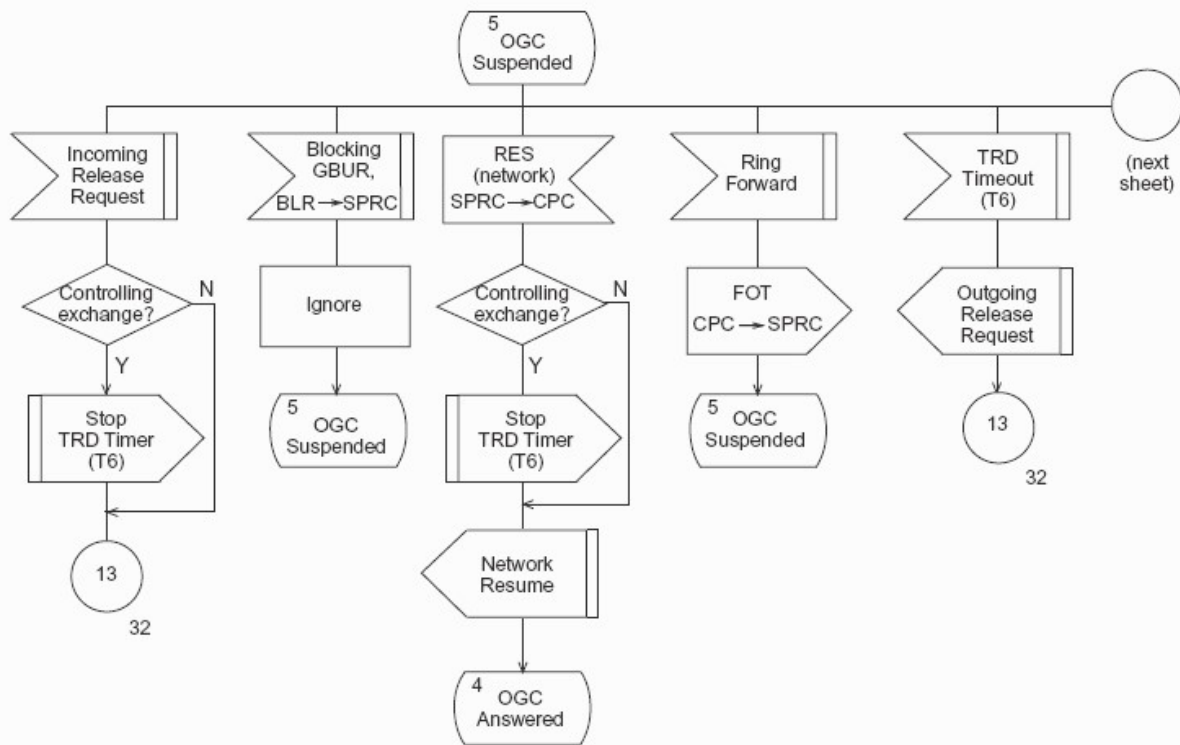


Figure 2.3 – Call processing control (CPC) incoming (Sheet 37 of 41) - ATIS-1000113.2015 – Chapter 6

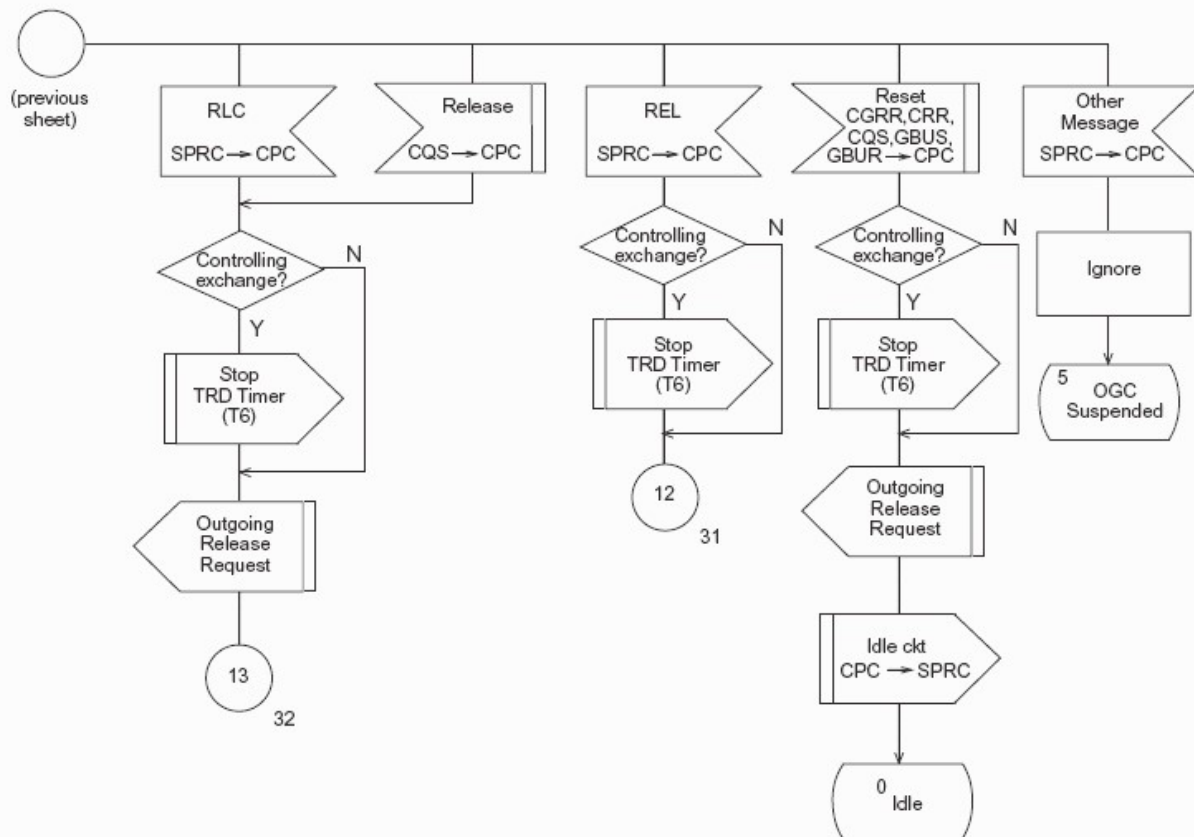


Figure 2.3 – Call processing control (CPC) incoming (Sheet 38 of 41) - ATIS-1000113.2015 – Chapter 6

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Figure 2.3 – Call processing control (CPC) incoming (Sheet 39 of 41) - ATIS-1000113.2015 – Chapter 6

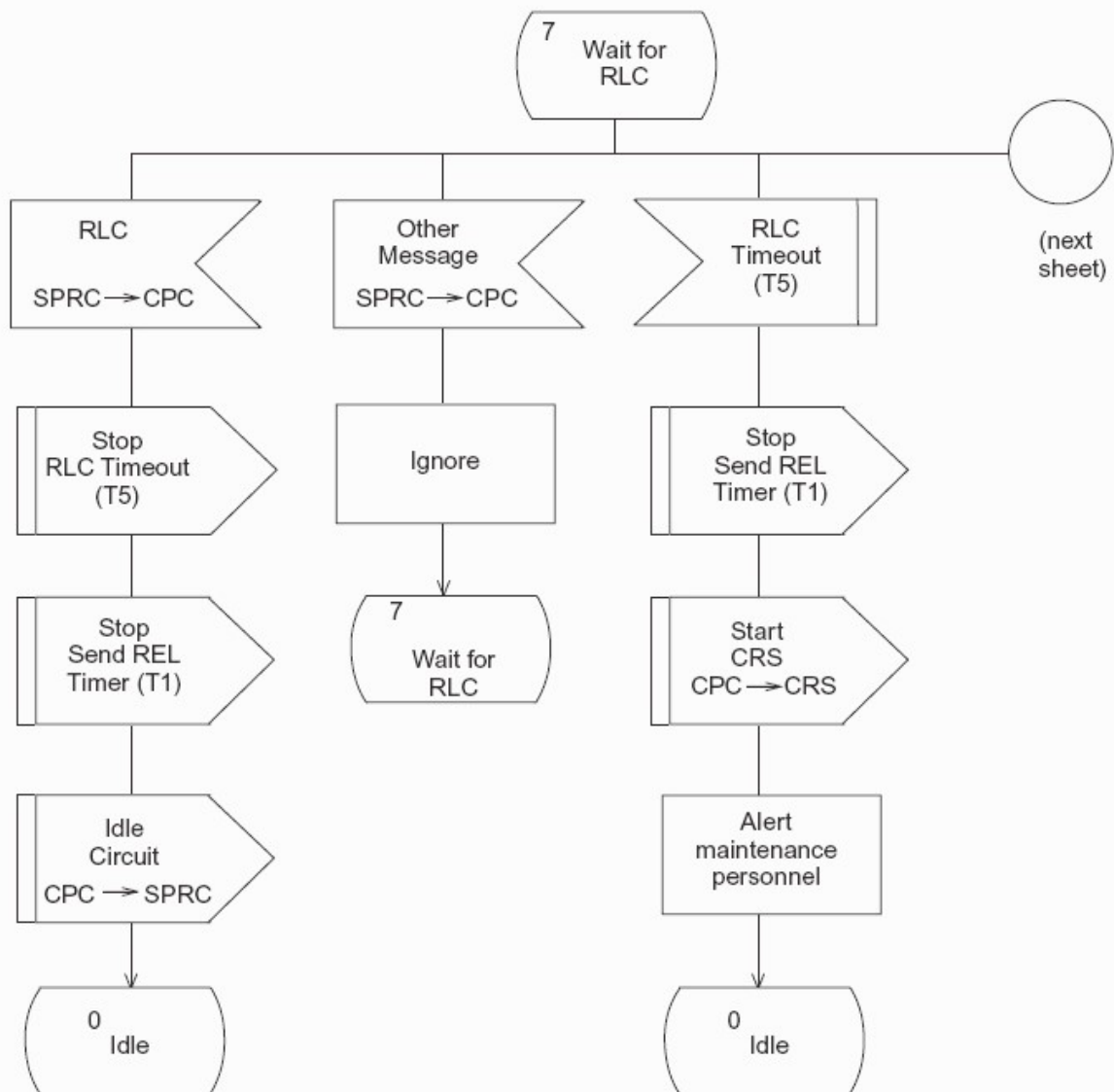


Figure 2.3 – Call processing control (CPC) incoming (Sheet 40 of 41) - ATIS-1000113.2015 – Chapter 6

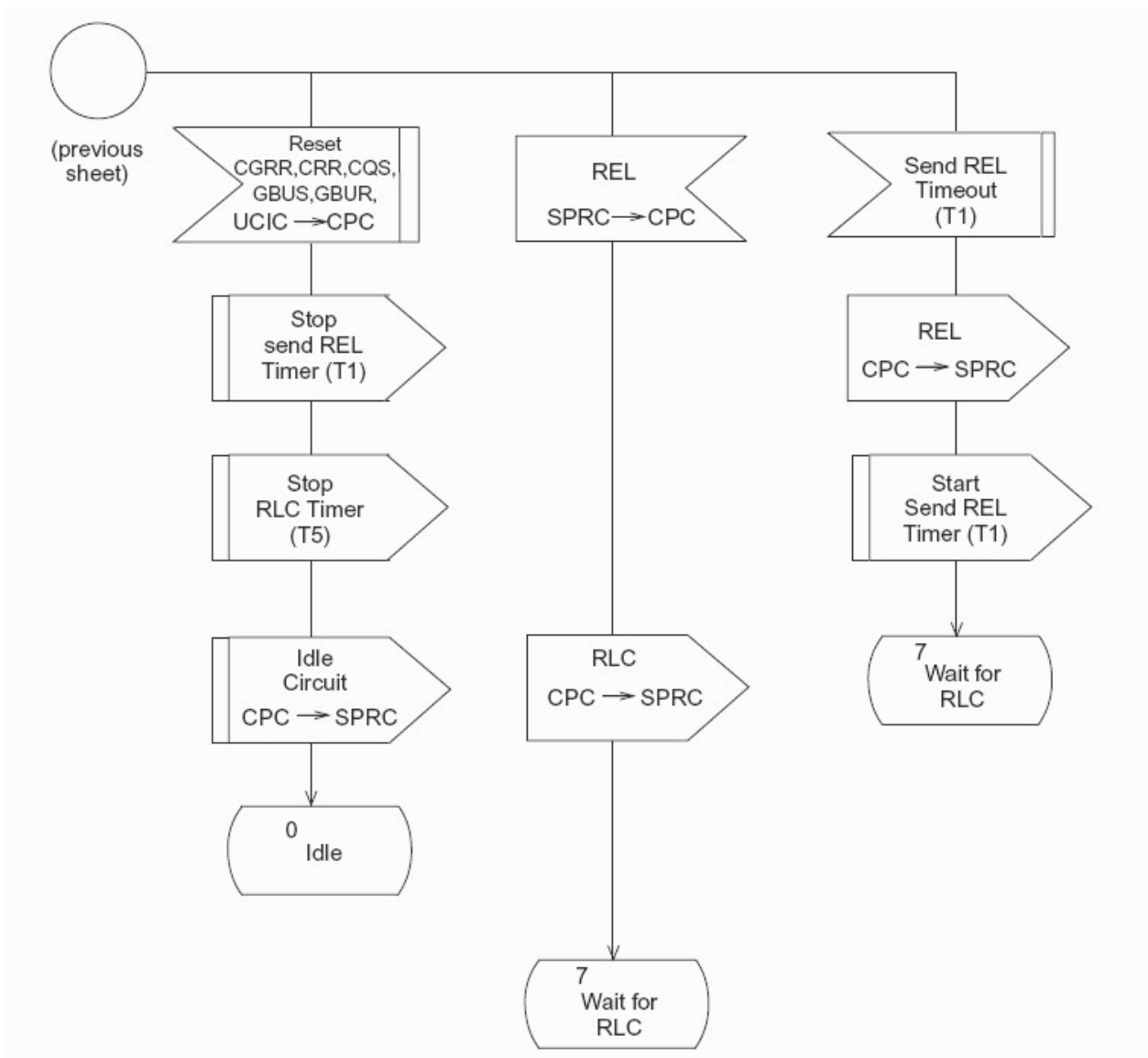


Figure 2.3– Call processing control (CPC) incoming (Sheet 41 of 41) - ATIS-1000113.2015 – Chapter 6

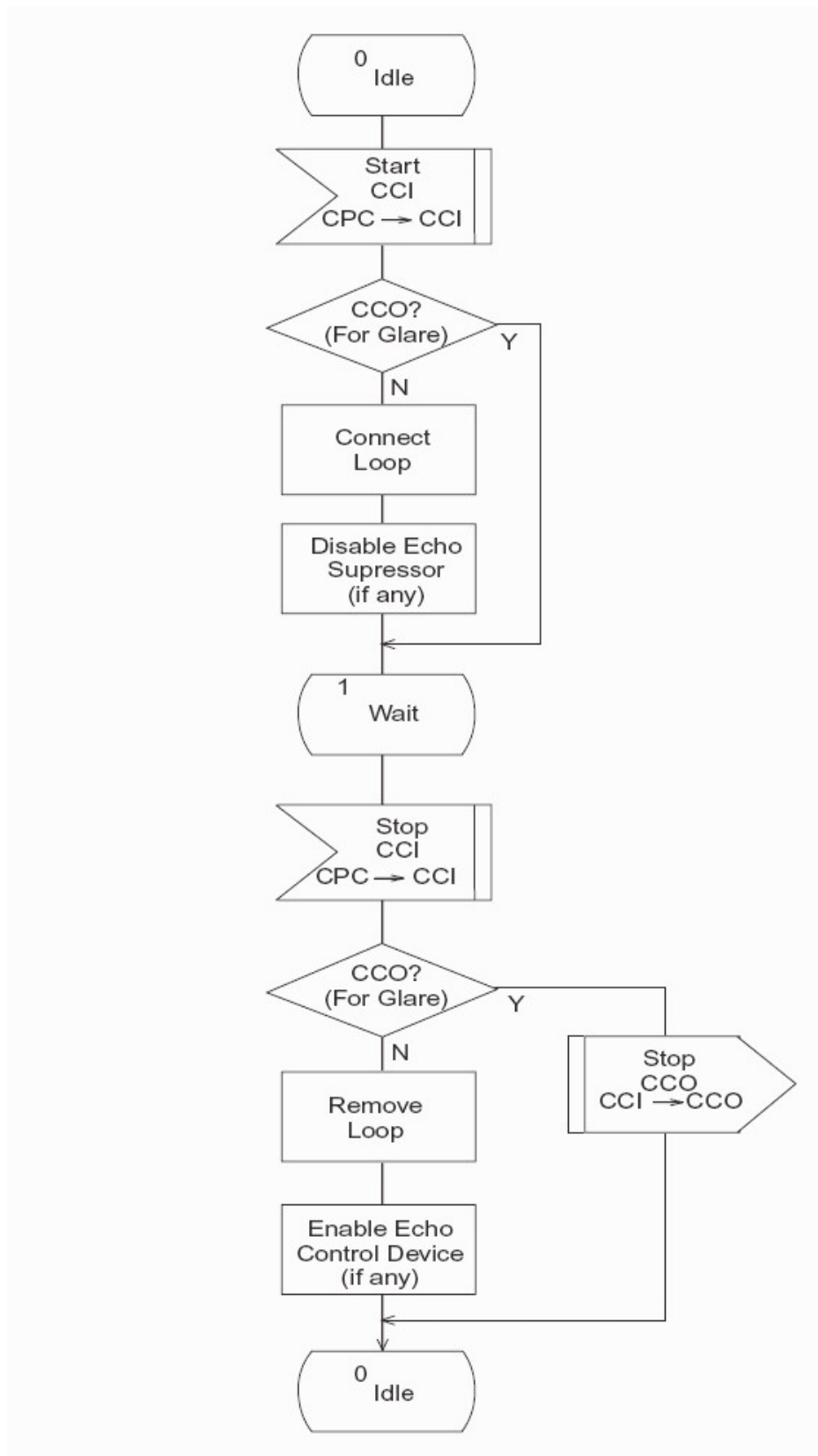


Figure 2.4 - Continuity check incoming (CCI) - ATIS-1000113.2015 – Chapter 6

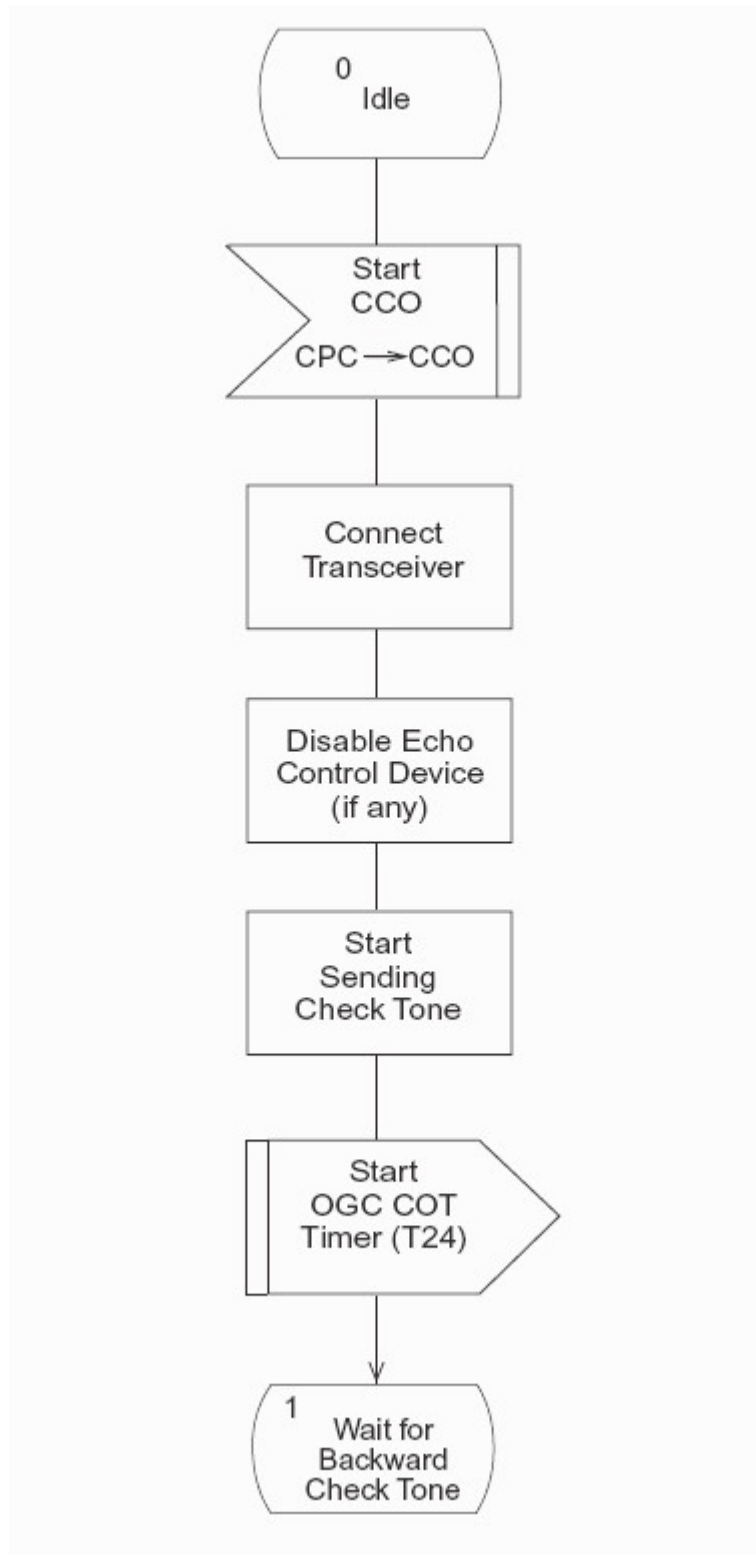


Figure 2.5 - Continuity check outgoing (CCO) (Sheet 1 of 3) - ATIS-1000113.2015 – Chapter 6

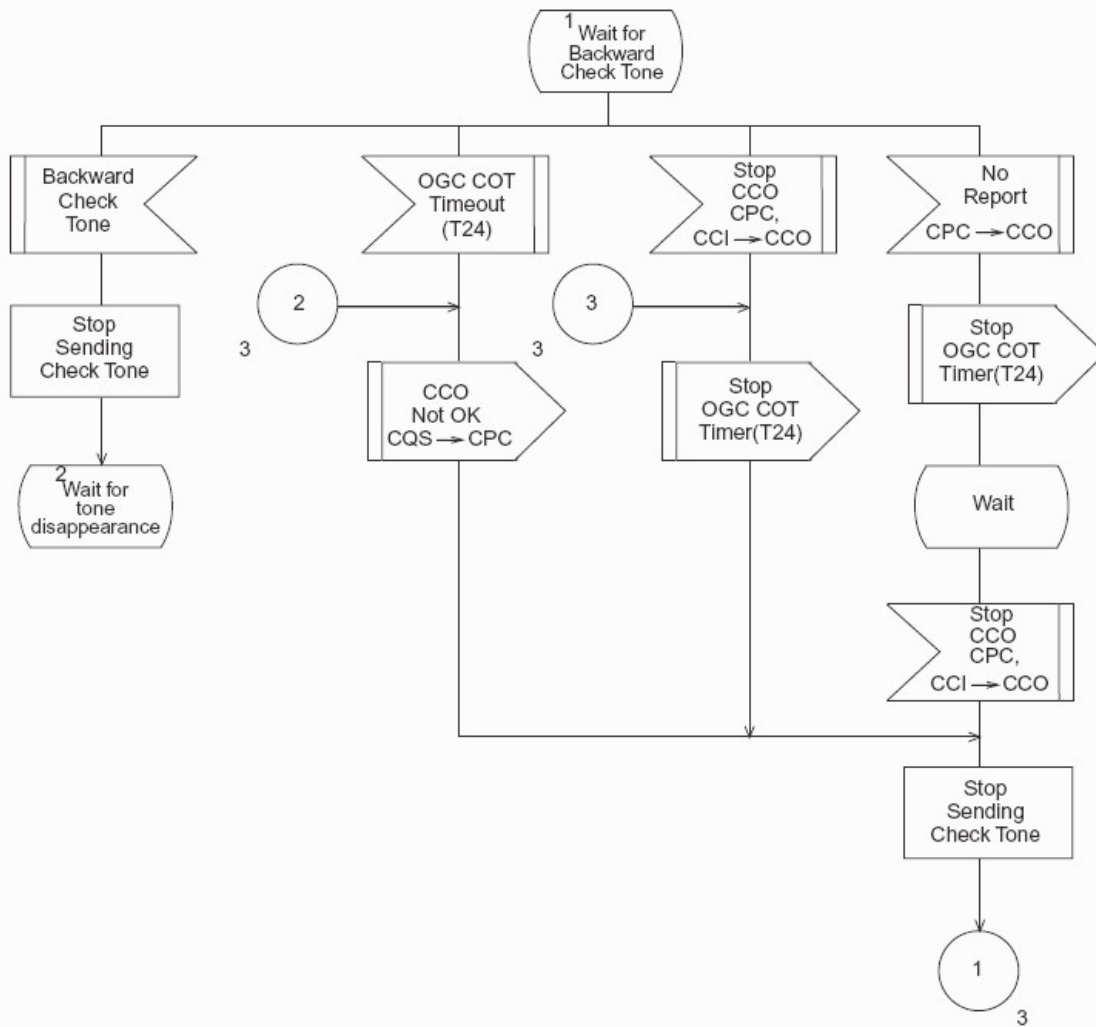


Figure 2.5 – Continuity check outgoing (CCO) (Sheet 2 of 3) – ATIS-1000113.2015 – Chapter 6

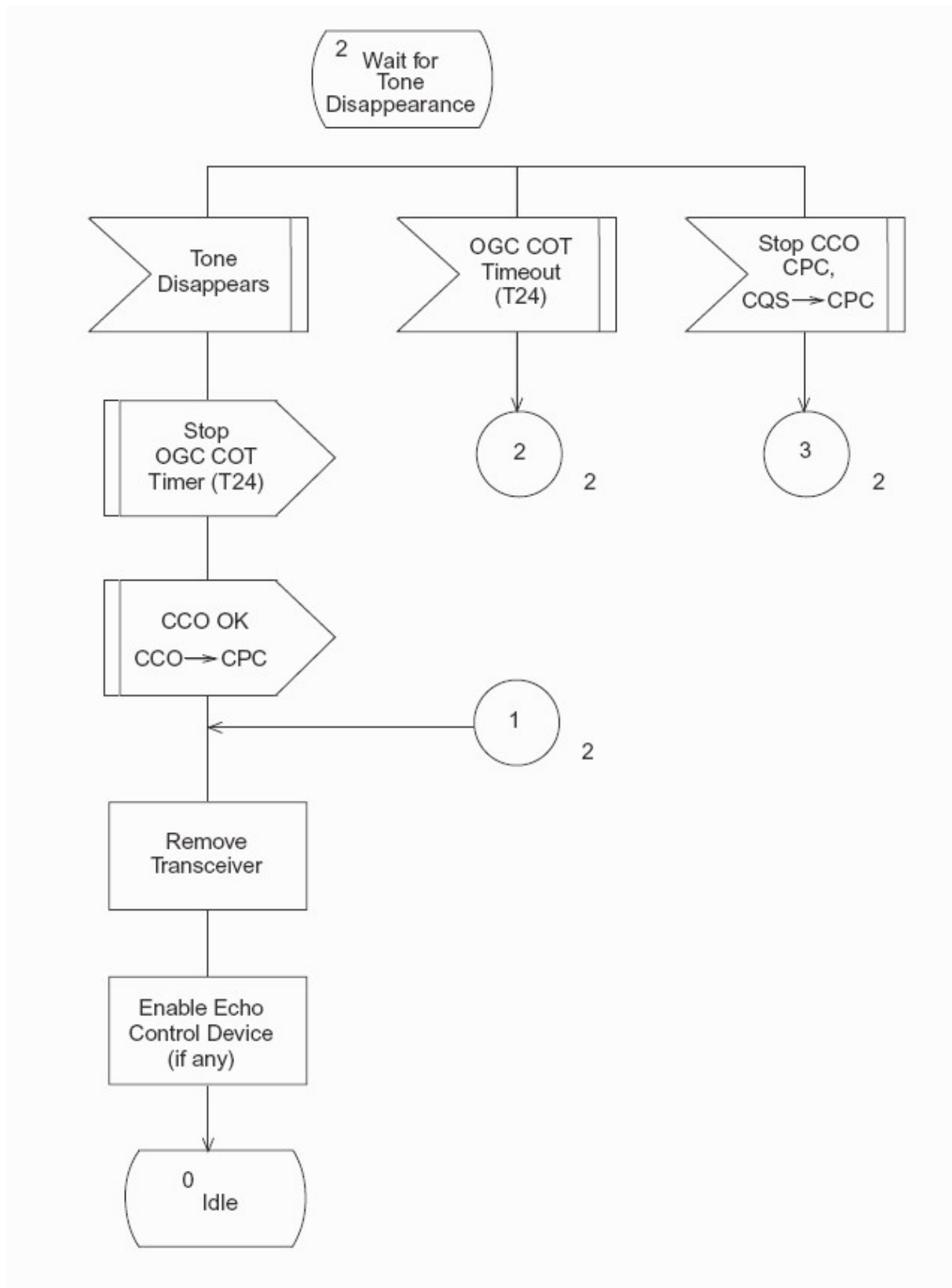


Figure 2.5 – Continuity check outgoing (CCO) (Sheet 3 of 3) – ATIS-1000113.2015 – Chapter 6

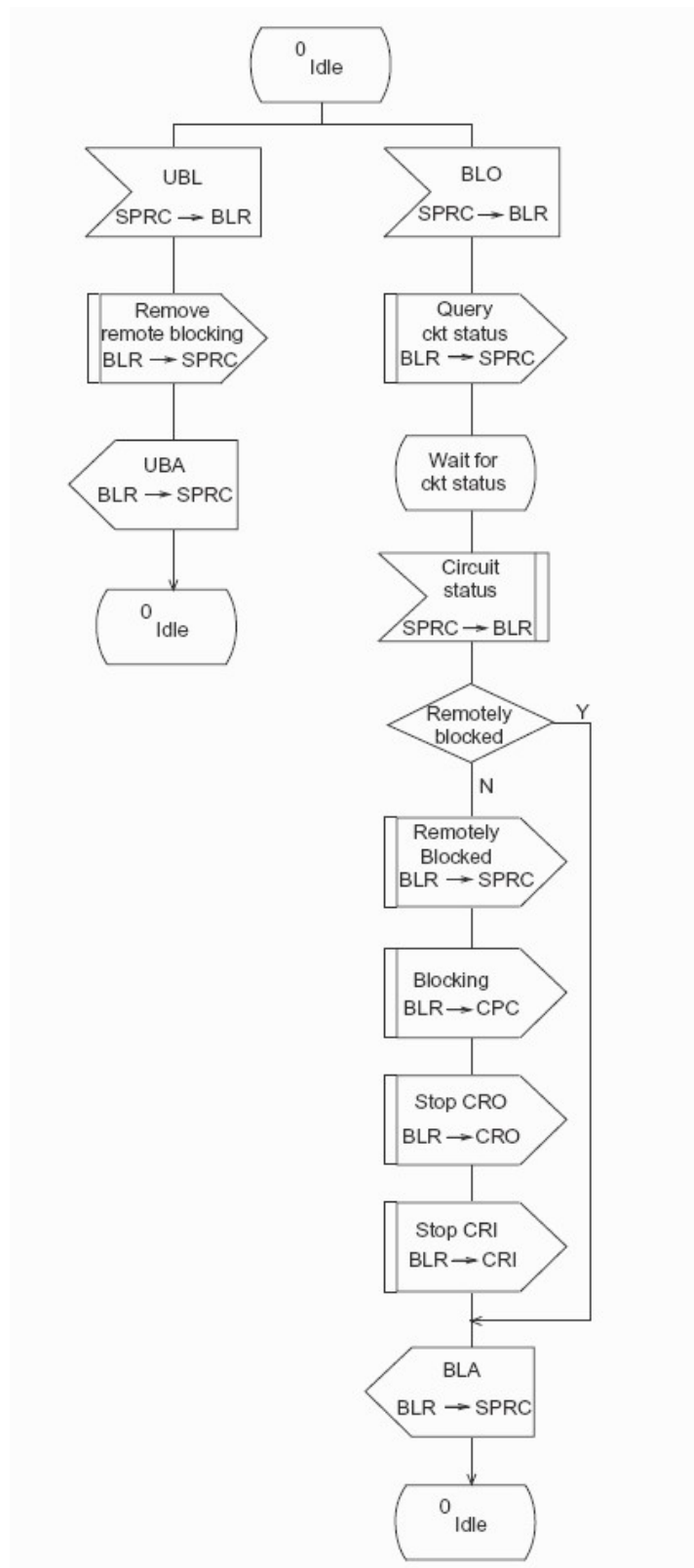


Figure 2.6 - Blocking/unblocking signal reception (BLR) (Sheet 1 of 2) - ATIS-1000113.2015 – Chapter 6

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Figure 2.6 – Blocking/unblocking signal reception (BLR) (Sheet 2 of 2) – ATIS-1000113.2015 – Chapter 6

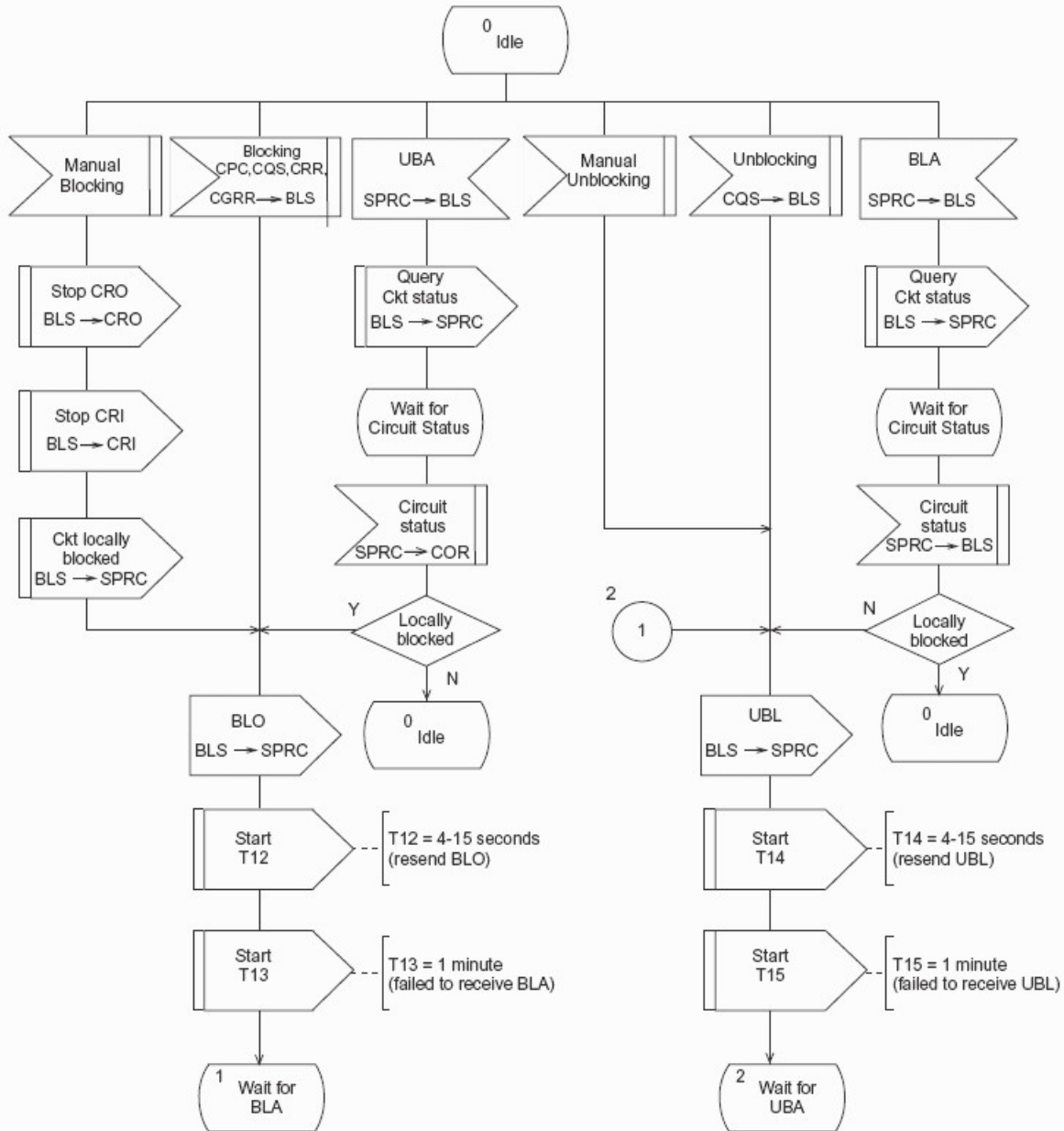


Figure 2.7 - Blocking/unblocking signal sending (BLS) (Sheet 1 of 4) - ATIS-1000113.2015 – Chapter 6

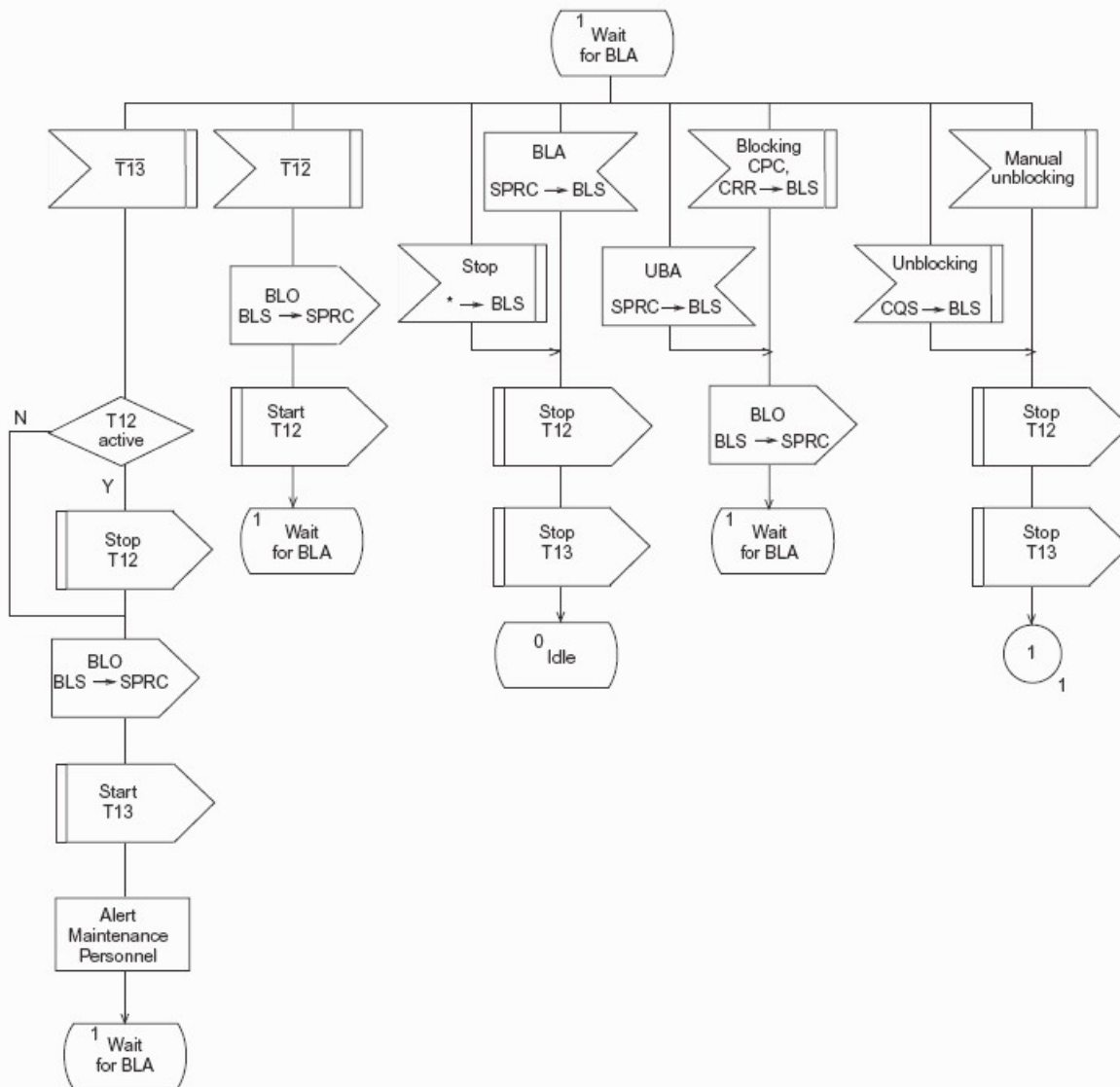


Figure 2.7– Blocking/unblocking signal sending (BLS) (Sheet 2 of 4) – ATIS-1000113.2015 – Chapter 6

Deleted. (No procedure specified for U.S. networks)

Figure 2.7– Blocking/unblocking signal sending (BLS) (Sheet 3 of 4) – ATIS-1000113.2015 – Chapter 6

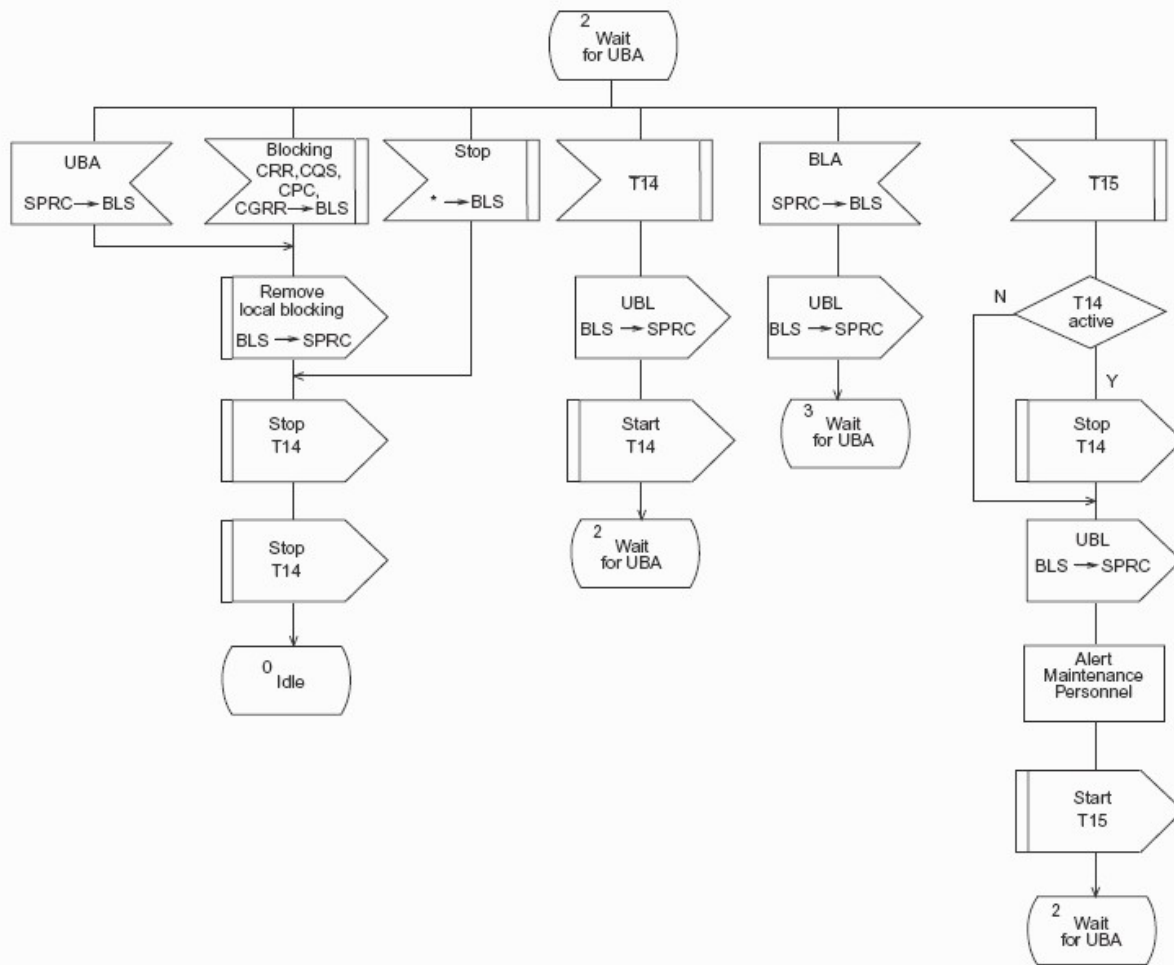


Figure 2.7 – Blocking/unblocking signal sending (BLS) (Sheet 4 of 4) – ATIS-1000113.2015 – Chapter 6

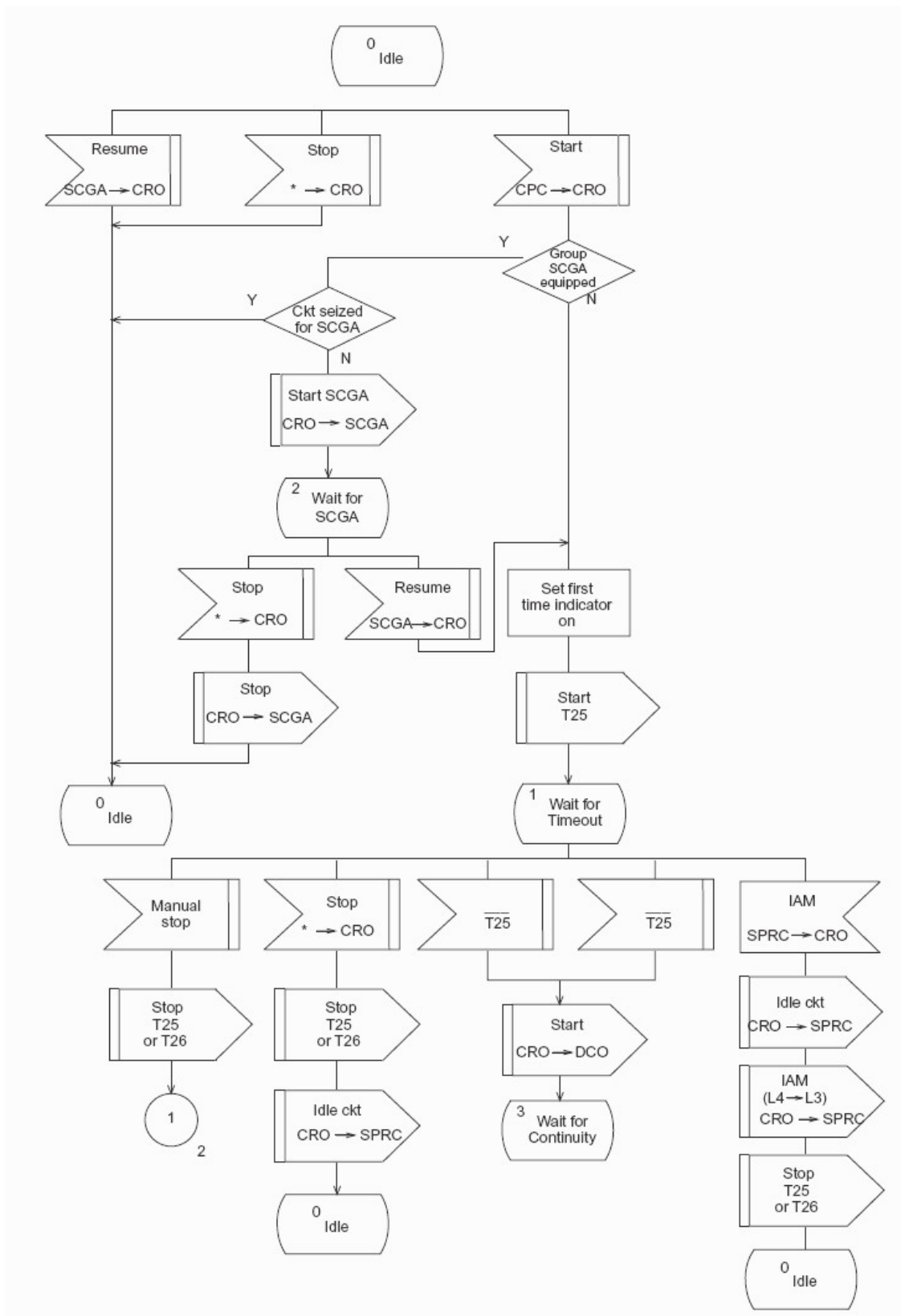


Figure 2.8 - Continuity recheck outgoing (CRO)(Sheet 1 of 4) - ATIS-1000113.2015 – Chapter 6

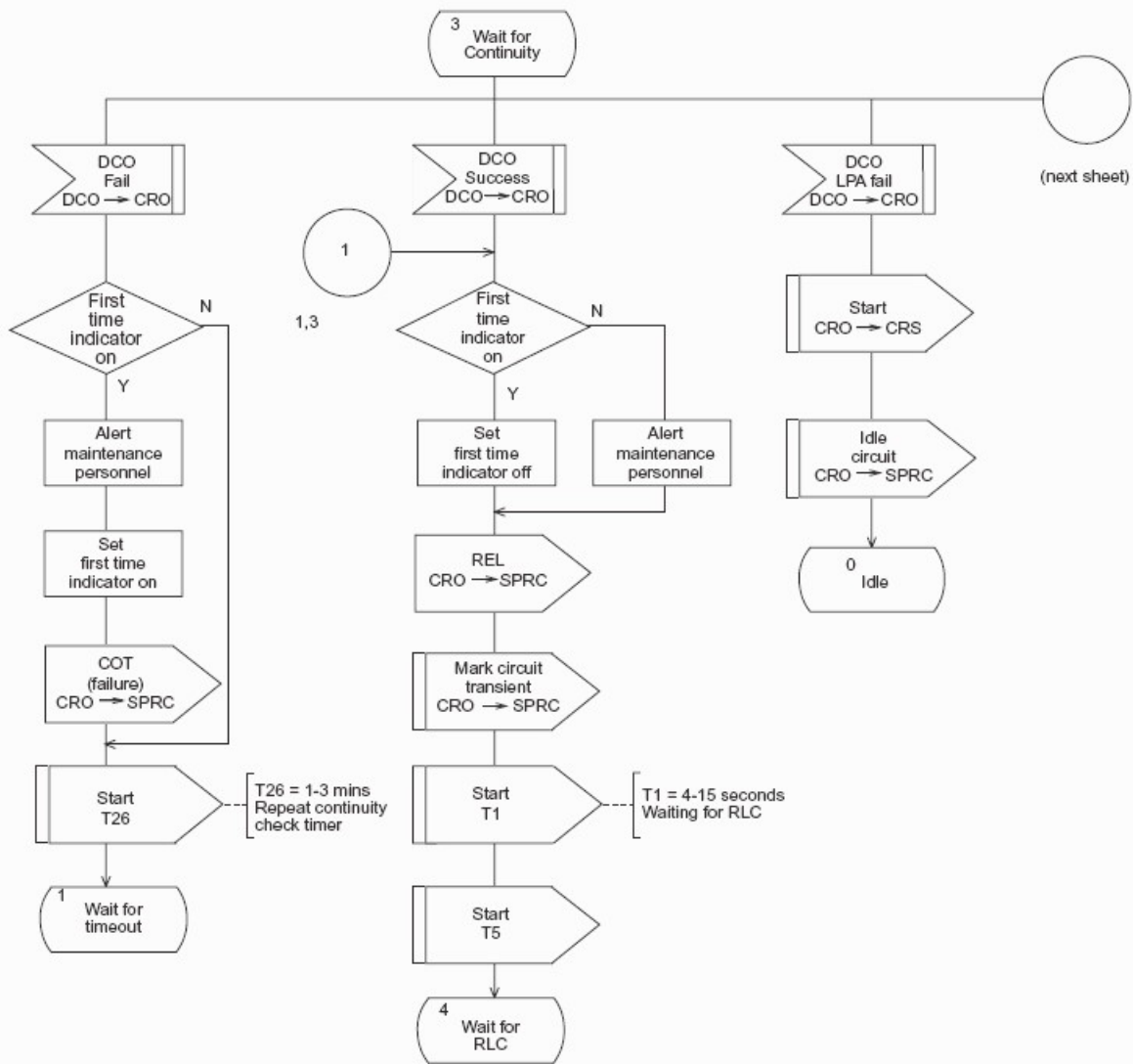


Figure 2.8 – Continuity recheck outgoing (CRO)(Sheet 2 of 4) – ATIS-1000113.2015 – Chapter 6

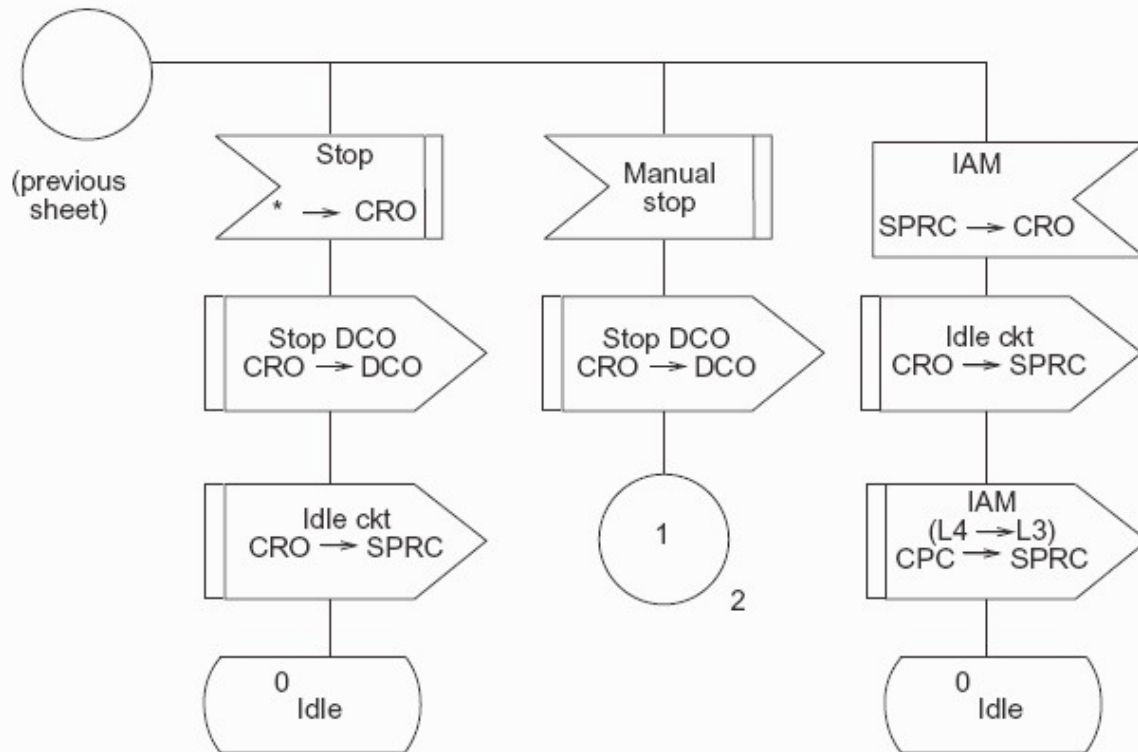


Figure 2.8 – Continuity recheck outgoing (CRO)(Sheet 3 of 4) – ATIS-1000113.2015 – Chapter 6

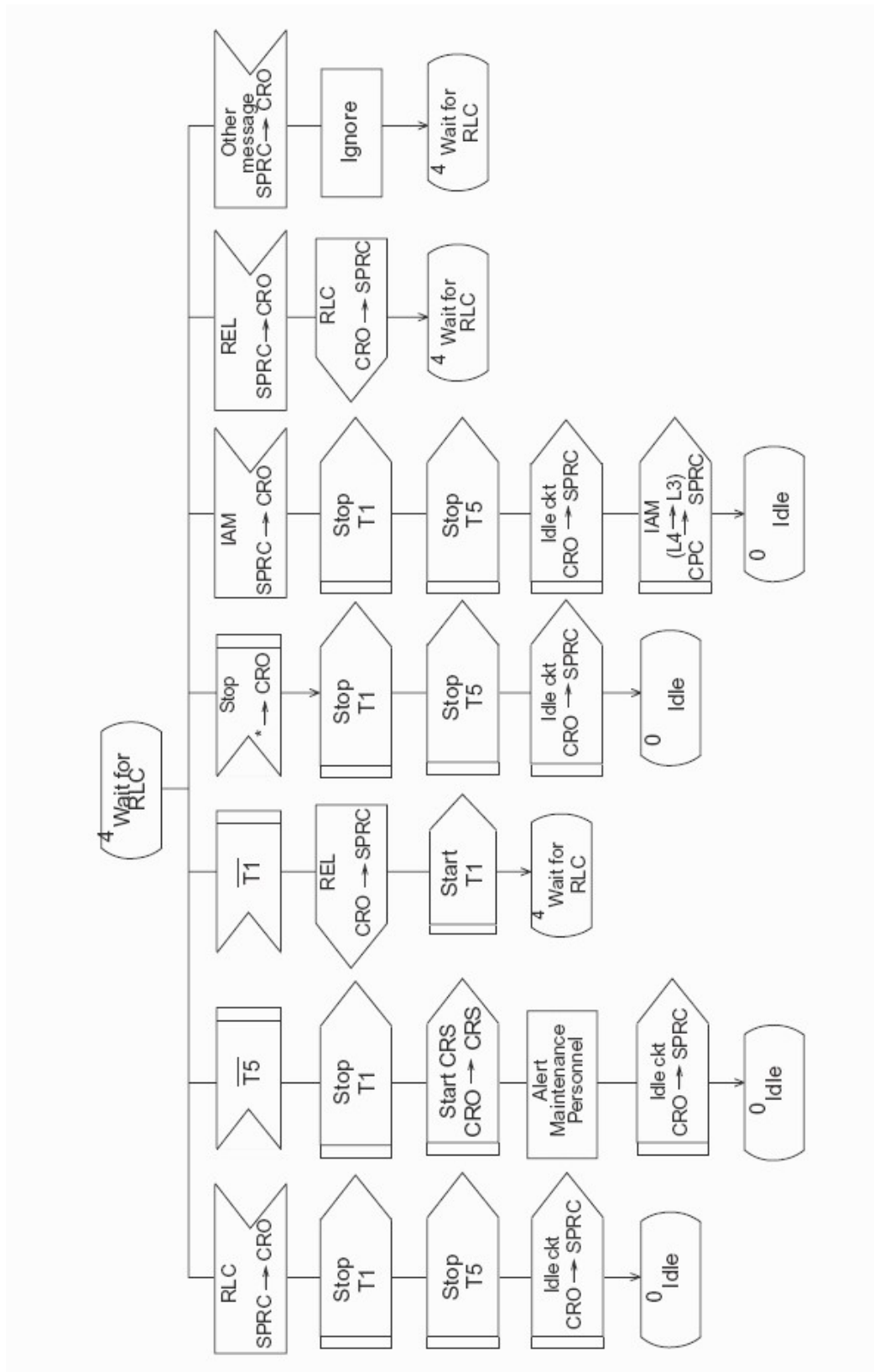


Figure 2.8 – Continuity recheck outgoing (CRO)(Sheet 4 of 4) – ATIS-1000113.2015 – Chapter 6

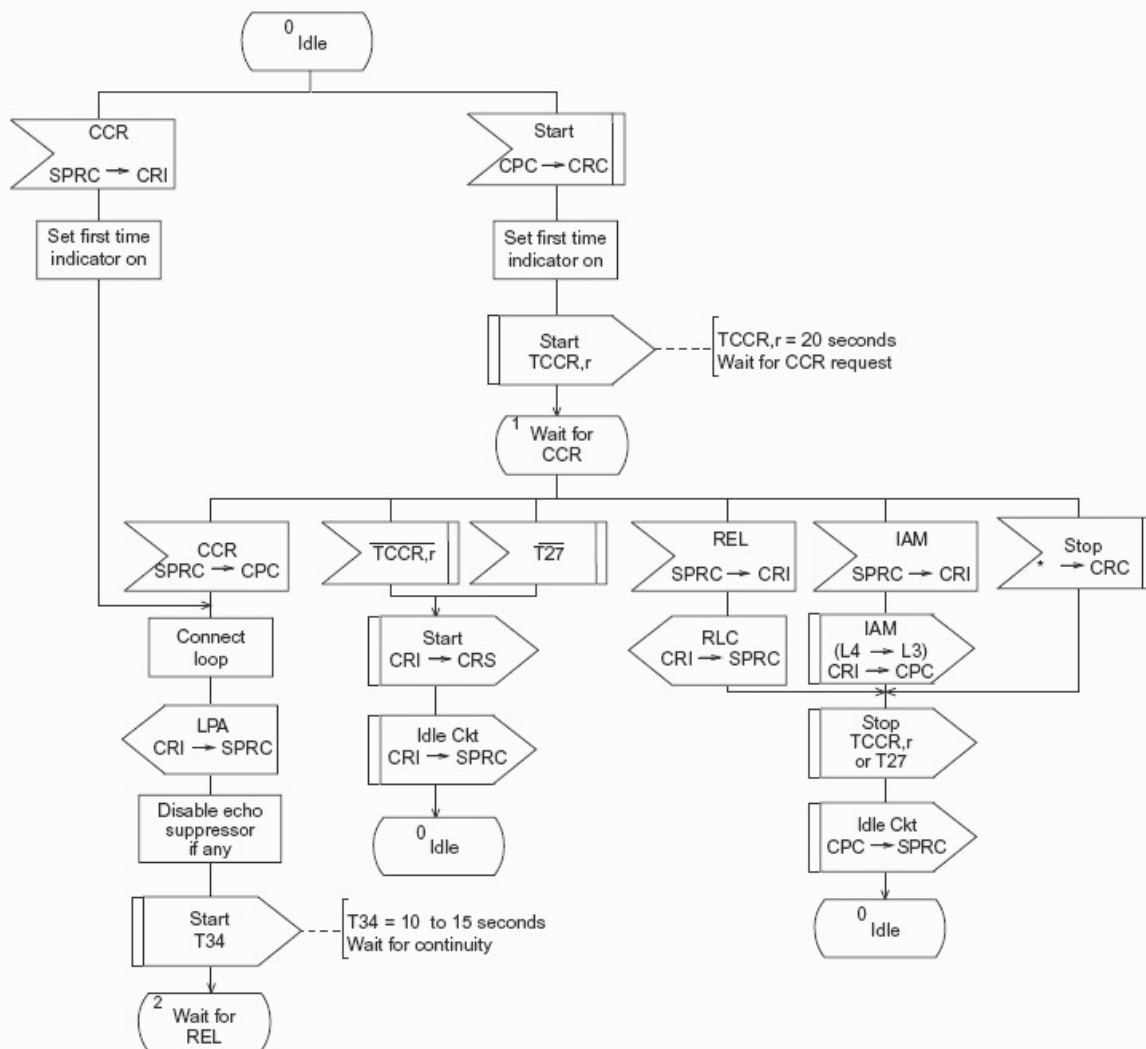


Figure 2.9 - Continuity recheck incoming (CRI)(Sheet 1 of 3) - ATIS-1000113.2015 – Chapter 6

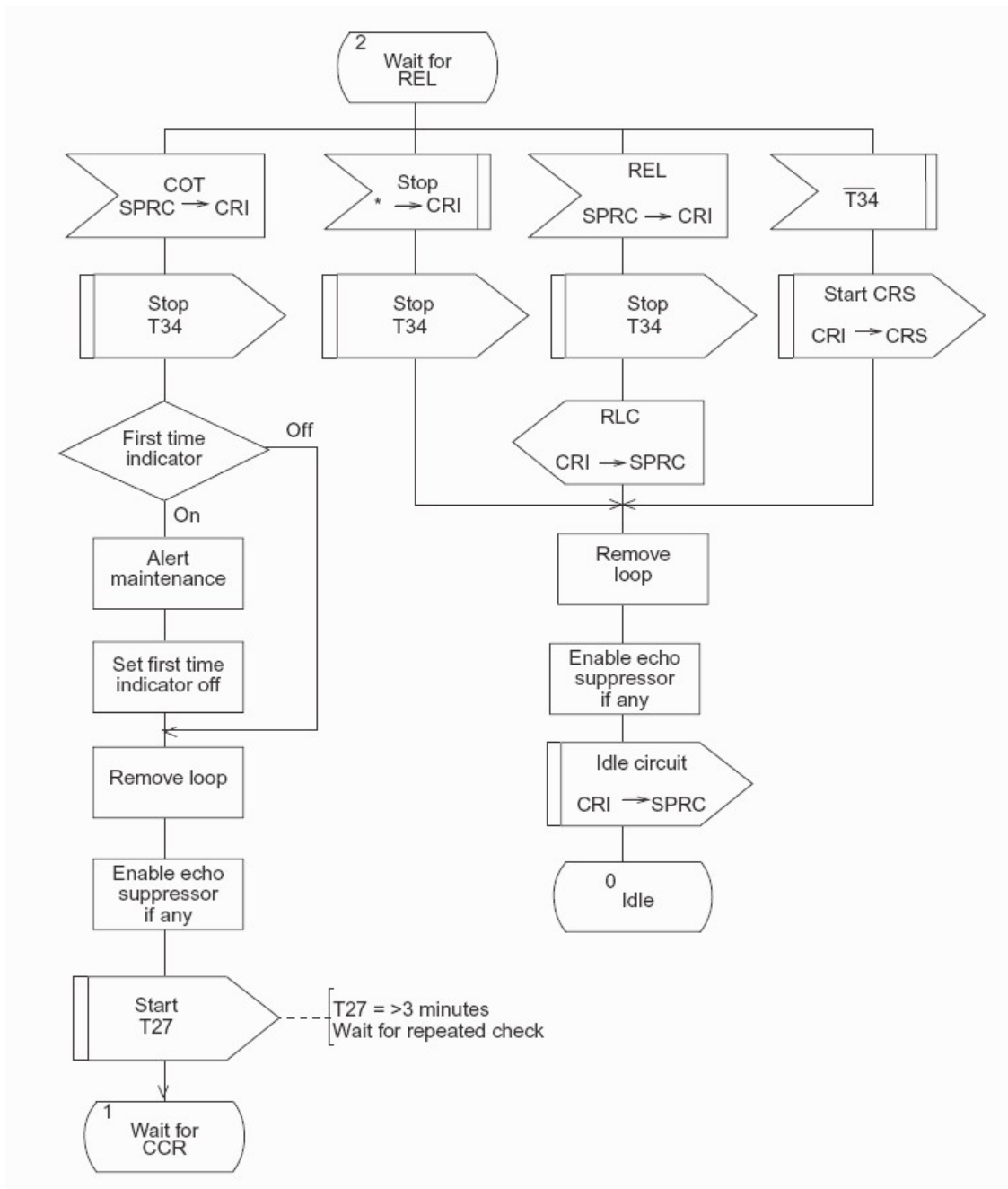


Figure 2.9 – Continuity recheck incoming (CRI)(Sheet 2 of 3) – ATIS-1000113.2015 – Chapter 6

Deleted. (No procedure specified for U.S. networks)

Figure 2.9 – Continuity recheck incoming (CRI)(Sheet 3 of 3) – ATIS-1000113.2015 – Chapter 6

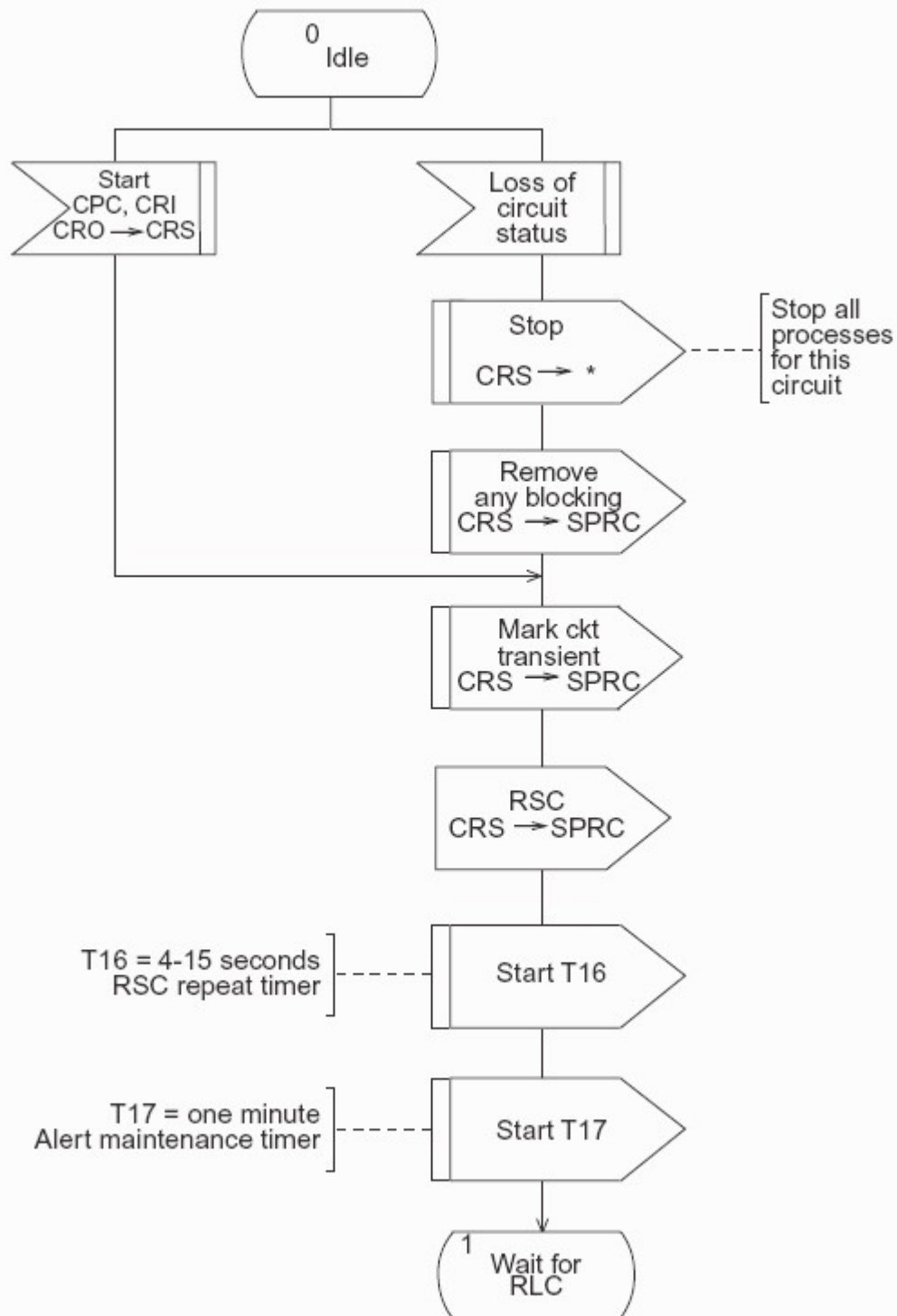


Figure 2.10 - Circuit reset sending (CRS)(Sheet 1 of 2) - ATIS-1000113.2015 – Chapter 6

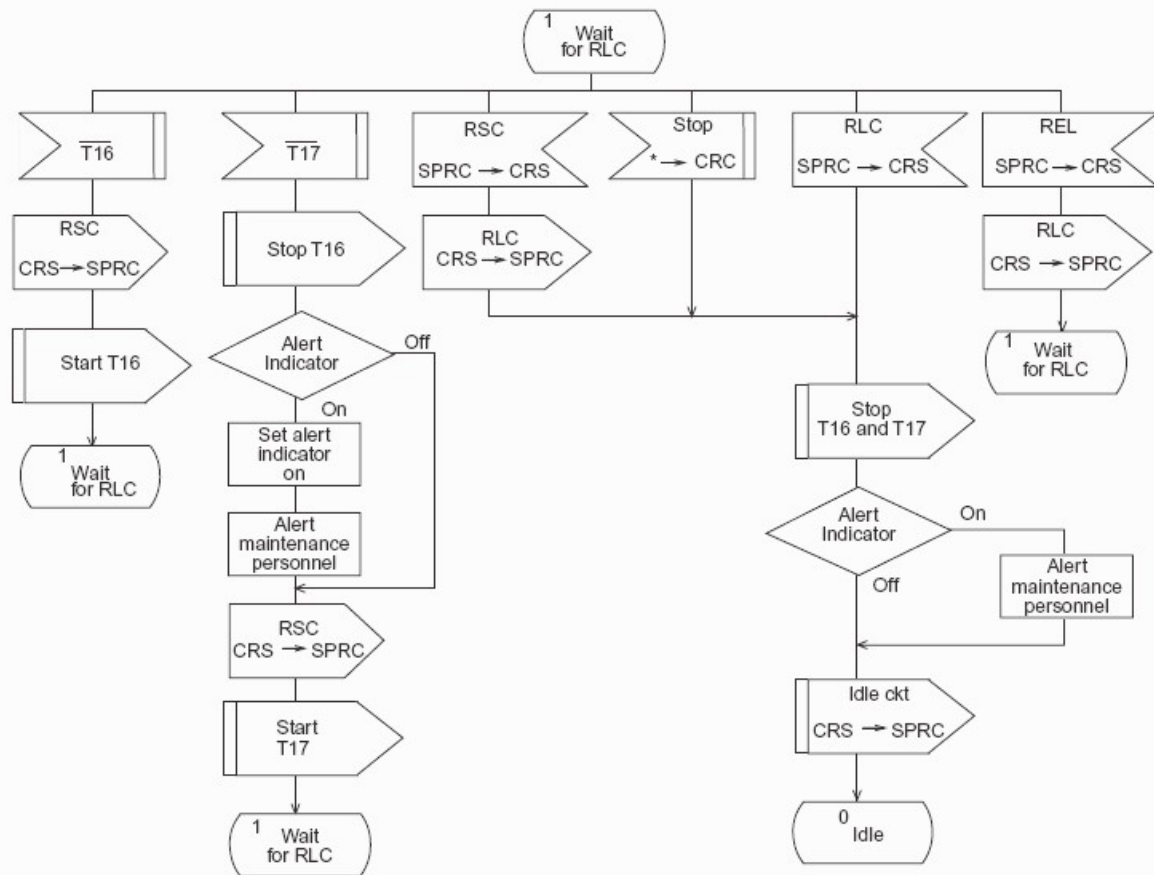


Figure 2.10 – Circuit reset sending (CRS)(Sheet 2 of 2) – ATIS-1000113.2015 – Chapter 6

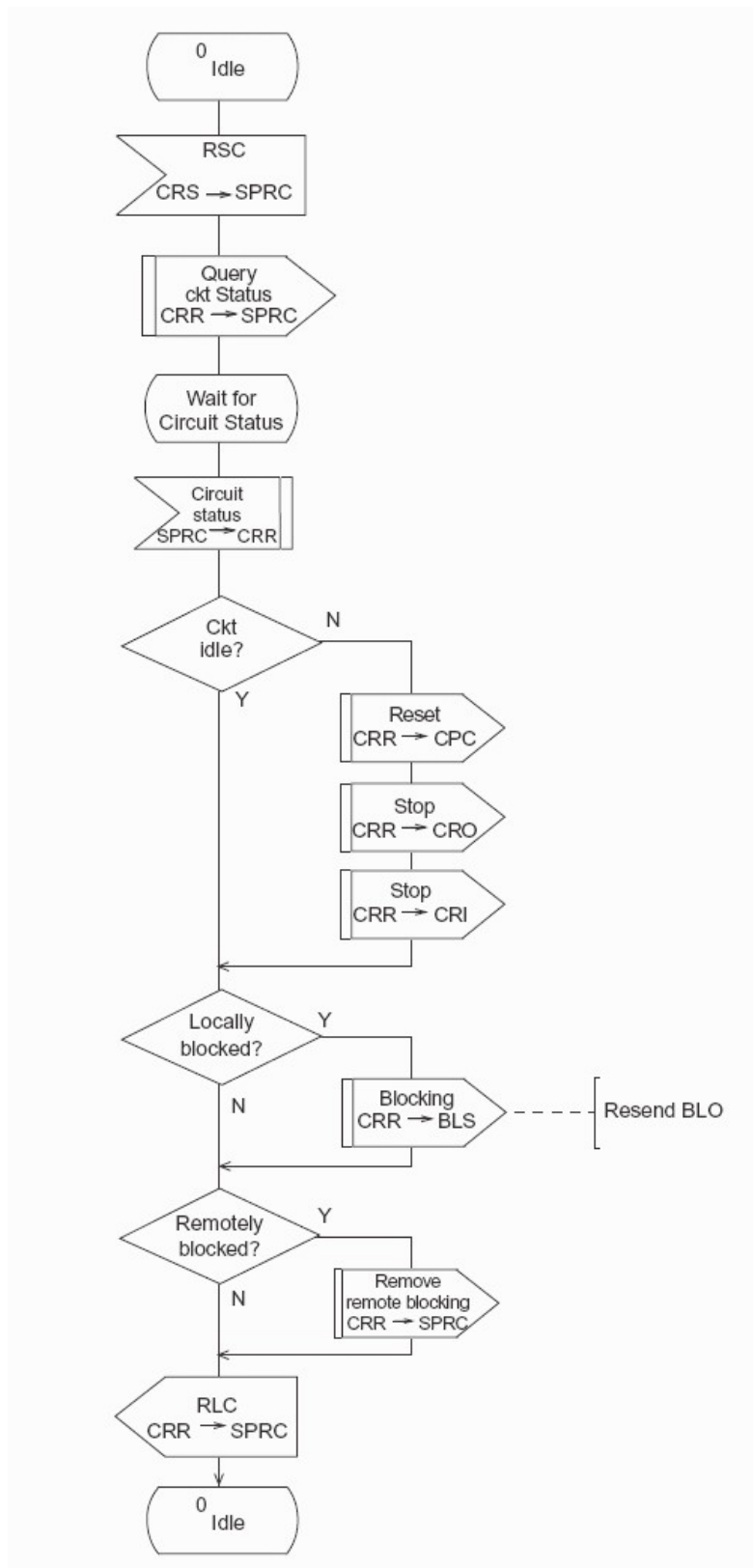
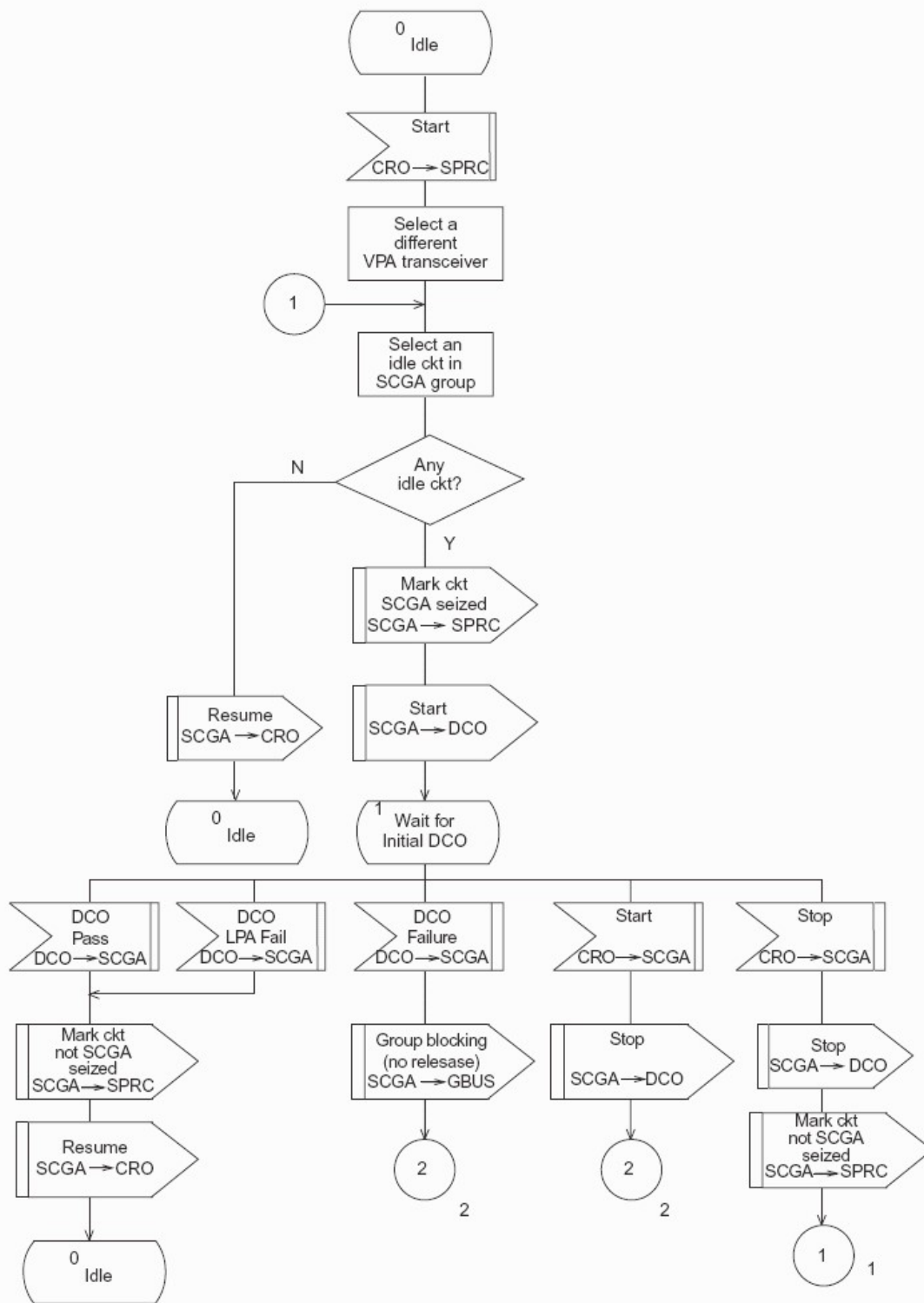


Figure 2.11 - Circuit reset reception (CRR) - ATIS-1000113.2015 – Chapter 6



NOTE —Coding of circuit group blocking type by bilater agreement

Figure 2.12 - Software carrier group alarm (SCGA)(Sheet 1 of 3) - ATIS-1000113.2015 – Chapter 6

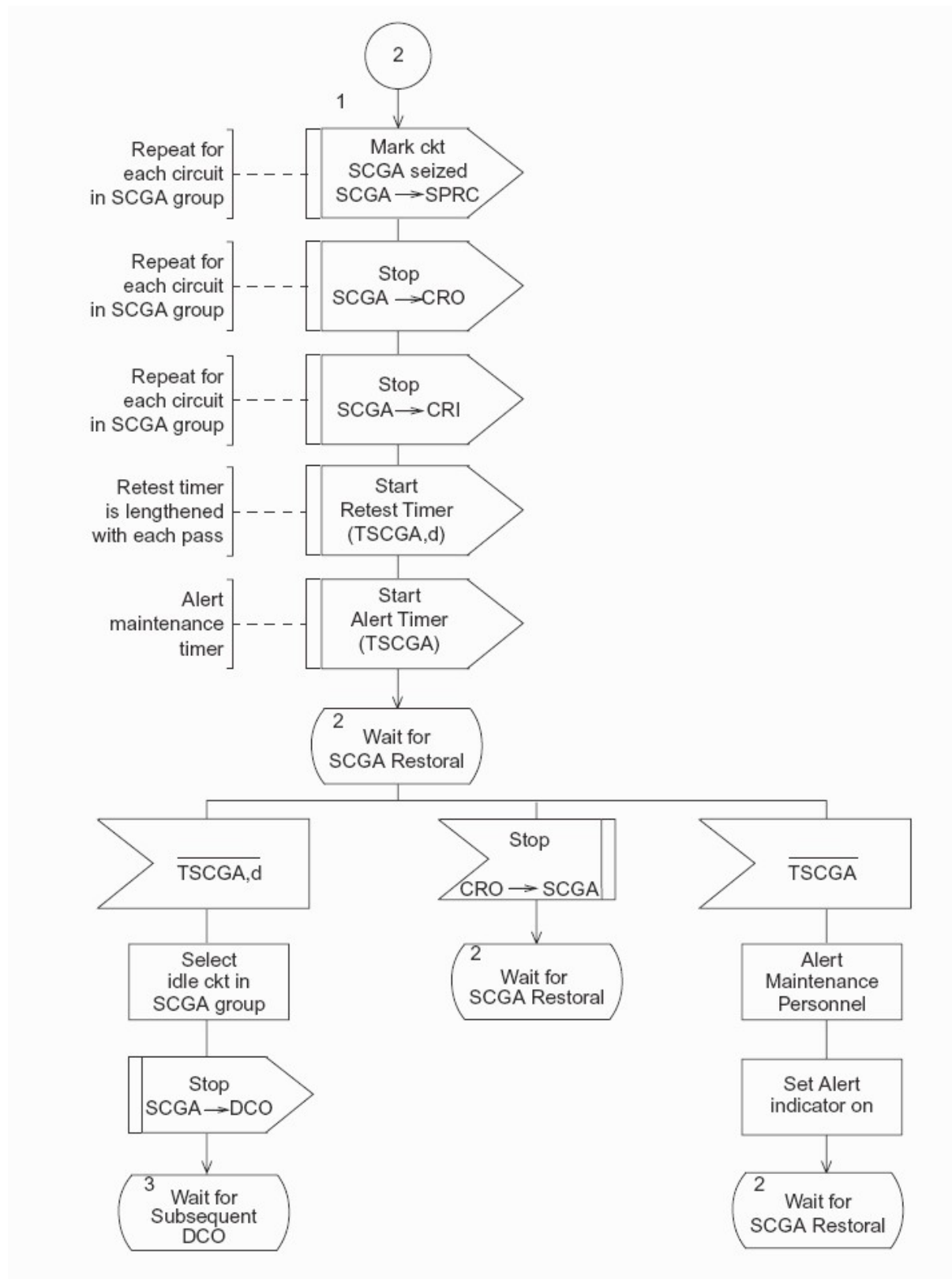


Figure 2.12 – Software carrier group alarm (SCGA)(Sheet 2 of 3) – ATIS-1000113.2015 – Chapter 6

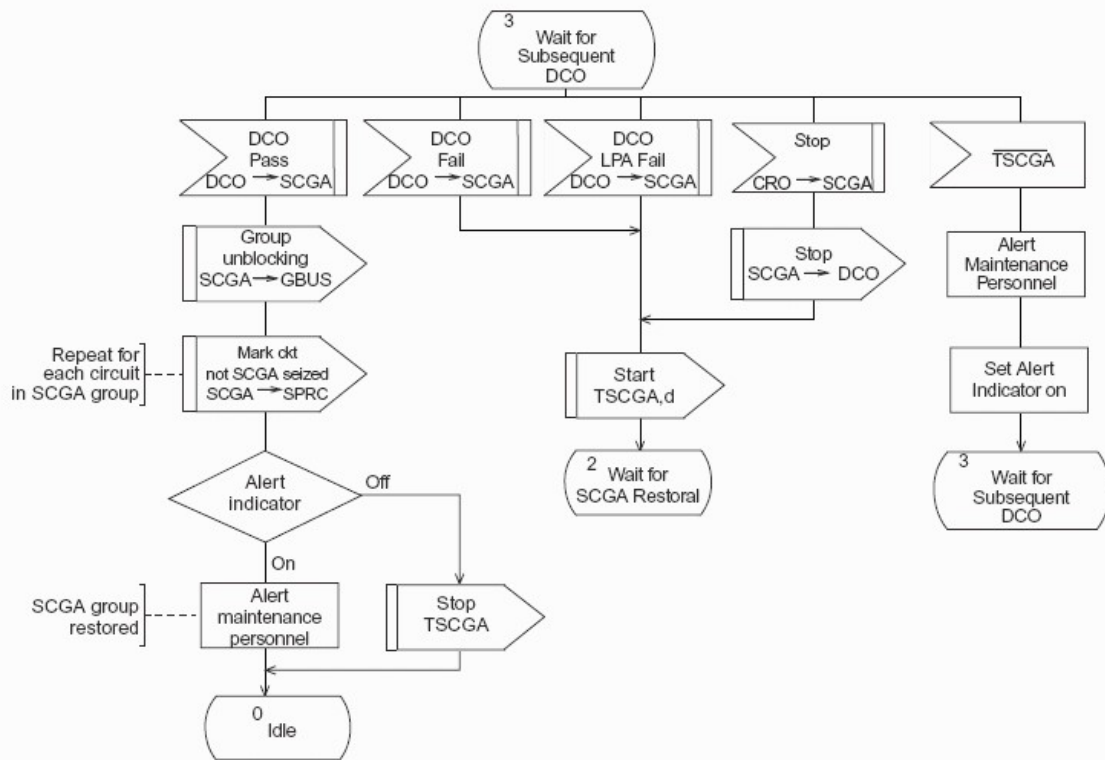


Figure 2.12 – Software carrier group alarm (SCGA)(Sheet 3 of 3) – ATIS-1000113.2015 – Chapter 6

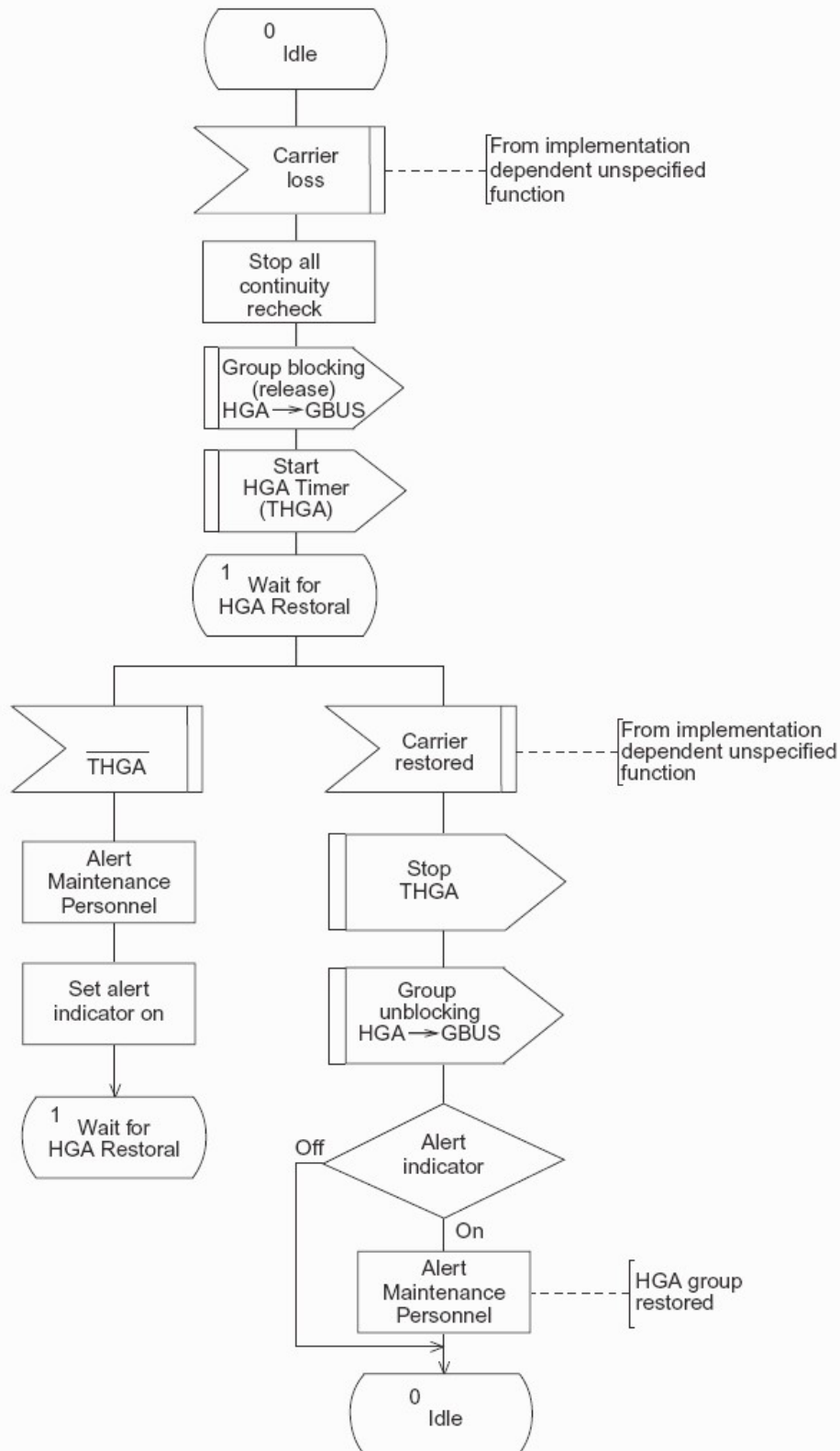


Figure 2.13 - Hardware carrier group alarm (HGA) - ATIS-1000113.2015 – Chapter 6

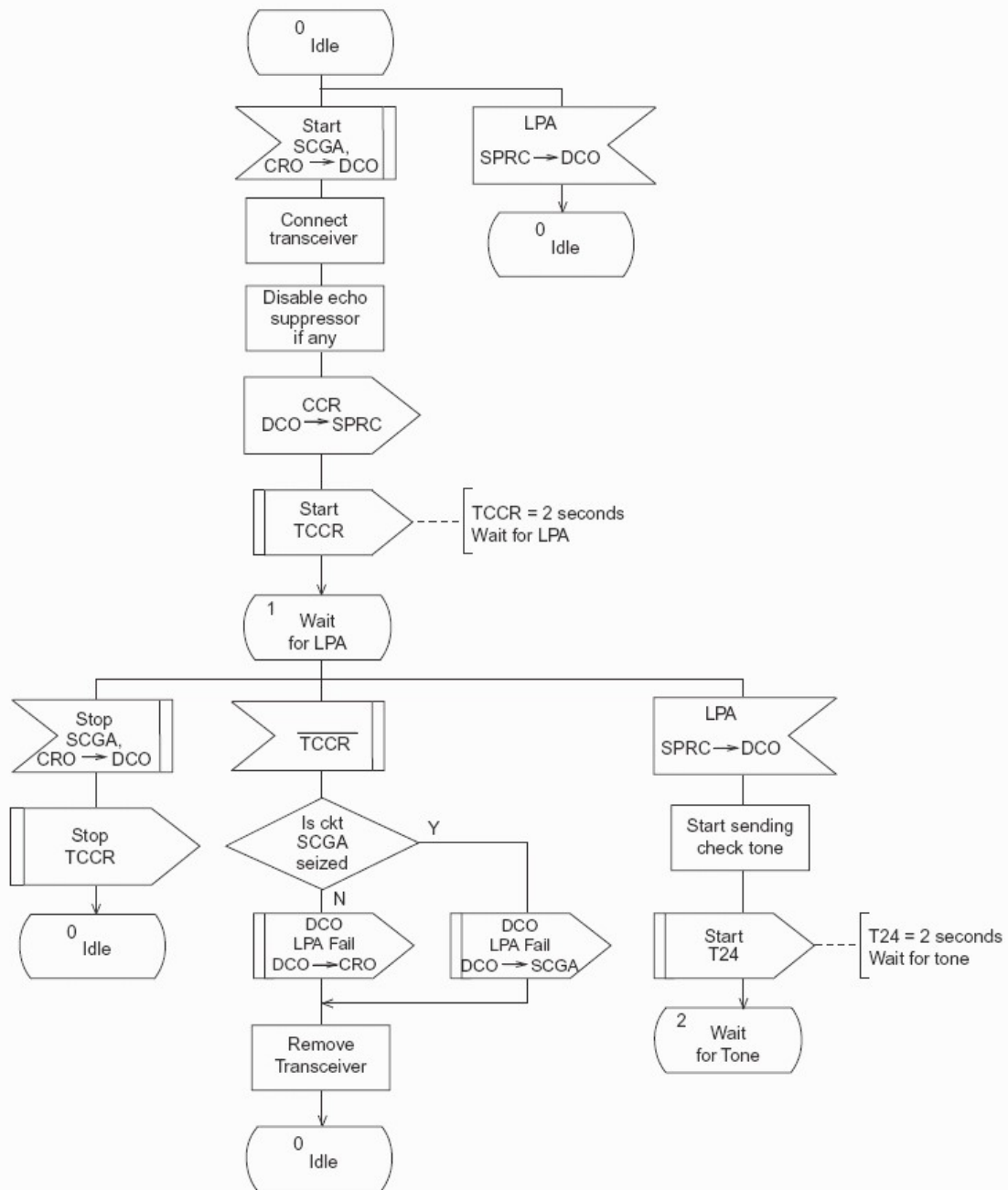


Figure 2.14 - Demand continuity outgoing (DCO)(Sheet 1 of 3) - ATIS-1000113.2015 – Chapter 6

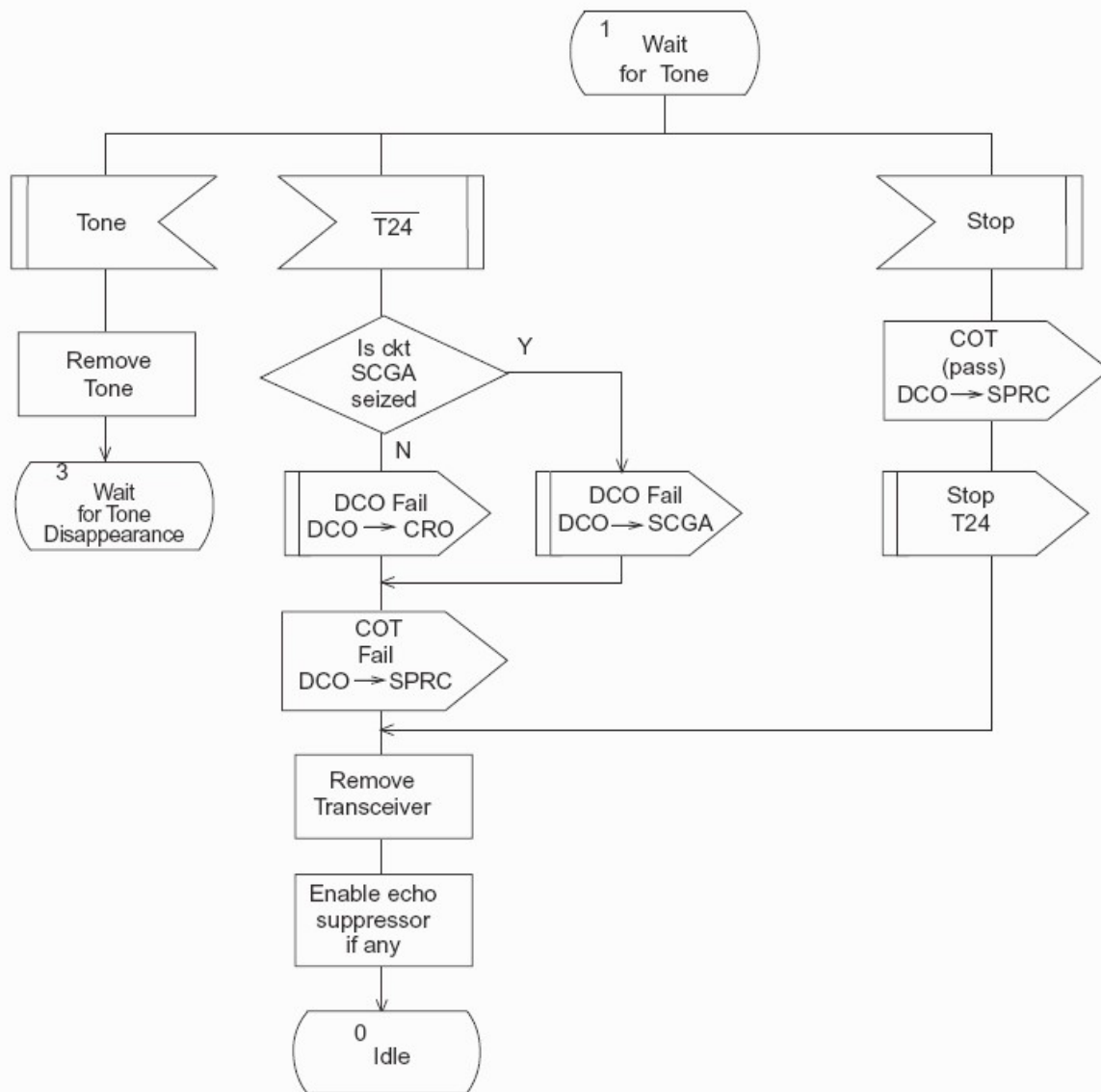


Figure 2.14 – Demand continuity outgoing (DCO)(Sheet 2 of 3) – ATIS-1000113.2015 – Chapter 6

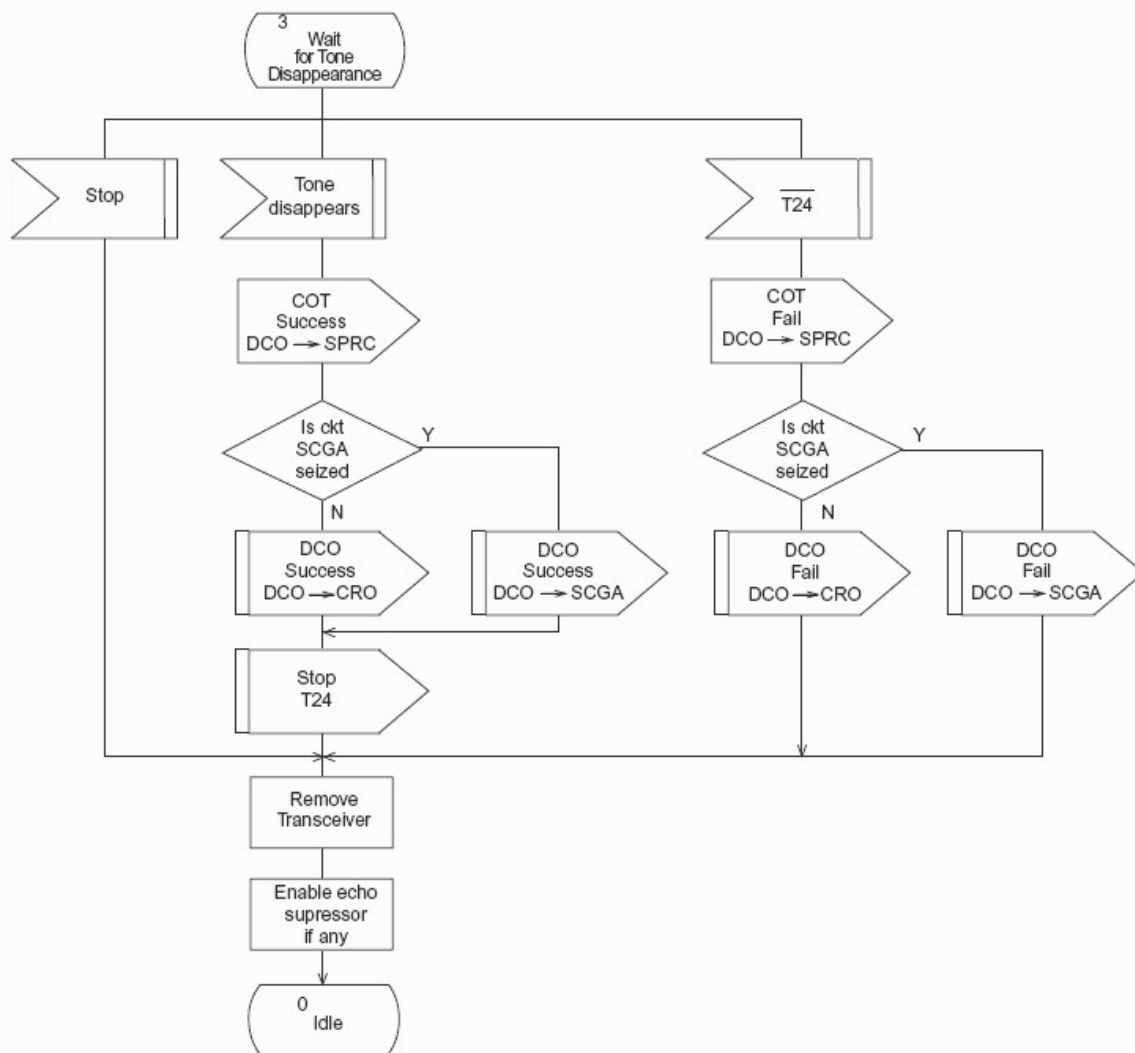


Figure 2.14 – Demand continuity outgoing (DCO)(Sheet 3 of 3) – ATIS-1000113.2015 – Chapter 6

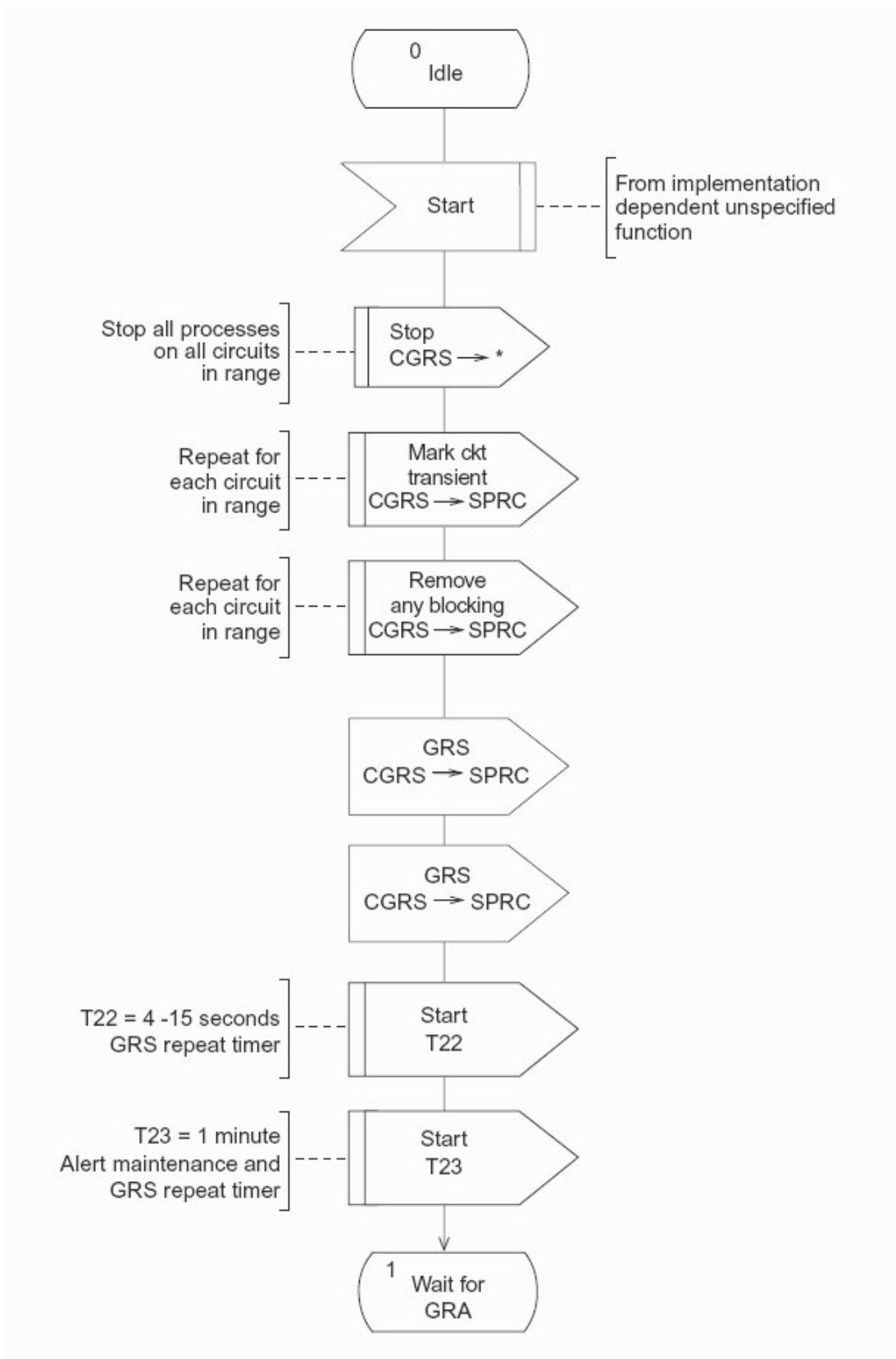


Figure 2.15 - Circuit group reset sending (CGRS) (Sheet 1 of 2) - ATIS-1000113.2015 – Chapter 6

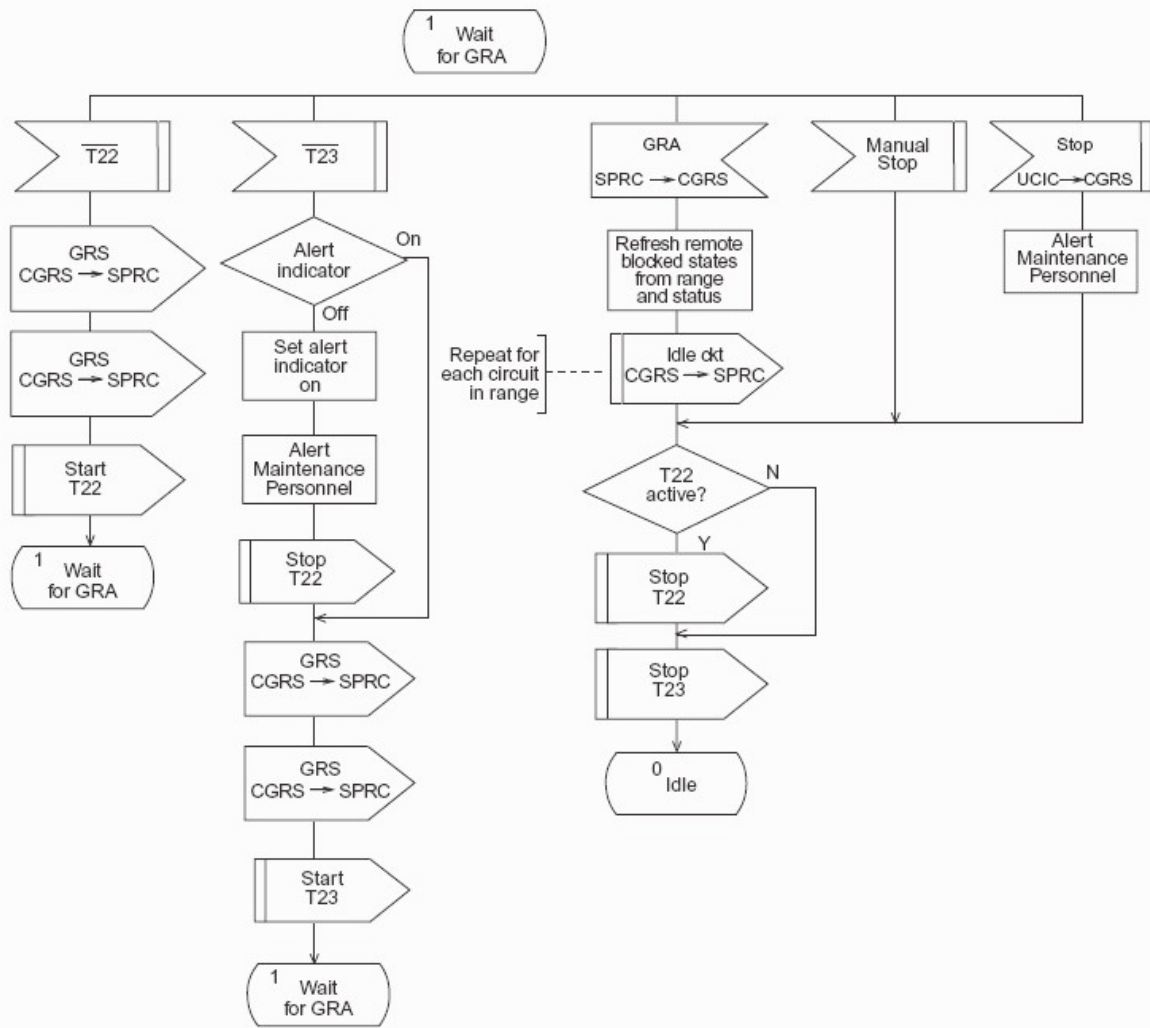


Figure 2.15 - Circuit group reset sending (CGRS) (Sheet 2 of 2) – ATIS-1000113.2015 – Chapter 6

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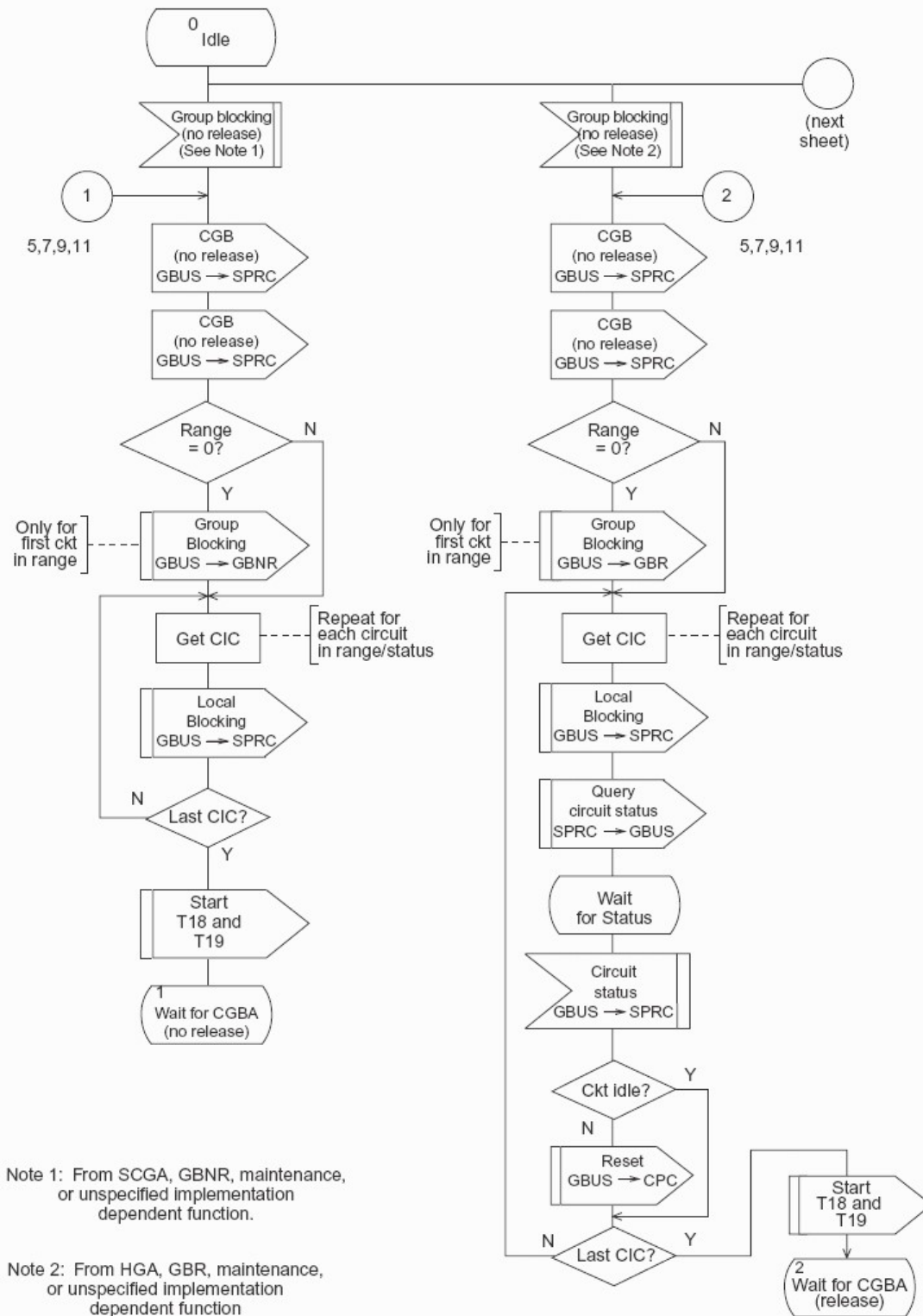
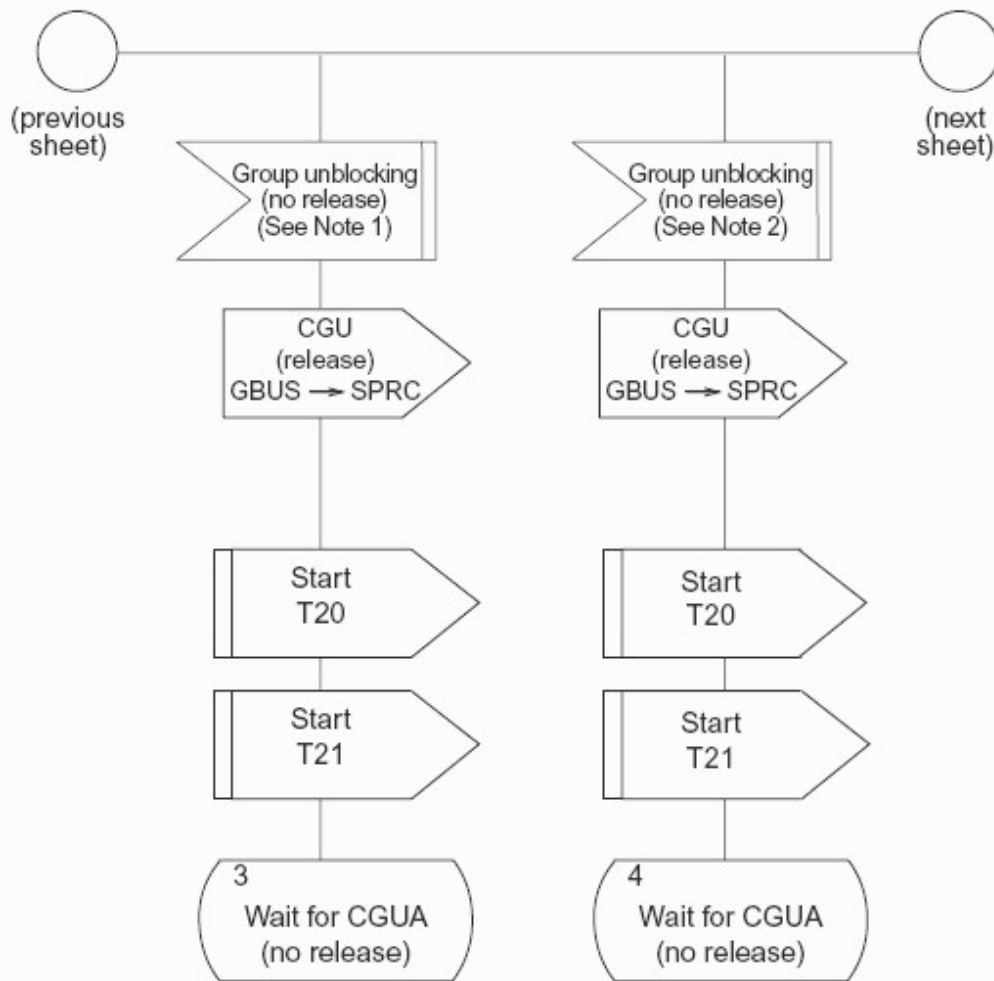


Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 1 of 11) - ATIS-1000113.2015 – Chapter 6



Note 1: From SCGA, maintenance,
or unspecified implementation
dependent function.

Note 2: From HGA, maintenance,
or unspecified implementation
dependent function

Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 2 of 11) - ATIS-1000113.2015 – Chapter 6

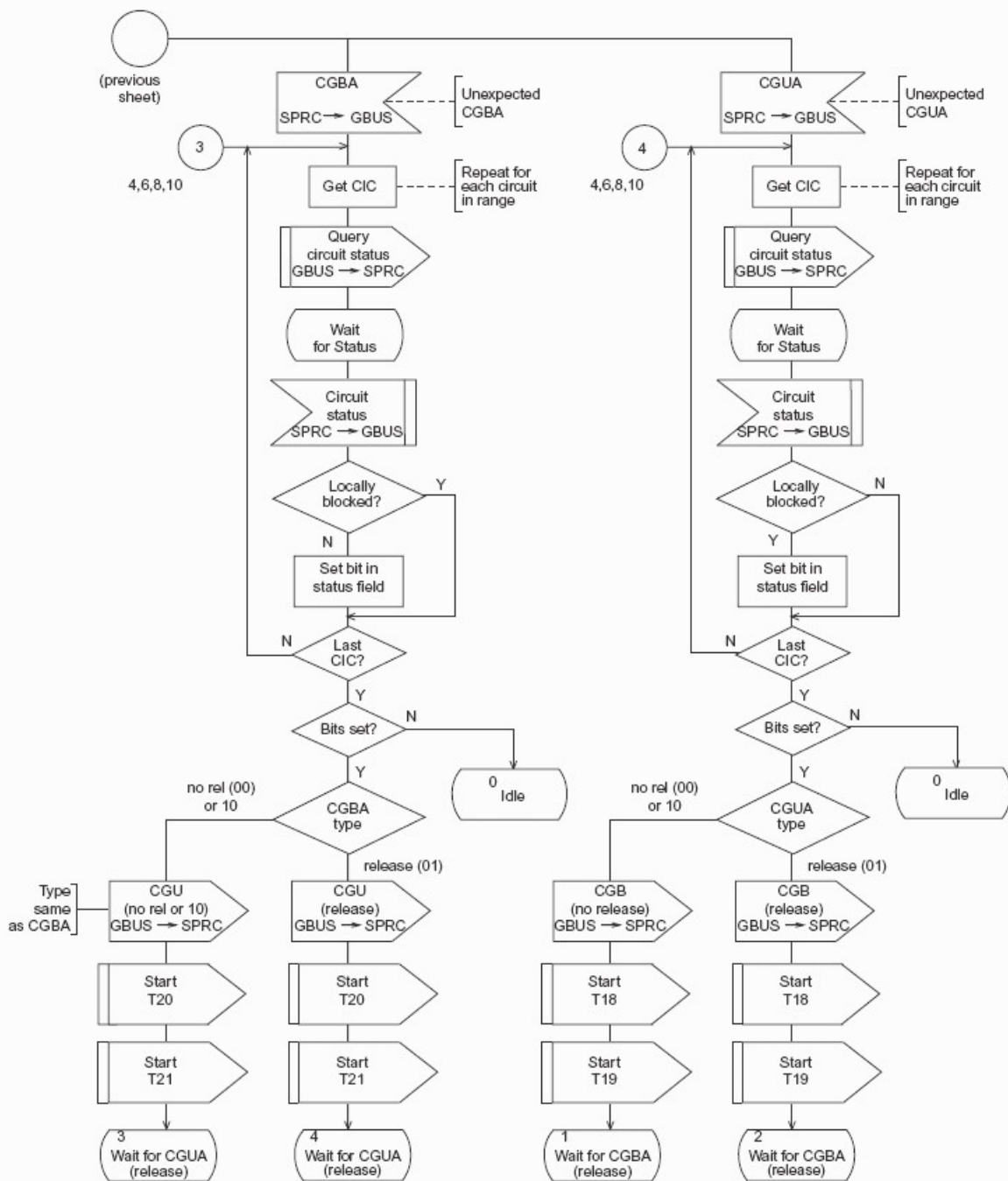


Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 3 of 11) - ATIS-1000113.2015 – Chapter 6

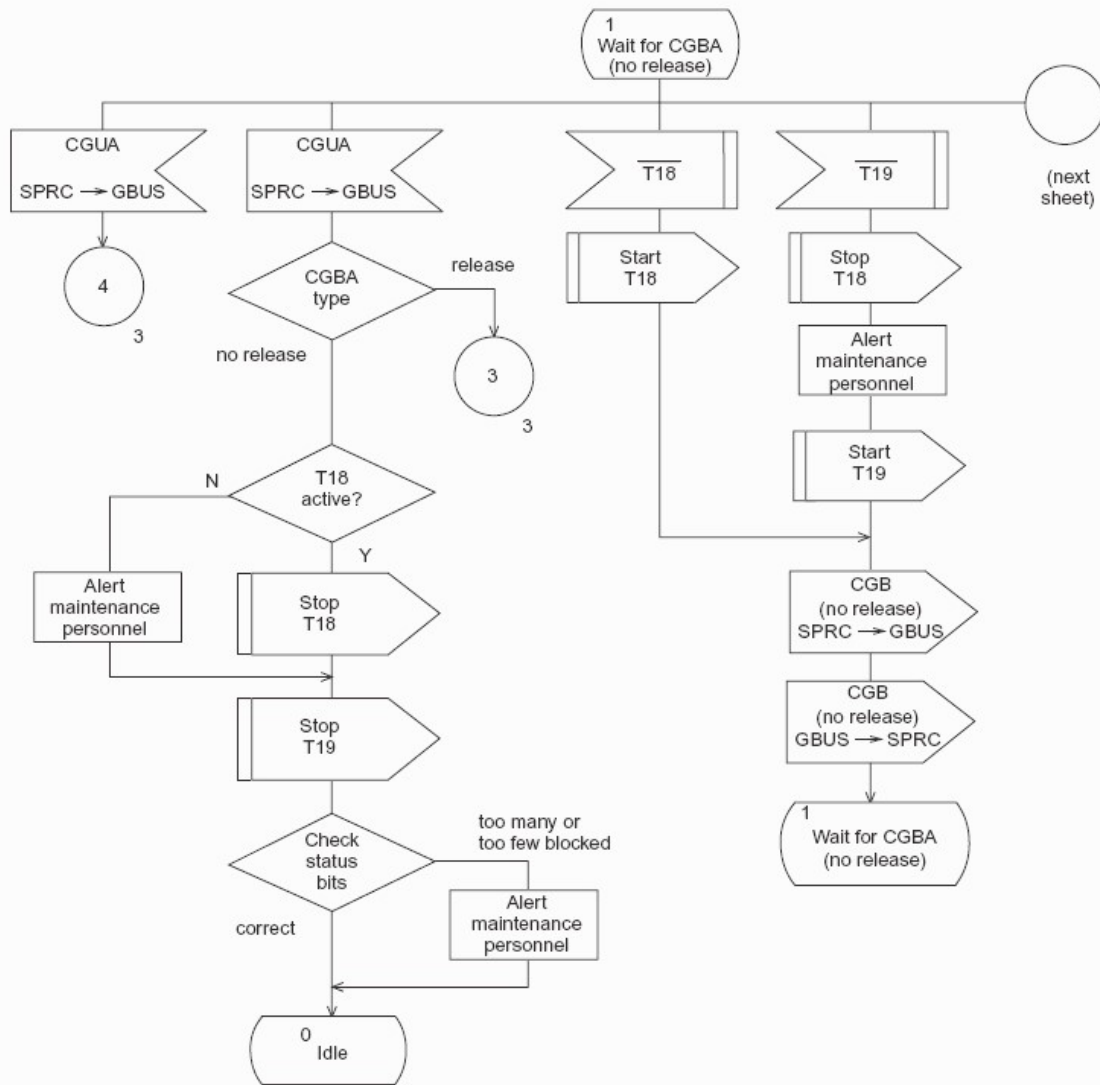
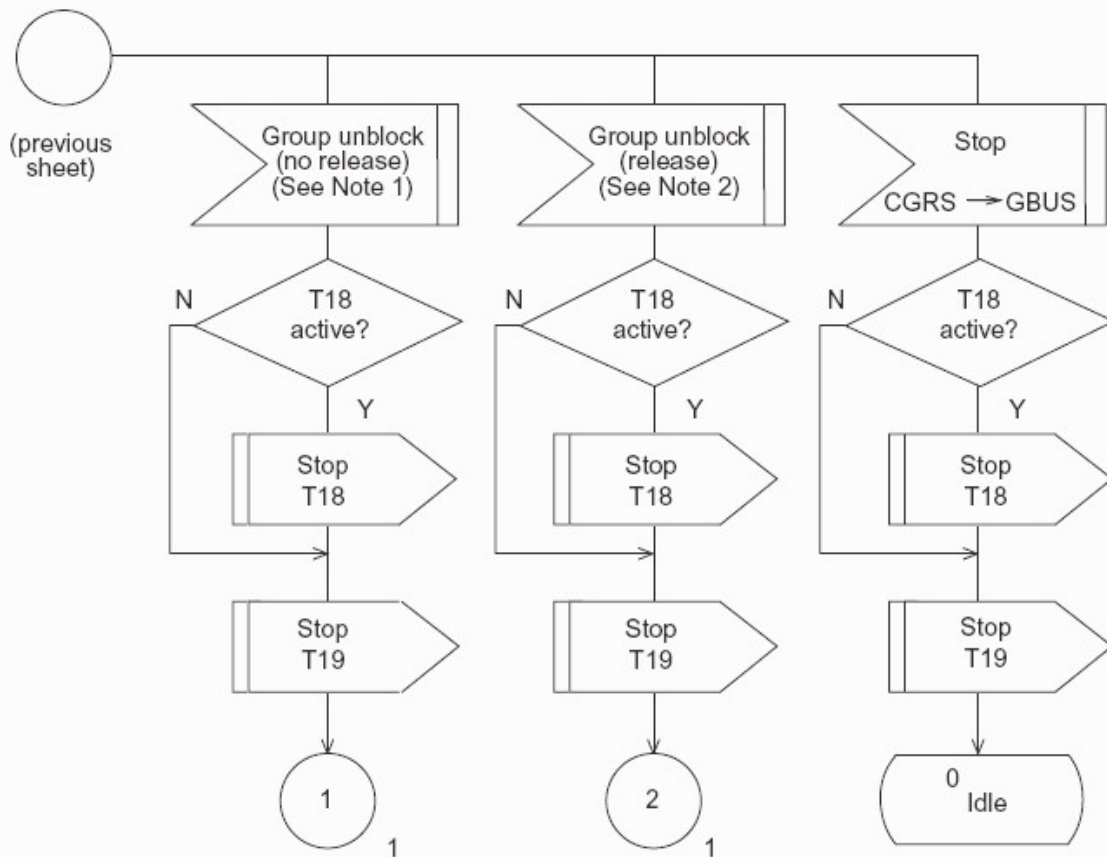


Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 4 of 11) - ATIS-1000113.2015 – Chapter 6



Note 1: From SCGA, maintenacne,
or unspecified implementation
dependent function.

Note 2: From HGA, maintenacne,
or unspecified implementation
dependent function.

Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 5 of 11) - ATIS-1000113.2015 – Chapter 6

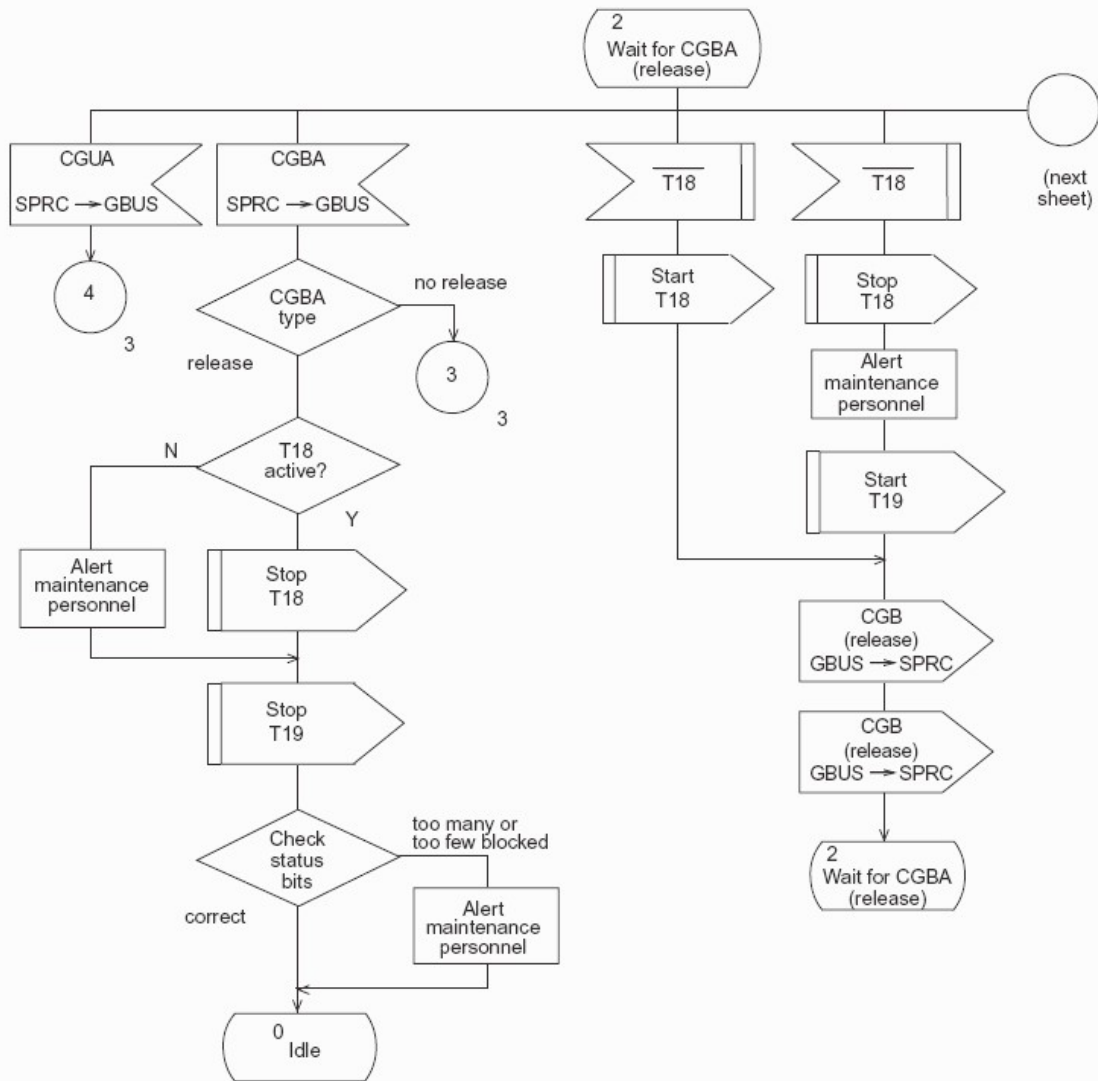
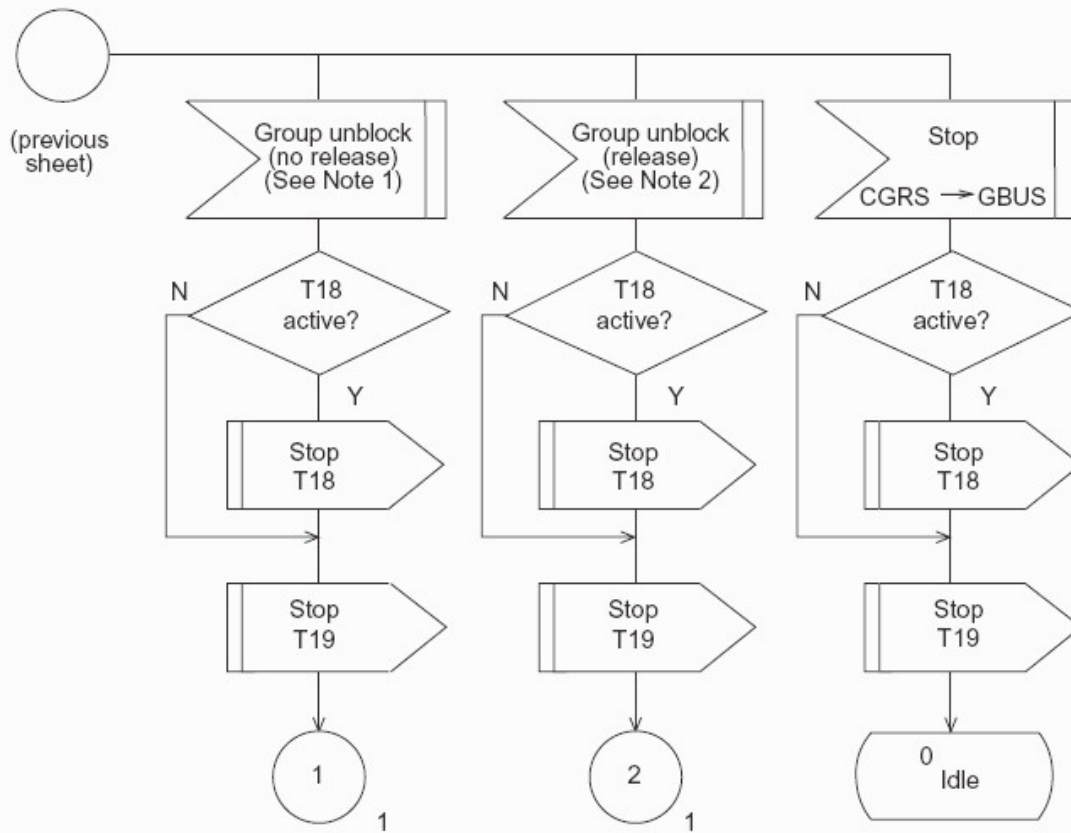


Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 6 of 11) - ATIS-1000113.2015 – Chapter 6



Note 1: From SCGA, maintenacne, or unspecified implementation dependent function.

Note 2: From HGA, maintenacne, or unspecified implementation dependent function.

Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 7 of 11) - ATIS-1000113.2015 – Chapter 6

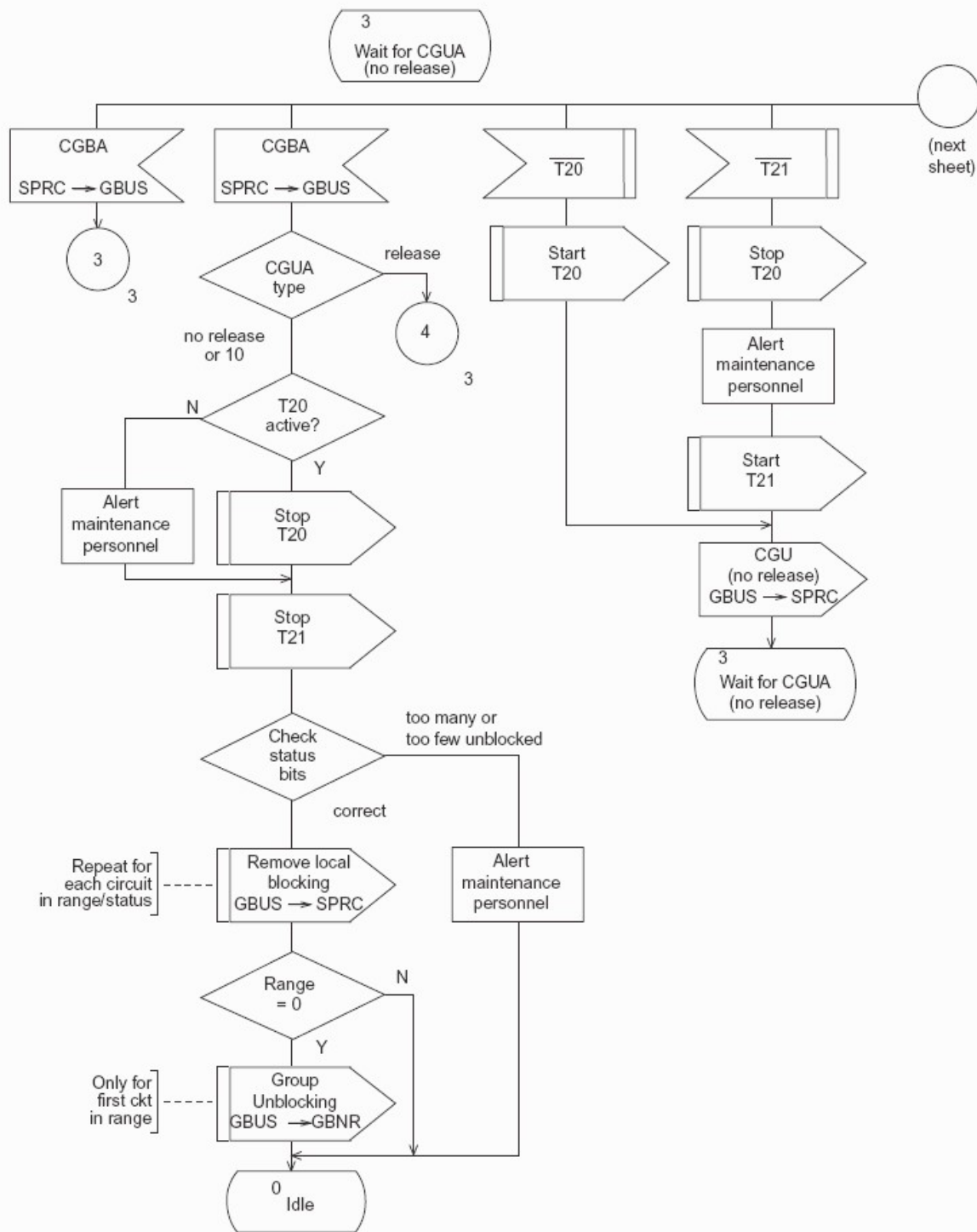
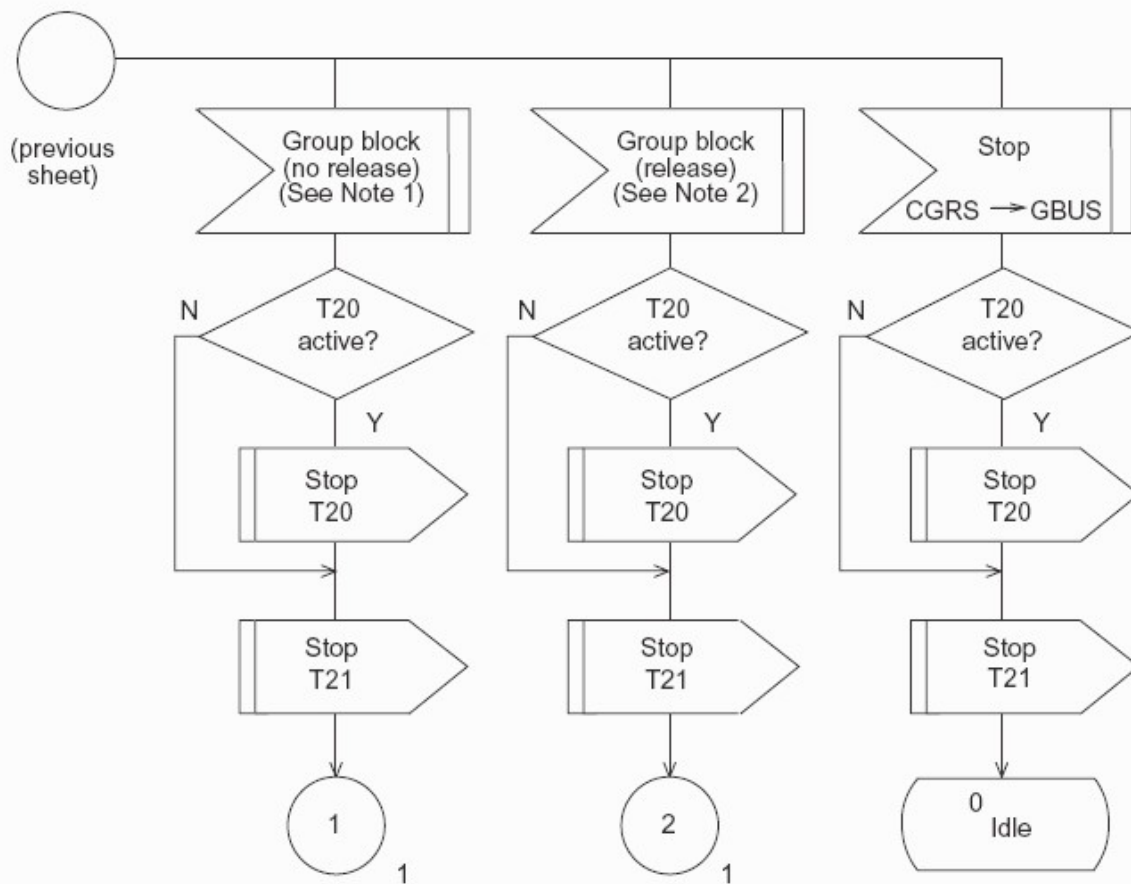


Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 8 of 11) - ATIS-1000113.2015 – Chapter 6



Note 1: From SCGA, maintenacne,
or unspecified implementation
dependent function.

Note 2: From HGA, maintenacne,
or unspecified implementation
dependent function.

Figure 2.17- Circuit group blocking/unblocking sending (GBUS) (Sheet 9 of 11) - ATIS-1000113.2015 – Chapter 6

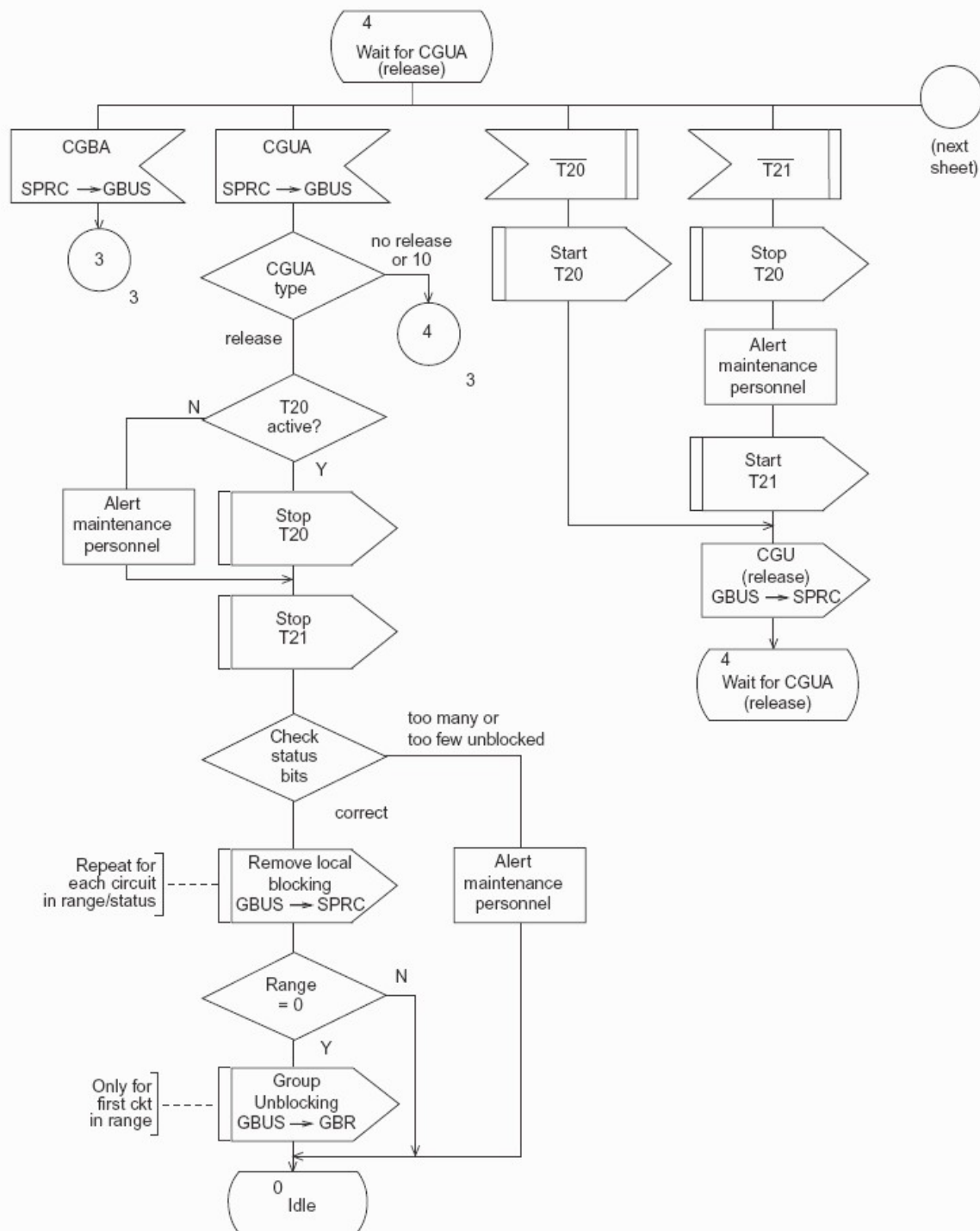
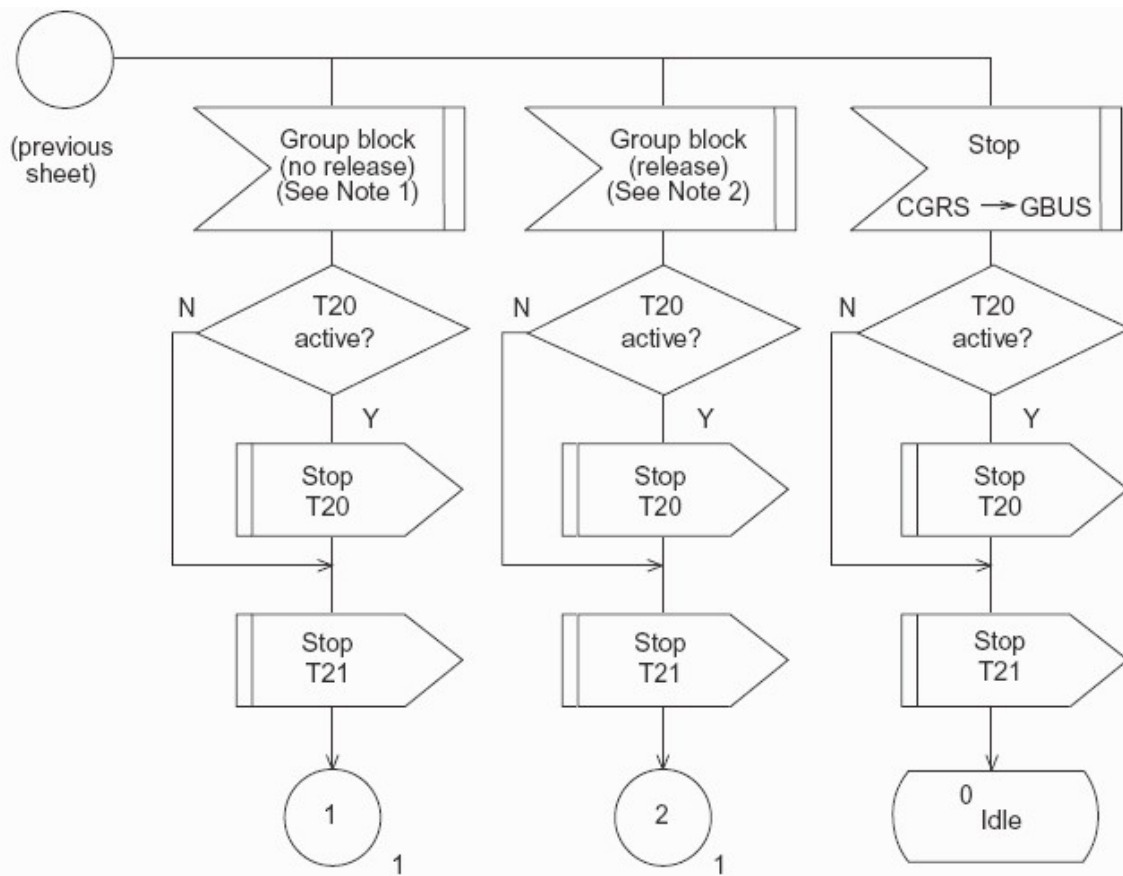


Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 10 of 11) - ATIS-1000113.2015 – Chapter 6



Note 1: From SCGA, maintenacne,
or unspecified implementation
dependent function.

Note 2: From HGA, maintenacne,
or unspecified implementation
dependent function.

Figure 2.17 - Circuit group blocking/unblocking sending (GBUS) (Sheet 11 of 11) - ATIS-1000113.2015 – Chapter 6

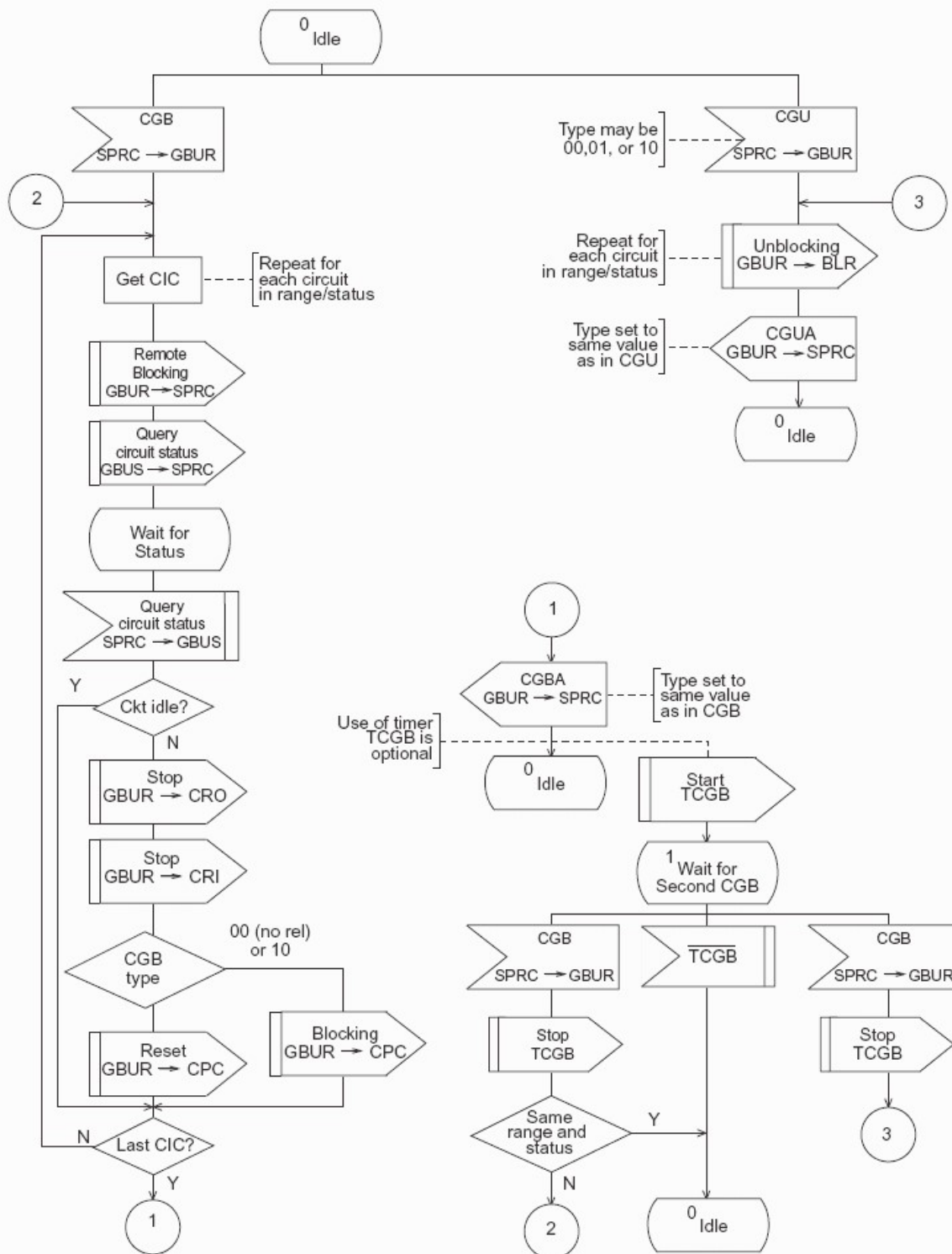


Figure 2.18 - Circuit group blocking/unblocking reception (GBUR) - ATIS-1000113.2015 – Chapter 6

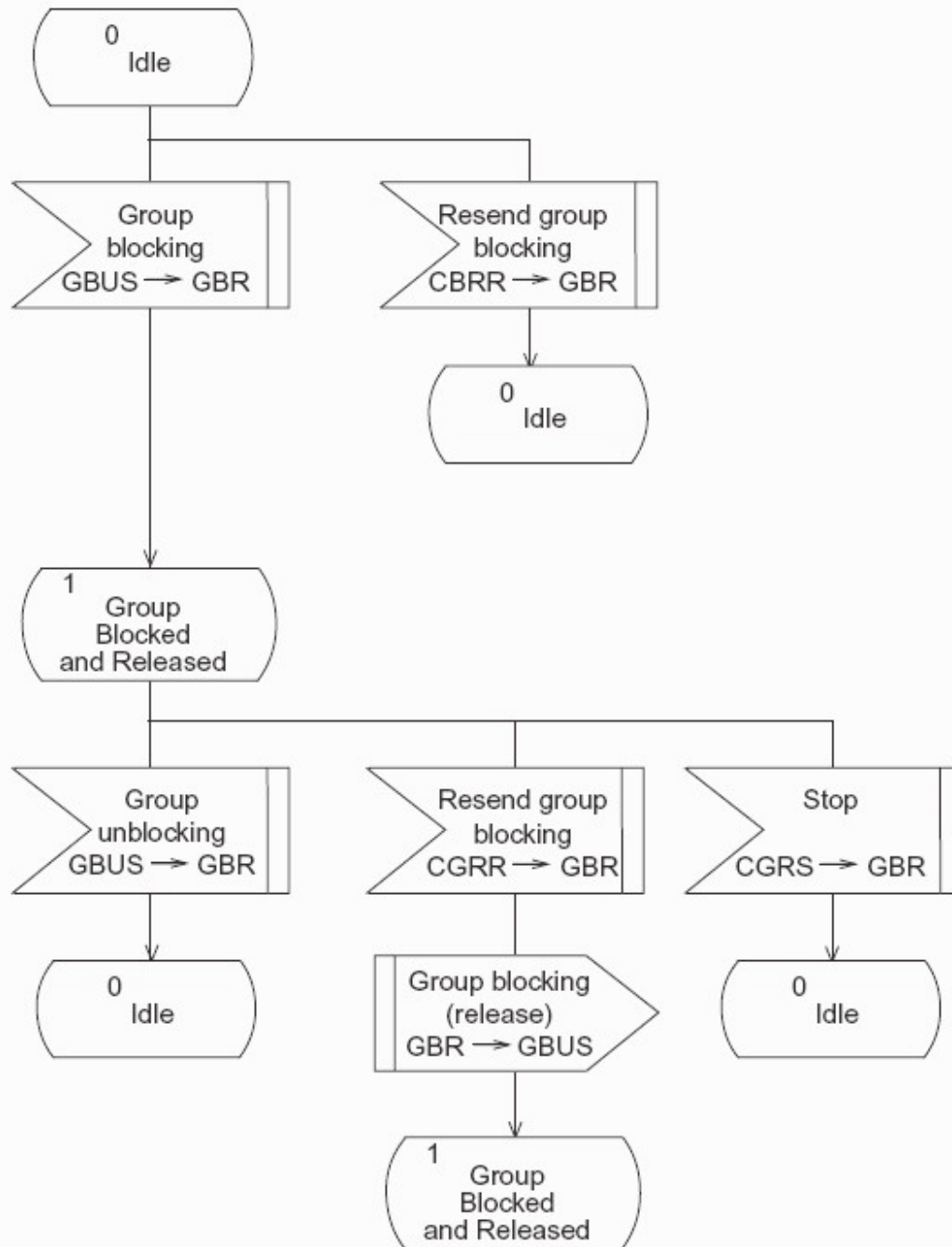


Figure 2.19 - Circuit group blocking with release (GBR) - ATIS-1000113.2015 – Chapter 6

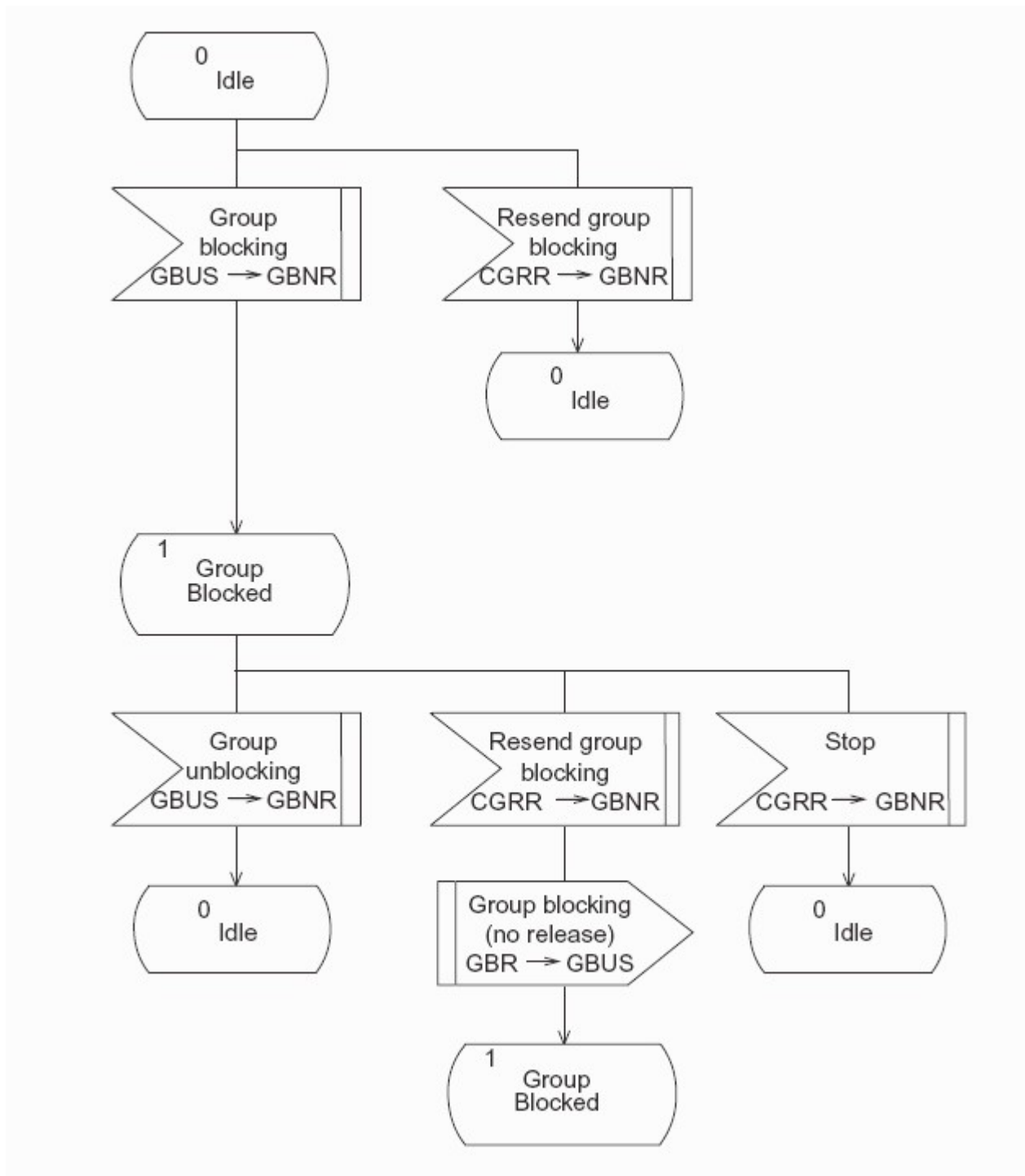


Figure 2.20 - Circuit group blocking without release (GBNR) - ATIS-1000113.2015 – Chapter 6

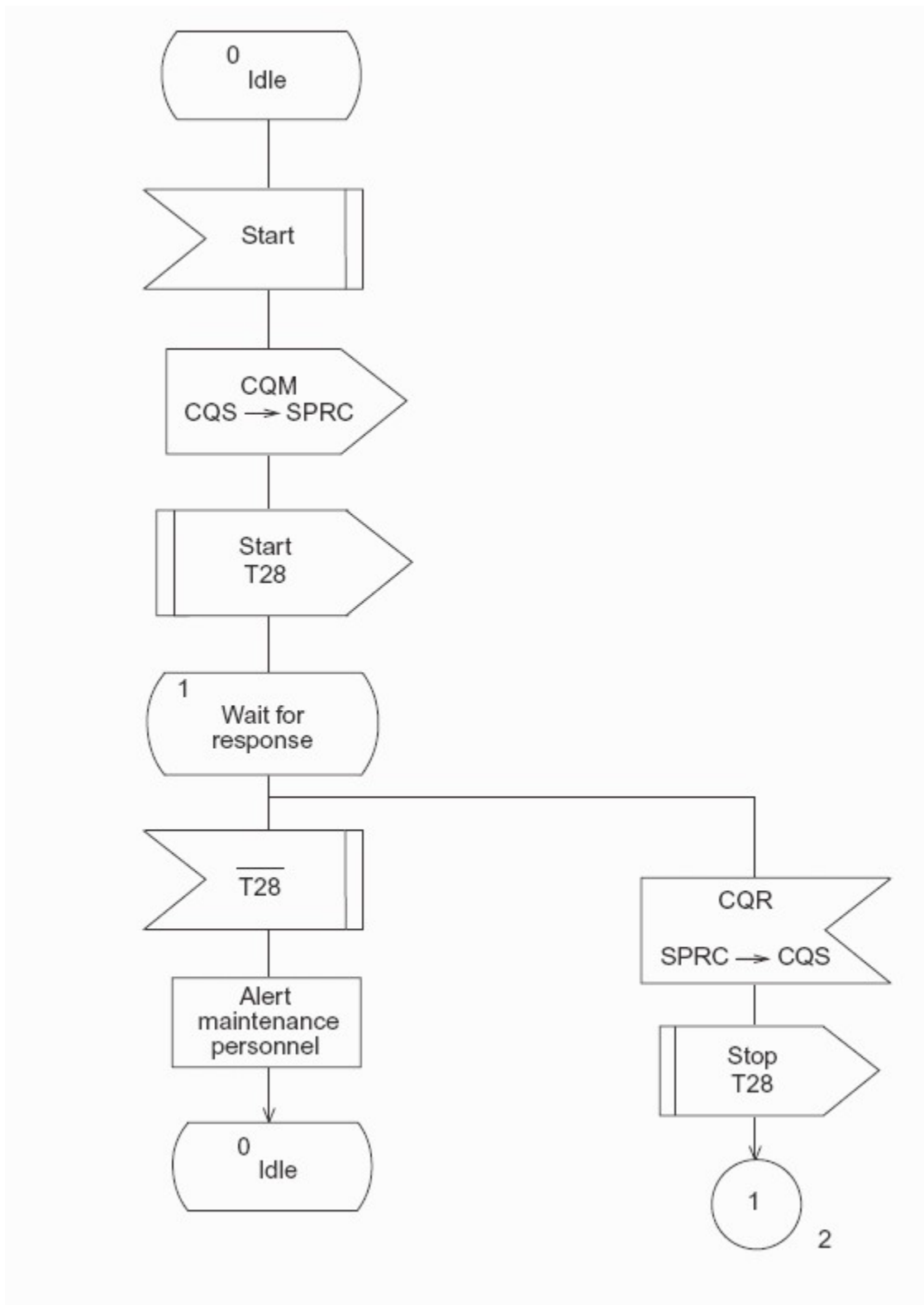


Figure 2.21 - Circuit query sending (CQS) (Sheet 1 of 4) - ATIS-1000113.2015 – Chapter 6

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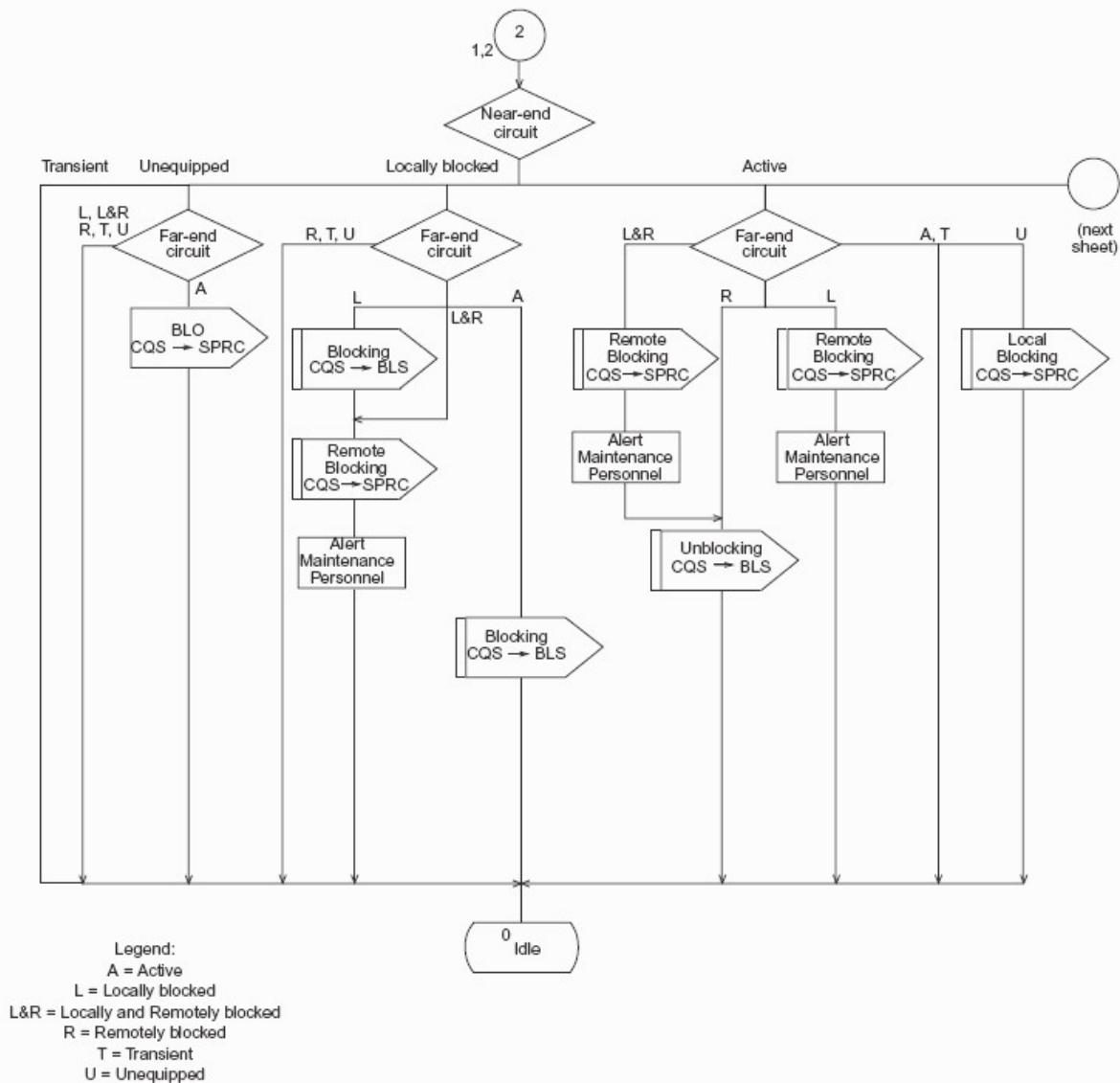


Figure 2.21 – Circuit query sending (CQS) (Sheet 3 of 4) - ATIS-1000113.2015 – Chapter 6

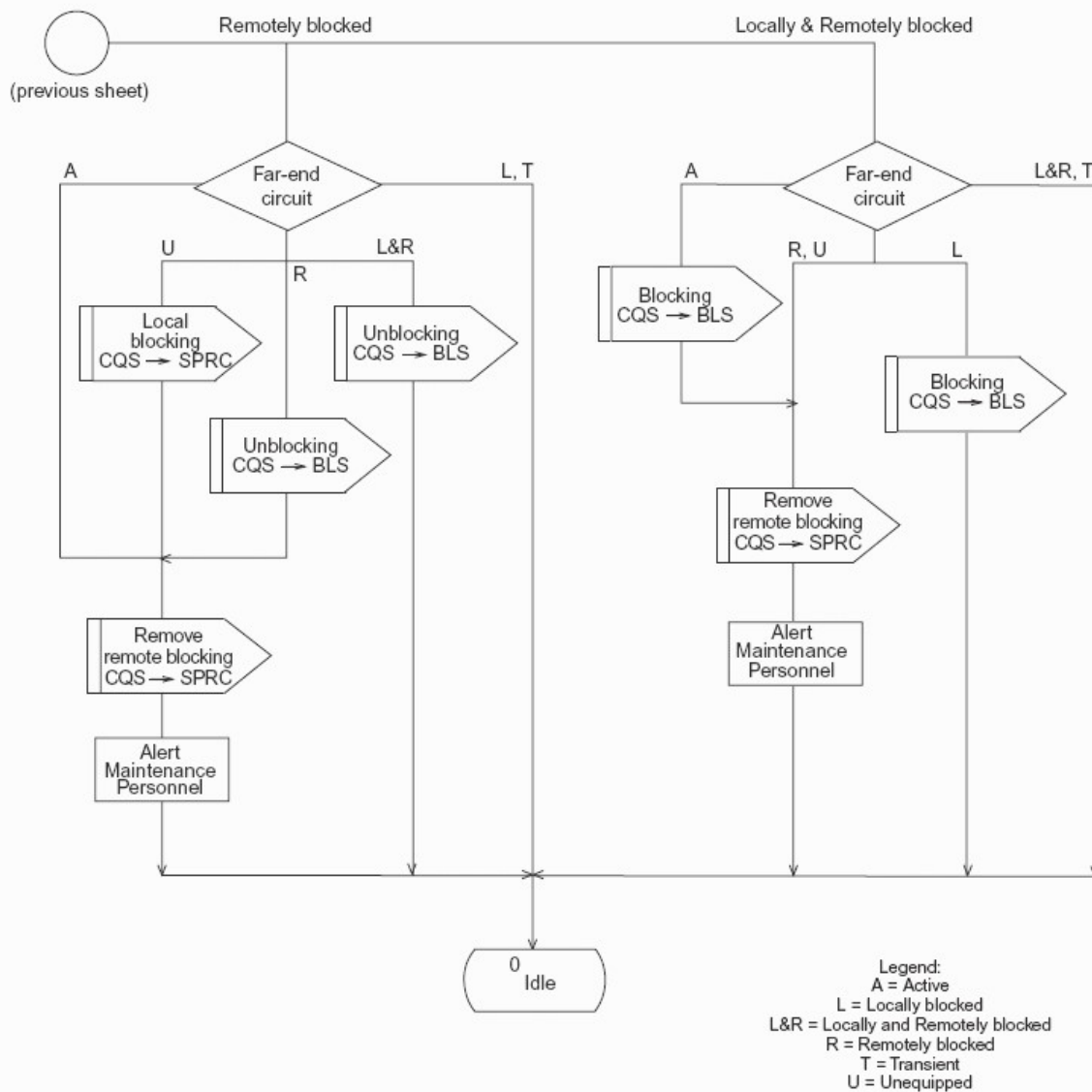


Figure 2.21 – Circuit query sending (CQS) (Sheet 4 of 4) - ATIS-1000113.2015 – Chapter 6

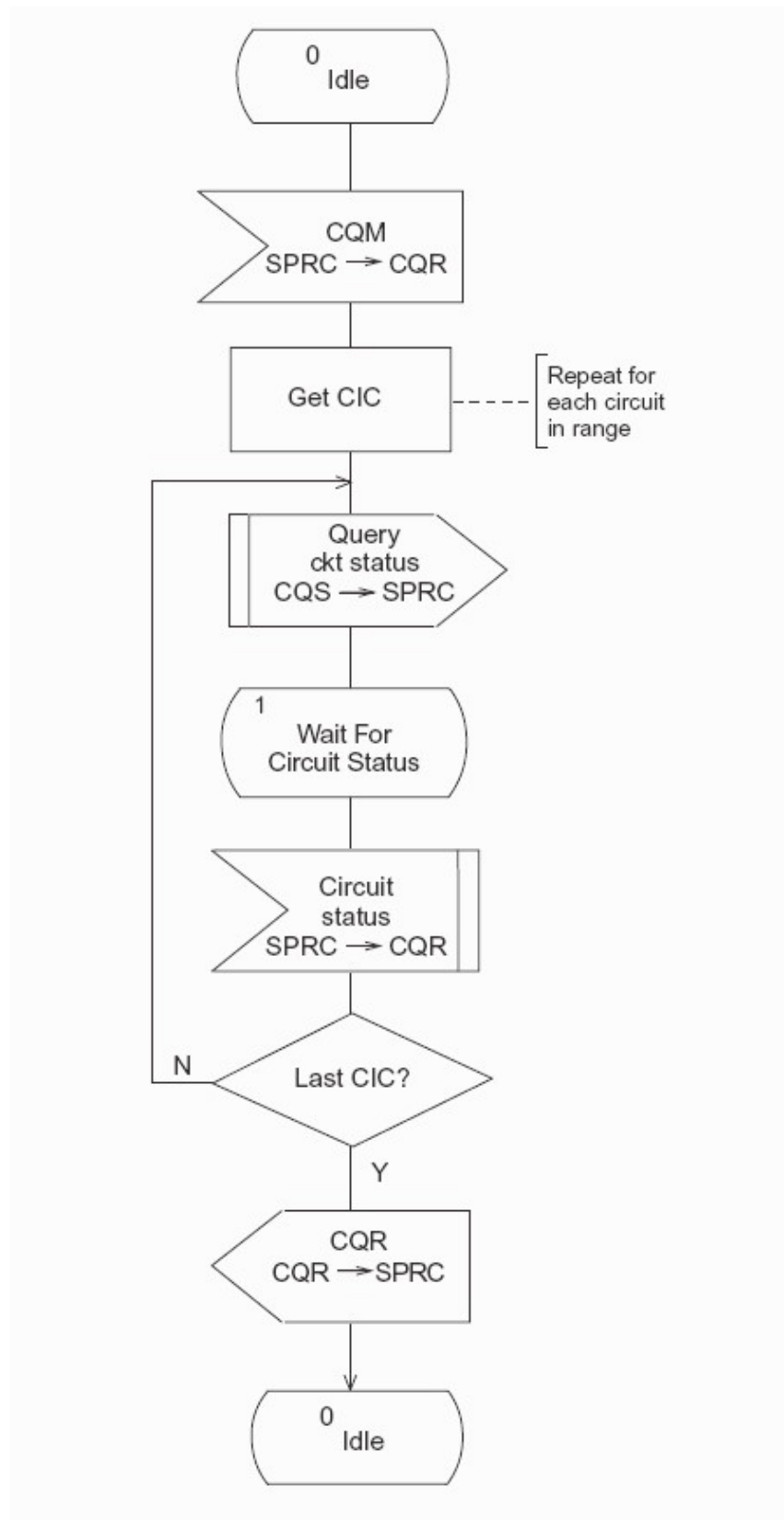


Figure 2.22 - Circuit query reception (CQR) - ATIS-1000113.2015 – Chapter 6

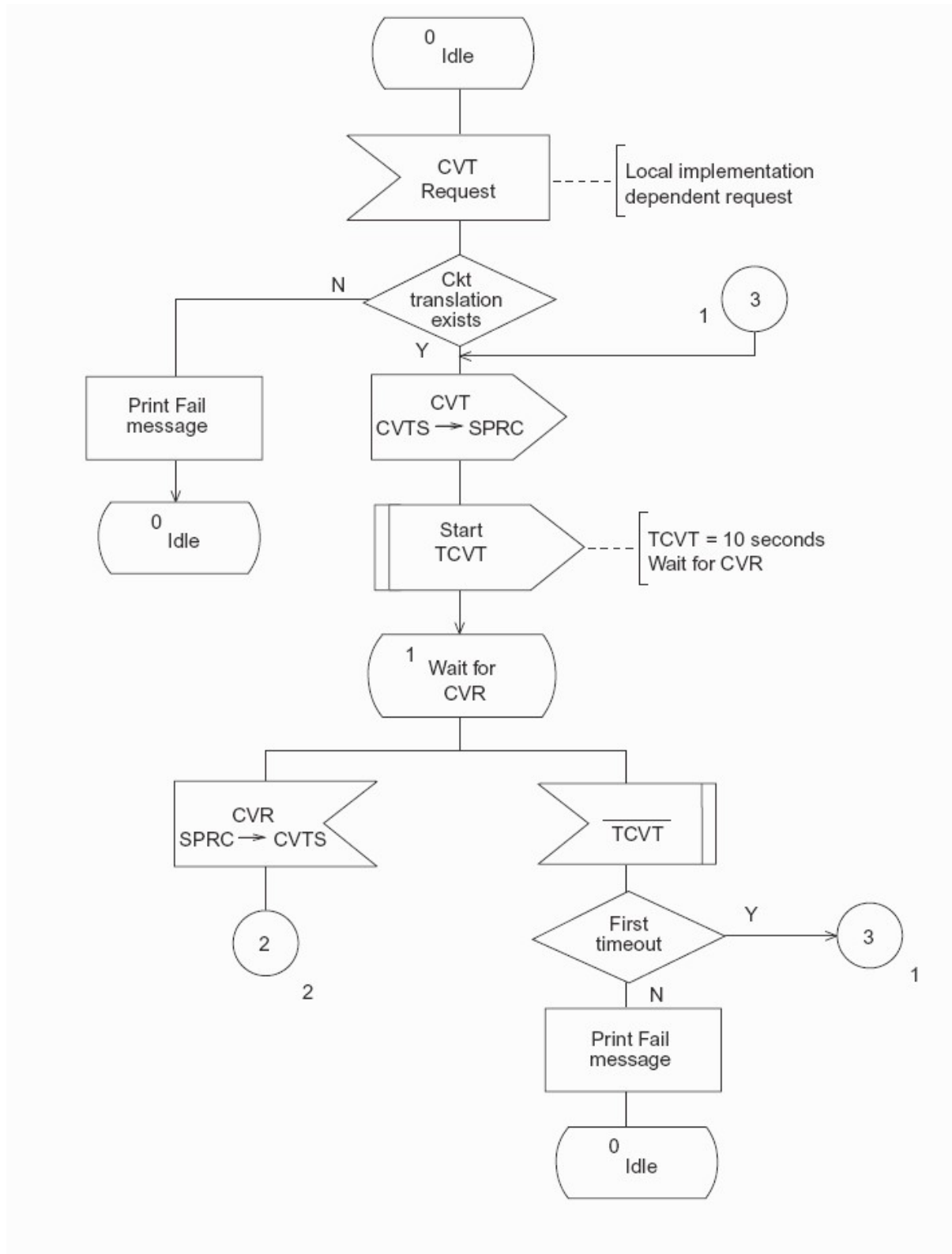


Figure 2.23 - Circuit validation test sending (CVTS) (Sheet 1 of 2) - ATIS-100113.2015 – Chapter 6

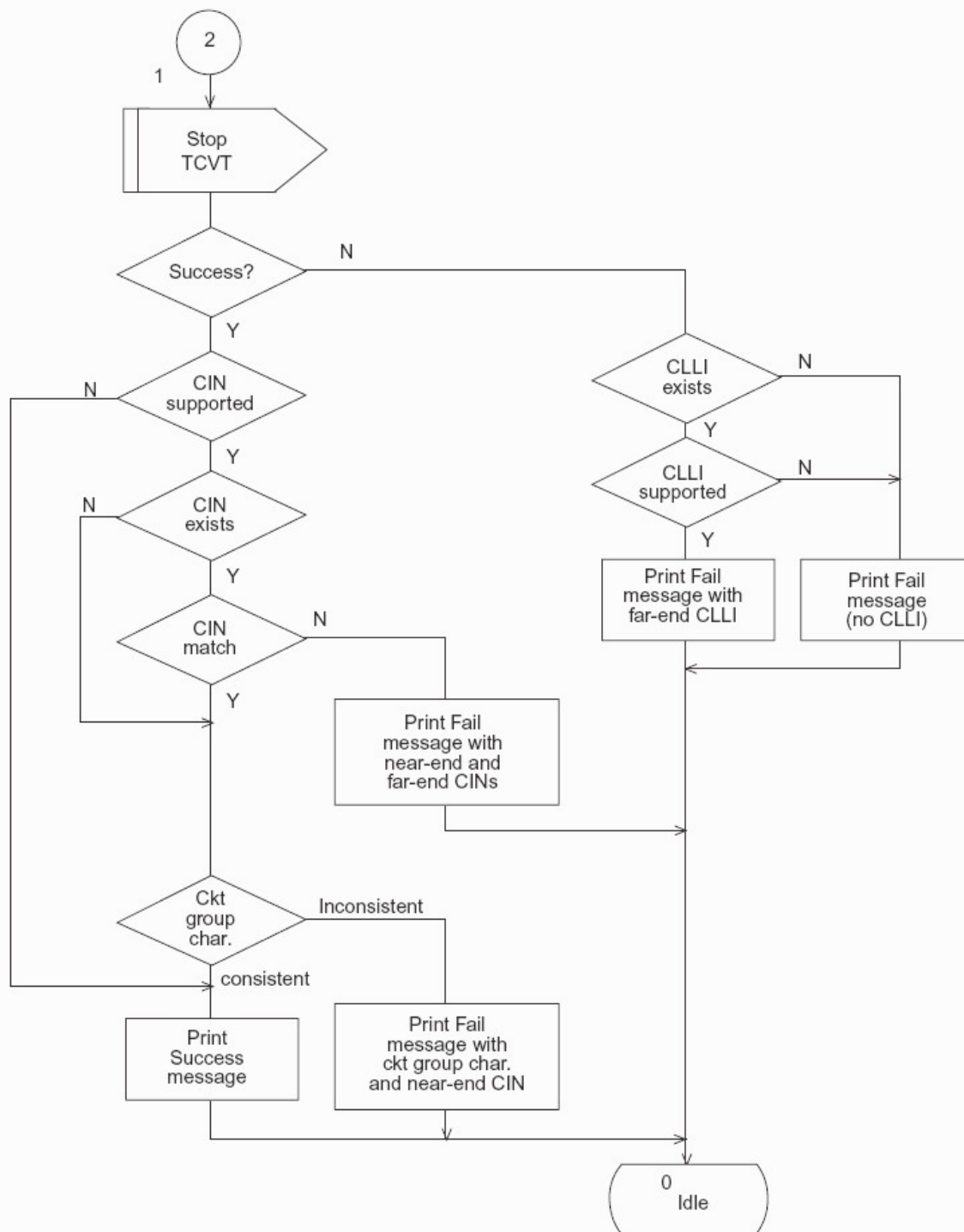


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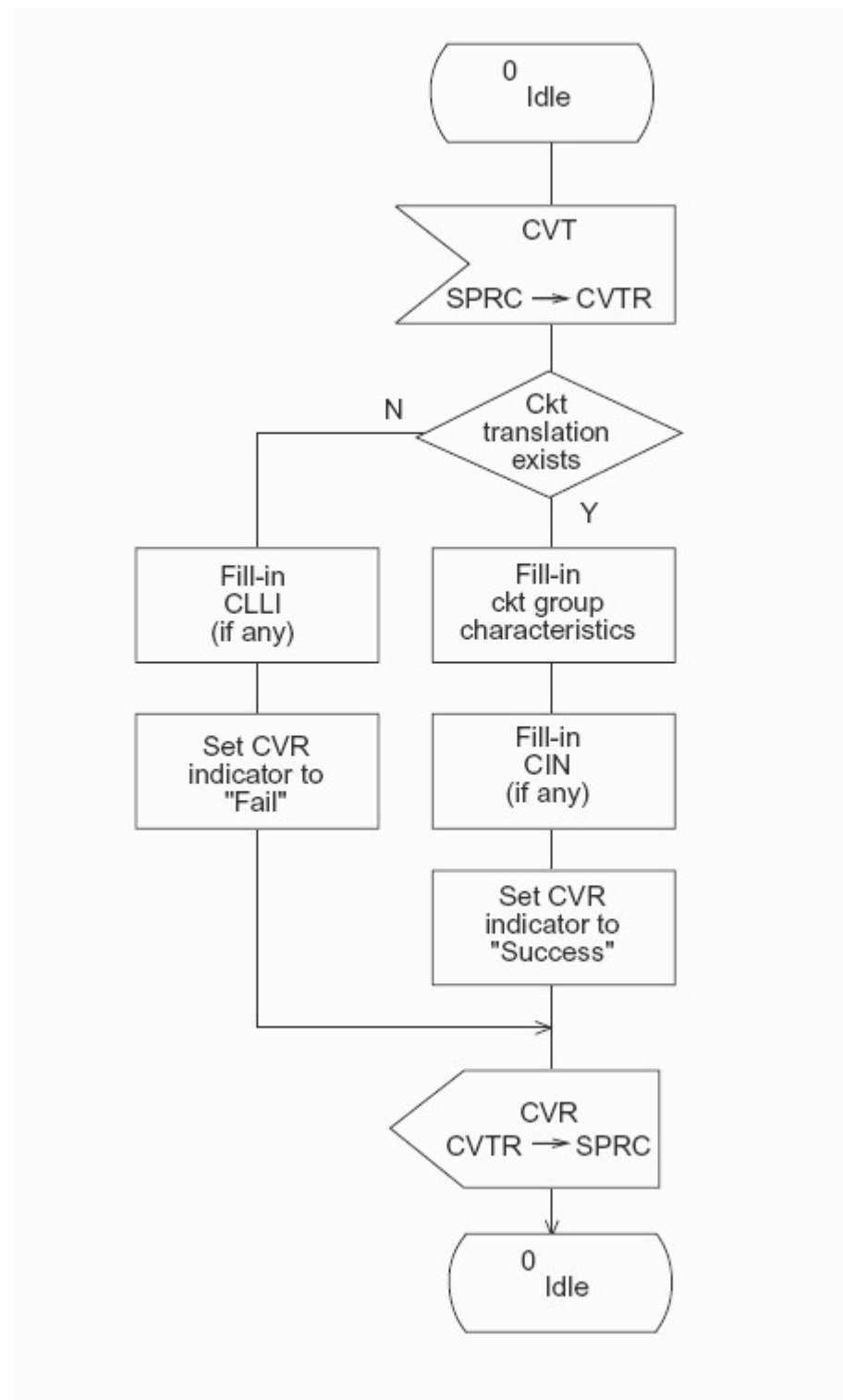


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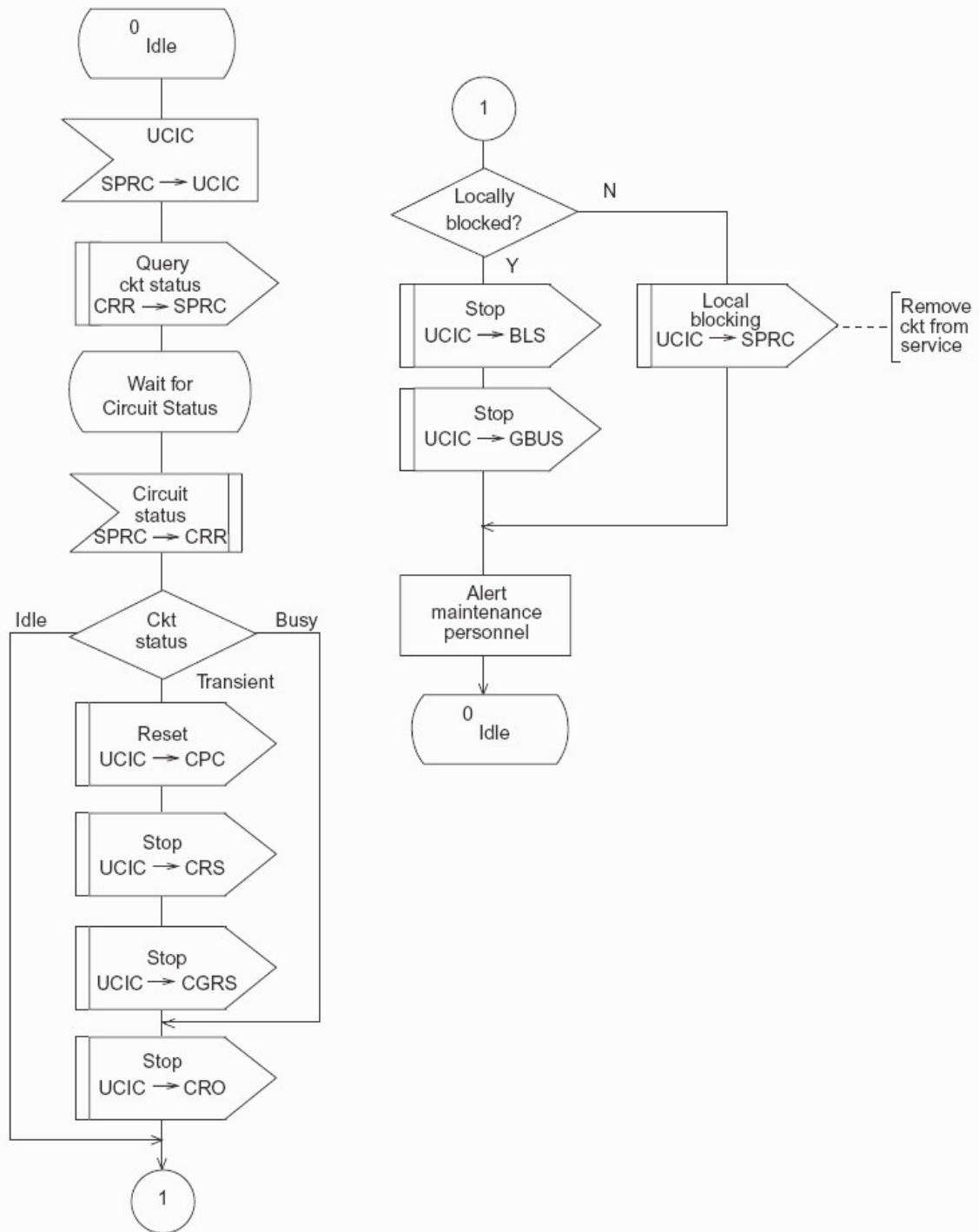


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**Signaling System No. 7 (SS7) --
Integrated Services Digital Network (ISDN) User Part**

Chapter 7

Application Transport Mechanism

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1 Scope

This chapter describes the additions to the ISDN User Part (ISUP) for the introduction of a transport mechanism for use by applications requiring a bearer in conjunction with the support of the application's signaling information flow. This transport mechanism shall provide the same capabilities as the Transaction Capabilities Application Part (TCAP) provides to its users. The definitions of the applications that use this mechanism are documented in their own Standard and are therefore outside the scope of this chapter.

The Application Transport mechanism (APM) is capable of creating signaling associations between APM-user application logic located at an Application Initiating Node (AIN) and its peer APM-user application logic located at the Application Addressed Node (AAN). (The AIN/AAN concept is described in 6). The ability to create different AIN/AAN relationships is only limited by the addressing mechanism used. At call setup, the ISUP basic call mechanism is used to route the call through the network towards the AAN in the same manner as it normally establishes a call. The APM addressing mechanism is used to determine the node in the call path where the Application Information has to be handled but has no influence on the routing of the call.

This transport mechanism provides the APM-user applications with both an implicit and explicit APM addressing capability.

At any time of the call, it is possible to create the following AIN/AAN relationships:

- AIN and AAN at end exchanges (originating exchange and destination exchange);
- AIN at intermediate exchange and AAN at end exchange;
- AIN at end exchange and AAN at intermediate exchange;
- AIN and AAN at intermediate exchanges.

This means that an AIN located anywhere in the call path has the capability to create an AIN/AAN relationship with any exchange in the call path having the APM-user capability. The intermediate exchanges having the APM capability but not the APM-user capability will transit the APM information.

It is, of course, possible to communicate in both directions once an AIN/AAN relationship has been created. It should be noted that only one AIN/AAN relationship may exist over the same segment of the call path for a given application (Context identity value) which does not use the explicit addressing mechanism. For example, if an AIN/AAN relationship has been established (AIN) between the originating exchange (OE) and an intermediate exchange in the call path (AAN), it is not possible to later establish an AIN/AAN relationship from the destination exchange to the originating exchange for the same application since its corresponding AAN would be located at the OE and would therefore result in two AIN/AAN relationships overlapping at the call leg between the OE and the intermediate exchange. However, it is possible to establish overlapping AIN/AAN relationships for a given application using the explicit addressing mechanism.

2 References

This chapter uses the ITU Recommendation Q.765 as the basis with the following modifications.

- Recommendation Q.765 uses the terms public initiating node (PIN) and public address node (PAN) in the description of the PIN/PAN concept in the network model. Since this Application Transport mechanism is an addition to the ISUP standard, emphasizing “public” seems not necessary. Instead, this chapter uses the terms Application Initiating Node (AIN) and Application Address Node (AAN). There are no changes to the original PIN (AIN)/PAN (AAN) concept and to the context of their use in the text.

The following list includes other ITU Recommendation(s) used as references in this text. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Standard are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below.

ITU-T Recommendation E.164 – 2010, *The International Public Telecommunication Numbering Plan*.¹

ITU-T Recommendation Q.765 - 2000, *Signaling System No. 7 – Application Transport Mechanism*.⁴⁷

ITU-T Recommendation Q.1400 - 1993, *Intelligent Network - Architecture framework for the development of signaling and OA&M protocols using OSI concepts*.¹

3 Definitions

3.1 Context - A set of rules by which to interpret the contents of the Encapsulated Application Information field as identified by a context identifier which uniquely represents an application to which data is associated.

3.2 APM user application - An APM-user application which is defined to be supported by the application transport mechanism specified in this chapter.

3.3 APM end node – A node which determines that the APM application information cannot be passed on beyond that node. The way a node determines that it is the APM end node is beyond the scope of this chapter.

4 Abbreviations

For the purpose of this chapter the following abbreviations are used:

AAN	Application Addressed Node
AIN	Application Initiating Node
AE	Application Entity
AEI	Application Entity Invocation
ALS	Application Layer Structuring
AP	Application Process
APM	Application Transport mechanism
APM-user	Application Transport mechanism User Application
APP	Application Transport Parameter
ASE	Application Service Element
EH ASE	Errors Handling Application Service Element
EUCEH	Enhanced Unidentified Context and Error Handling
LE	Local Exchange
MTP-3	Message Transfer Part Level 3
M/O	Mandatory/Optional
NI	Network Interface
NNI	Network Nodal Interface
OSI	Open Systems Interconnection

⁴⁷ This document is available from the International Telecommunications Union. < <http://www.itu.int/ITU-T/> >

SACF	Single Association Control Function
SAO	Single Association Object
SID	Signaling Identifier
TE	Transit Exchange (aka, IE- Intermediate Exchange)
UCEH	Unidentified Context and Error Handling

5 Document Structure

The description of the ISDN User Part procedures in this chapter are structured according to the model described in 6.2. The description is thus divided into two main parts:

- Protocol functions.
- Non-protocol functions, i.e., exchange nodal functions; this is referred to as the "Application Process".

This chapter describes only the part of the total Application Process and Protocol functions in the exchange that relates to NNI enhancements for the support of the Application Transport mechanism.

The protocol functions relate only to signaling associations with a bearer (ISUP) and describe the additional information and procedures to that defined for ISUP Basic Call (see ATIS-1000113.2015 – Chapter 4) and its associated formats and codes (see ATIS-1000113.2015 – Chapter 3) required to support the Application Transport mechanism.

The signaling association with a bearer is subdivided into three parts: APM-user Protocol Control (APM-user ASE), Application Transport mechanism protocol control (APM ASE), and the ISUP Basic Call (ISUP ASE). These are coordinated by the Single Association Coordination Function (SACF).

The Application Entity (AE) can contain more than one APM-user application. It also contains Errors Handling (EH ASE) for taking the appropriate actions in the case when the addressed node (AAN) does not support the APM-user application or for the handling of APM error cases.

The Application Process (AP) contains all Call Control functions, however, this chapter will only describe the enhancements required to support the Application Transport mechanism (APM). The AP relevant to the ISUP basic call can be found within ATIS-1000113.2015 – Chapter 4, whereas the APM-user functionality can be found in the suitable Standards that define the given application.

The service primitive technique, used to define the ISUP ASEs and the SACF specific to the Application Transport mechanism's signaling needs, is a way of describing how the services offered by an ASE, or SACF – the provider of a (set of) service(s) – can be accessed by the user of the service(s), the SACF or the AP, respectively.

The service primitive interface is a conceptual interface and is not a testable or accessible interface. It is a descriptive tool. The use of service primitives at an interface does not imply any particular implementation of that interface, nor does it imply that an implementation must conform to that particular service primitive interface to provide the stated service. All conformance to the ISUP specification is based on the external behaviour of a node, i.e., on the generation of the correct message structure and in the proper sequence (as specified in ATIS-1000113.2015 – Chapter 3, ATIS-1000113.2015 – Chapter 4, and this chapter).

The structure and examples of its usage are illustrated in Clause 6.2.

Examples of primitive flow sequence diagrams for APM segmentation can be found in Annex A.

6 Modeling

The models described in this clause introduce concepts and terminology used in this specification of the Application Transport mechanism.

6.1 Network Model

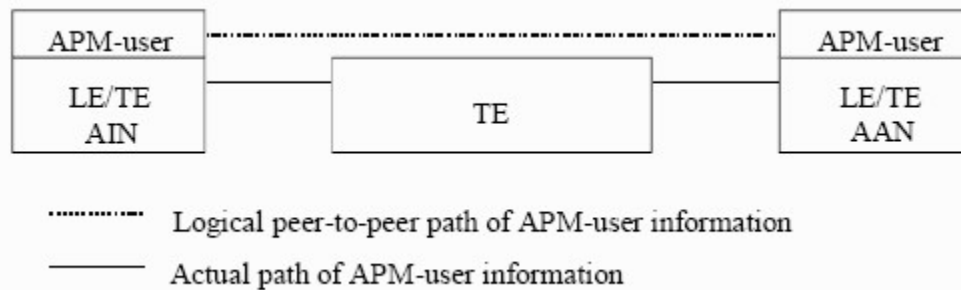


Figure 6.1 - Network model - ATIS-1000113.2015 – Chapter 7

This clause illustrates the relationship between the APM-user Application and the APM implemented across a network. Figure 6.1 of ATIS-1000113.2015 – Chapter 7 provides an example of a call from an initiating application to an addressed application via a transit network. The APM provides the APM-user application with the service of providing both a signaling association as well as a bearer between remote applications.

The Application Initiating Node (AIN) and Application Addressed Node (AAN) concept is introduced here to assist in the description of the APM. The AIN represents the point in the network that wishes to initiate communications towards a peer APM-user application located at an addressed location (AAN). An APM-user application may result in the establishment of a signaling and bearer association in which case it will use the services of the ISUP basic call.

An AIN/AAN signaling relationship may be established:

- At any time in association with an already established basic call,
- At call set-up by utilizing the received IAM, or
- By the application establishing a new call.

In the third case, the initiating APM-user's Application Process supplies a normal ITU-T Recommendation E.164 number which is used to route through the network thus establishing an association between the application initiating node (AIN) and the application addressed node (AAN). At any phase of the call, the APM addressing mechanism is used to specify the location of the AAN. Either the initiating APM-user supplies the address of the node where the Application Information shall be delivered (explicit addressing), or no address is provided by the initiating application, in which case the AAN is the next node supporting the APM-user application (implicit addressing).

The APM destination address does not influence the routing of the call through the public network but is only used to determine whether a node in the call path is the AAN. The AAN identifies the particular APM-user application by the Context Identifier value carried within the Application Transport Parameter (APP).

The ISUP basic call mechanism is employed to provide an association between the AIN and the AAN. In routing through the network the call may pass through intermediate nodes with or without the ability to support the particular APM-user functionality. However if the application is not addressed towards that node, it will behave as a normal intermediate node.

As a number of APM-user applications may be independently active on the same basic call, it is possible to have a number of AIN/AAN relationships established in either the forward or backward direction and at different phases with respect to the ISUP basic call.

6.2 Specification Model

6.2.1 Introduction

The model used to structure the description of ISUP procedures herein are based on the OSI Application Layer Structure (ALS) model, see ITU-T Recommendation Q.1400. This clause presents the model and gives a general description of its operation. This clause shows the generalized model for the "Exchange Application Process" for the support of applications making the use of the Application Transport mechanism over the network nodal interface (NNI).

6.2.2 General Model

The generalized model for the bearer related (ISUP) Application Transport mechanism Application Process is shown in Figure 6.2 of ATIS-1000113.2015 – Chapter 7. This figure does not represent the situation at any specific point during ISUP procedures, but instead it shows the full picture of the architecture. The specific application of this model is discussed in 6.1. Figure 6.2 of ATIS-1000113.2015 – Chapter 7 shows the primitive interfaces between the functional blocks, as used in the body of this chapter for calls with bearer (ISUP).

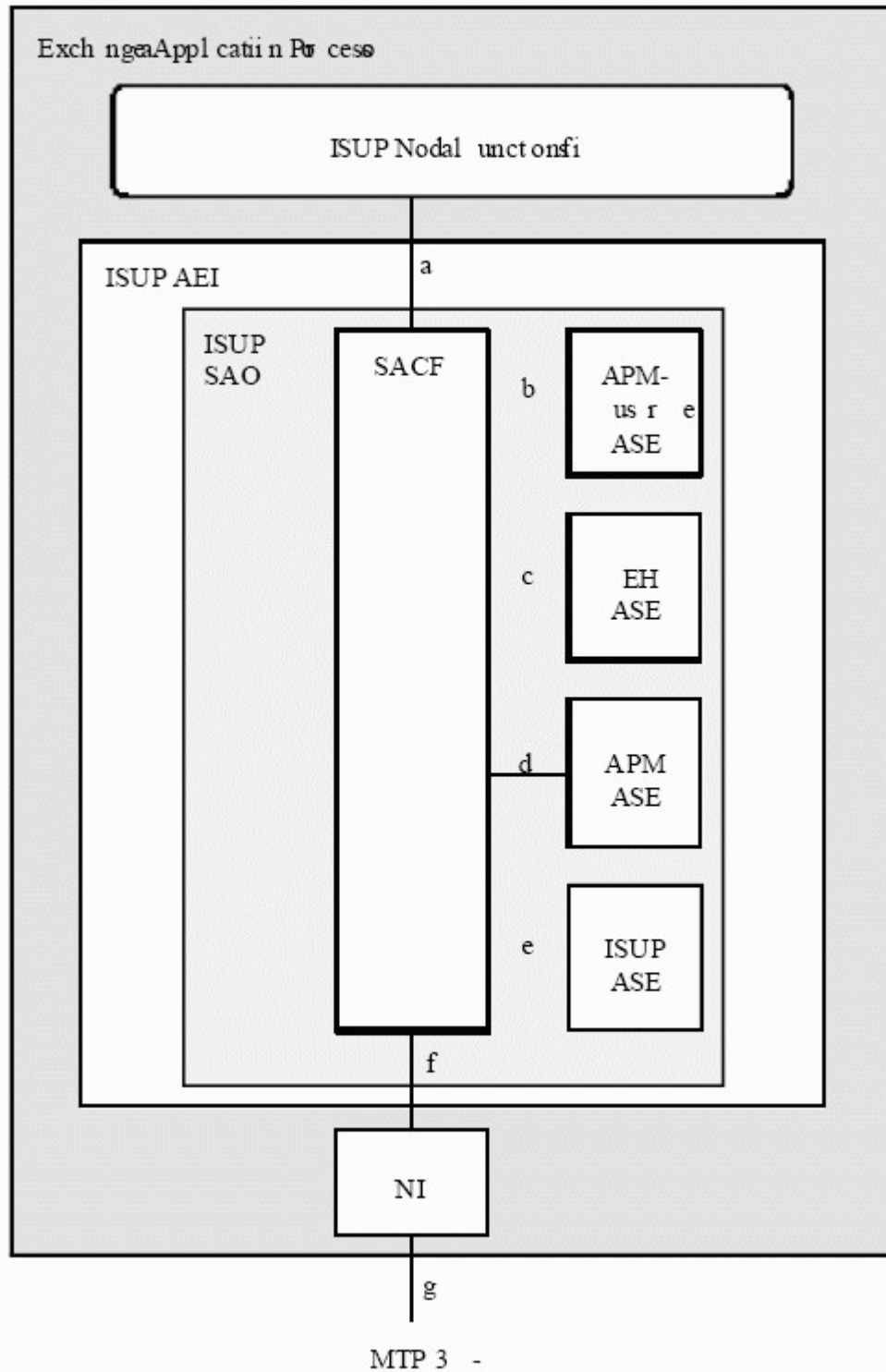


Figure 6.2 - ISUP specification model - ATIS-1000113.2015 – Chapter 7

The definitions of the interfaces a to g are:

- a) Interface between the Application Process nodal functions (AP) and the SACF for the support of the APM over the NNI – see Clause 7.2.2.
- b) Interface between SACF and APM-user ASE representing the application being supported by the APM. (interface is out of the scope of this Standard, except for the primitive interface part used to access the services of the APM ASE) - see Clause 11.1.
- c) Interface between SACF and EH ASE representing the handling of unidentified context identifier values and error cases - see Clause 13.1.
- d) Interface between SACF and APM ASE representing enhancements of the ISUP functionality for providing a transportation mechanism for the support of various applications (APM-user) over the NNI - see Clause 10.1.
- e) Interface to ISUP basic call signaling ASE (interface is out of the scope of this Standard, except for the primitive interface part used by the APM ASE to access the services of the ISUP ASE) - see Clause 9.
- f) Interface between SACF and NI function - see Clause 12.2.2.
- g) Interface to MTP-3.

With respect to Figure 6.2 of ATIS-1000113.2015 – Chapter 7, all functions also have an interface to a "Management application"; this is not defined as a formal primitive interface.

The term "Exchange Application Process" is used to describe all the Application functionality in an exchange. ISUP is a part of the Exchange Application Process. Thus the ISUP Nodal functions shown on the model are referred to as the ISUP Application Process functions in the body of this chapter.

The ISUP AEI provides all the bearer related communication capabilities required by the ISUP Nodal functions. For simplicity an ISUP AEI is defined as containing just one SAO; this avoids the need to specify a Multiple Association Control Function (MACF). Thus all coordination of ISUP signaling associations are performed via the ISUP Nodal functions.

The SACF has the responsibility of coordinating the flow of primitives between its interfaces in the appropriate manner.

The ISUP ASE is defined by ATIS-1000113.2015 – Chapter 4. Its main responsibilities are basic call procedures and the handling of protocol errors and unrecognized information handling (see ATIS-1000113.2015 – Chapter 4). The monolithic nature of ISUP Standard means that both Call Control and Protocol Control functionality are defined together. It is not the intention of this chapter to redefine the ISUP basic call (see ATIS-1000113.2015 – Chapter 4) in ALS format; therefore it is referenced en-bloc within this chapter as the ISUP ASE. Conceptually, this should be considered to represent a logical division between the protocol control functionality within the ISUP ASE and its associated call control functionality within the application process. The modeling and interfaces with respect to this are outside the scope of this Standard.

The APM ASE provides the means for the transfer of information (including addressing) between nodes for signaling requiring a bearer, and to provide generic services to applications, while being independent of any of these. It is responsible for the enhancements to the NNI (ISUP) for the support of a mechanism which allows various applications to transport their information flows via the NNI. Its main responsibilities are:

1. To provide message segmentation in order to provide the APM-user the ability to transport up to 2048 octets of application information
2. To provide the means to identify the AAN.

The APM ASE is able to support multiple APM-users where each is treated independently and provided with the same level of service.

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The EH ASE handles the Application Transport Instruction Indicators (ATII), thereby providing a compatibility mechanism for the case where various levels of application (context) support exists within network nodes. It also handles APM reassembly error cases according to the ATII. For the compatibility mechanism it consists of two distinct sets of functions; one set used as the Application Addressed Node (AAN), and one set used as the Application Initiating Node (AIN) (supporting the signaling association to a subsequent exchange). The AIN/AAN concept is explained in clause 6.1.

The APM-user ASE is responsible for preparing the application specific signaling in a form that can be transported by the Application Transport mechanism. It is also responsible for providing any required addresses for the APM addressing mechanism.

To handle any particular ISUP function the Exchange Application Process creates an instance of the required ISUP Nodal functions. ISUP will create instances, as required, of the ISUP AEI. The Network Interface (NI) function exists to distribute messages received from the MTP-3 to the appropriate instance of the ISUP AEI. There is only one instance of the NI in an exchange. The NI also fulfils the presentation layer function according to the formats and codes of ATIS-1000113.2015 – Chapter 3.

The MTP-3 interface is defined in ATIS-1000113.2015 – Chapter 1.

The SAO contained in the ISUP AE is one of the following types:

- a) Application Initiating Node (AIN). This contains ISUP, Initiating APM, Initiating EH ASE, Initiating APM-user and ISUP SACF.
- b) Application Addressed Node (AAN). This contains ISUP, Addressed APM, Addressed EH ASE, Addressed APM-user, and ISUP SACF.

The ISUP may be incoming or outgoing depending on the direction of the AIN/AAN relationship with respect to the ISUP call.

6.2.3 Dynamic Primitive Flows

Figures 6.3 and 6.4 of ATIS-1000113.2015 – Chapter 7 illustrate the dynamic primitive flows for an APM-user call with a bearer being supported over the NNI (ISUP) for the case that a call control message is coincident with the application information flow. Figure 6.3 of ATIS-1000113.2015 – Chapter 7 shows the case when a message is being sent; Figure 6.4 of ATIS-1000113.2015 – Chapter 7 shows the case when a message is being received.

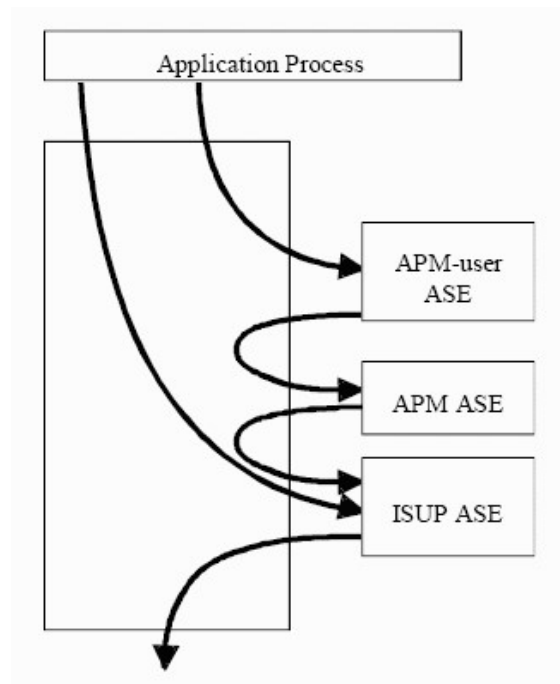


Figure 6.3 - Dynamic primitive flow with coincident call control message sent - ATIS-1000113.2015 – Chapter 7

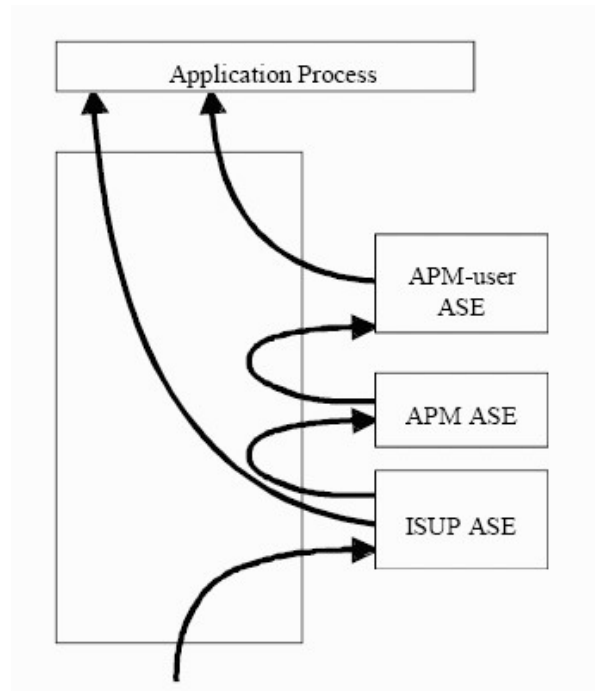


Figure 6.4 - Dynamic primitive flow with coincident call control message received - ATIS-1000113.2015 – Chapter 7

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Figures 6.5 and 6.6 of ATIS-1000113.2015 – Chapter 7 illustrate the dynamic primitive flows for the NNI support of the APM-user information flow via a call with a bearer where no call control messages are sent coincidentally. That is, the APM ASE initiates a primitive towards the ISUP ASE which in turn sends an APM message which will provide a mechanism for supporting the information flow.

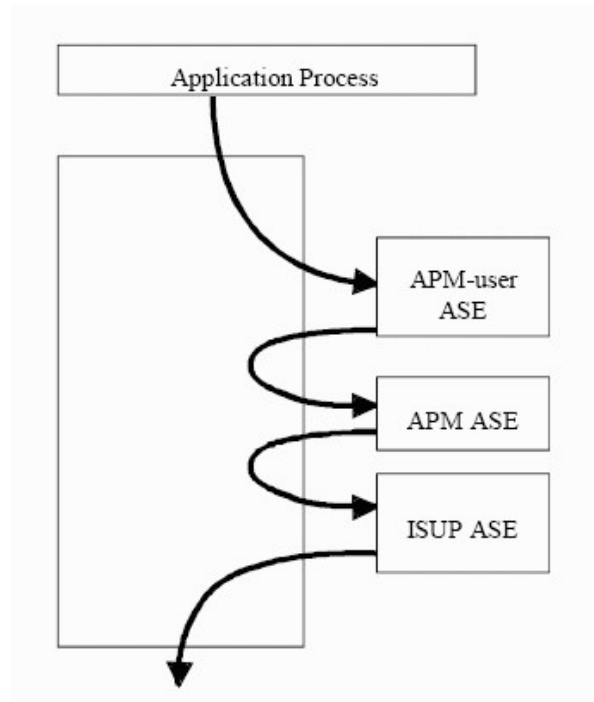


Figure 6.5 - Dynamic primitive flow with no concurrent call control message sent - ATIS-1000113.2015 – Chapter 7

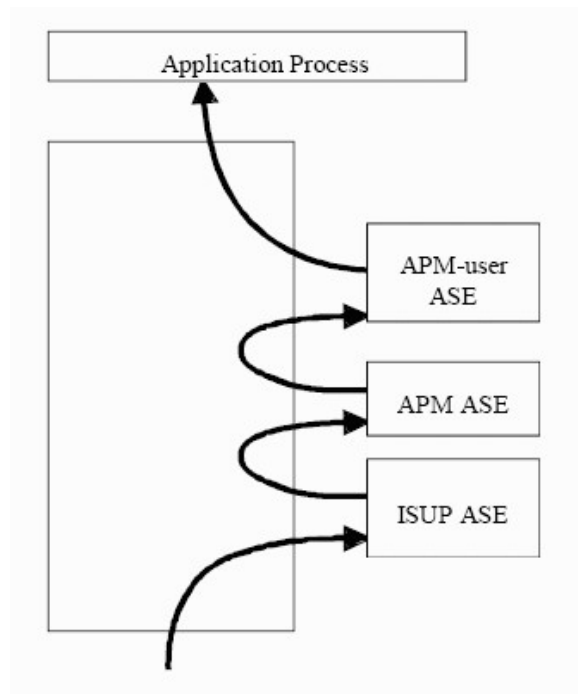


Figure 6.6 - Dynamic primitive flow with no concurrent call control message received - ATIS-1000113.2015 – Chapter 7

When the APM ASE and associated AP logic must communicate, primitives are passed between them. Figure 6.7 of ATIS-1000113.2015 – Chapter 7 illustrates the case when the AP requests a service directly from the APM ASE. Figure 6.8 of ATIS-1000113.2015 – Chapter 7 illustrates an indication being sent directly from the APM ASE to the AP.

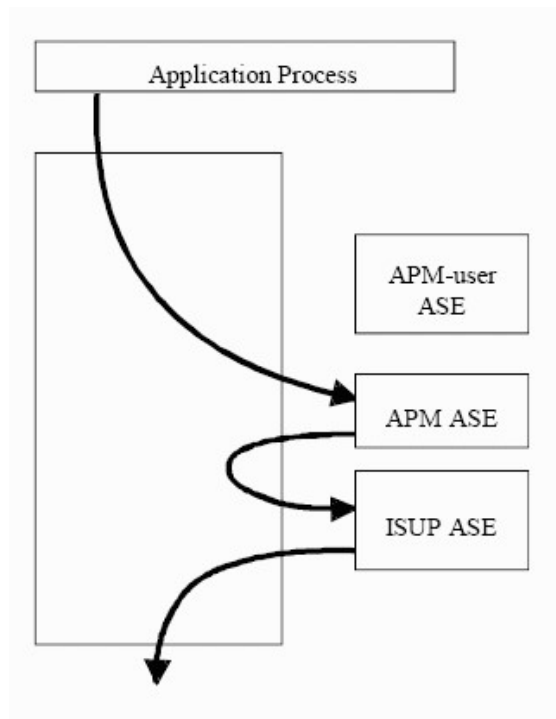


Figure 6.7 - AP requests service from APM ASE - ATIS-1000113.2015 – Chapter 7

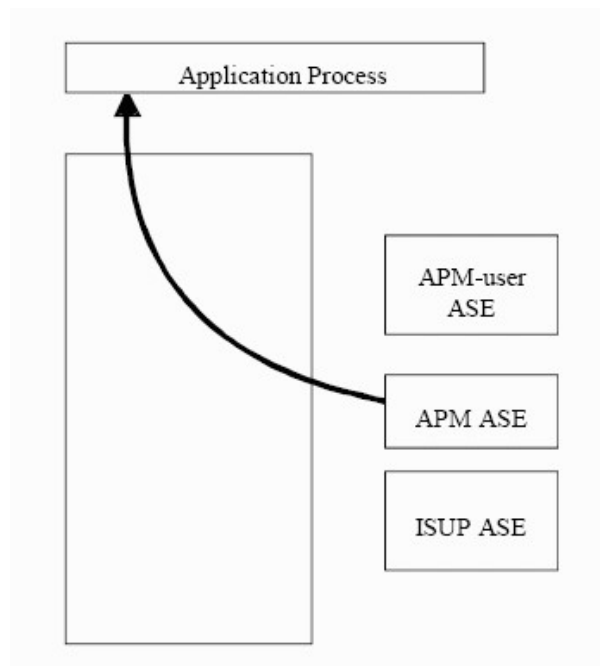


Figure 6.8 - APM ASE sends indication direct to AP- ATIS-1000113.2015 – Chapter 7

7 Application Process Functions

7.1 General

The modeling of the Application Process (AP) is outside the scope of this Standard, however, in order to appreciate the role of the AP for the purposes of this chapter it can be considered to consist of three different functional groups that are relevant to the support of an application over the NNI. These are the APM-user application processes (out of the scope of this Standard), the network ISUP basic call functionality, where the application process and protocol control functions are defined together in the monolithic specifications of the ISUP (see ATIS-1000113.2015 – Chapter 4), and the APM specific application process logic which is defined in this chapter.

It is the responsibility of the APM-user aspect of the application process to coordinate between the APM-user application process and the ISUP basic call application process functionality. It must ensure that the basic call states are aligned between the ISUP basic call and the APM-user application processes.

When the APM-user application requires the establishment of an AIN/AAN signaling association and the related ISUP call already exists, then the application makes use of the APM services in conjunction with the existing call. When no call already exists, it passes the routing information to the application process such that it can route the call from the Application Initiating Exchange (AIN) to the appropriate node in the network, Application Addressed Node (AAN), which contains the adjacent APM-user functionality. The AIN/AAN concept is described in clause 6.1. Details of the ISUP basic call routing information requirements can be found in ATIS-1000113.2015 – Chapter 4.

The definition of the primitive interface (interface (a) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) between the AP and the SACF for both the specific ISUP basic call primitives and those of the APM-user application are outside the scope of this Standard.

7.2 APM Application Process (AP) Functions

7.2.1 Introduction

The following functions are fulfilled by the APM application process:

1) Transit node operation.

The network may contain a number of intermediate exchanges between the AIN and the AAN. Some or all of these exchanges may support the APM however they are not the addressed node (AAN) for the application using the APM. In this case these nodes must pass the APM information transparently with the behavior of an intermediate exchange.

2) Support of APM signaling association acknowledgement mechanism (sent from the AAN in conjunction with the APM segmentation/reassembly procedures).

When sending information in subsequent messages after an IAM but before the reception of a first backwards message, there is no guarantee that the information will successfully arrive at its destination. Since APM-user applications may wish to send a greater amount of information during the establishment phase than can be carried in an ISUP IAM message, it is necessary to send the information in subsequent messages. To ensure the reliable delivery of this information the application process located at the AAN initiates the sending of an appropriate first backwards message (such as, an ACM with "no indication" or APM) towards the AIN on reception of an IAM indicating segmentation of APM information has occurred. This provides an acknowledgement to the IAM, thereby confirming the establishment of a signaling association.

NOTE - In the case that such an acknowledgement for an APM signaling association initiated by the AIN at call set-up has not yet been received before reception of either:

- An ACM indicating 'subscriber free', or
- A CPG indicating 'alerting', or
- An ANM;

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without the appropriate acknowledgement then if the application association for the call was essential, the call shall be released and the maintenance function shall be notified.

3) The coordination of segmented APM-user information with ISUP call control messages.

When application data is segmented by the APM the result is that the information is sent over the ISUP via a number of messages. It is therefore the responsibility of the APM to ensure that the information is reassembled correctly and that the application data is associated with the correct call control message, where applicable. This is achieved by the APM ASE informing the AP that the complete information has not been made available to the AP (i.e., reassembly procedure under way). Similarly the AP is informed once the complete information has been passed to it, thus allowing it to complete its processing. It is the responsibility of the AP to coordinate all the application processes related to the call.

In the case of the receipt of segmented application data relating to a Release message, the application data segments start with a Pre-release Information message, and the End_APP_Info indication primitive indicates to the application process that all the application information relating to the yet to be received Release message has been received.

4) The handling of instructions received from the SACF resulting from the handling of Application Transport Instruction Indicators.

The Application Transport Instruction Indicator (ATII) mechanism allows for an APM-user application to instruct a receiving node how to respond to error cases, for example it may wish to release the call in the case that the application is not supported at the AAN. This instruction is fulfilled when the AP receives the UCEH_Release indication primitive.

5) Use of Pre-release Information message.

This capability allows information to be transported at Release in a manner which is compatible with the 1992 and subsequent versions of the ISUP protocol. Any APM-user application requiring the transport of application data in the release phase of a call must make use of the pre-release mechanism (PRI message) described in Annex C.

7.2.2 Primitive Interface (AP - SACF)

The primitives in Table 7.1 of ATIS-1000113.2015 – Chapter 7 have been introduced by the functionality specified in this chapter. All other primitives at this interface (ISUP basic call or APM-user application) are outside the scope of this Standard.

Table 7.1 - Primitives between AP and SACF - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (NOTE)
APM_Transit	Indication/Request	→ / ←
APM_Acknowledgement	Request	←
More_APP_Info	Indication	→
End_APP_Info	Indication	→
UCEH_Release	Indication	→

NOTE - Primitive flow from SACF to AP - →
 Primitive flow from AP to SACF - ←

7.2.3 Procedures

This clause describes the additional procedures required in the application process for the support of the APM.

7.2.3.1 Transit Node

On receipt of an APM_Transit Indication primitive, the contents are passed transparently through the transit exchange and sent to SACF in the APM_Transit Request primitive.

7.2.3.2 Application Initiating Node (AIN)

7.2.3.2.1 APM Signaling Association Acknowledgement Mechanism

No specific procedures for the AIN.

7.2.3.2.2 Segmentation Coordination

The coordination of segmentation must be performed by the receiving node. To achieve this coordination, the AP must not complete the processing of information received (basic call control primitive) in conjunction with the reception of the More_APP_Info indication primitive.

On reception of the End_APP_Info indication primitive the AP may complete the processing of the received information.

7.2.3.3 Application Addressed Node (AAN)

7.2.3.3.1 APM Signaling Association Acknowledgement Mechanism

The reception of the More_APP_Info primitive indicates that APP segmentation/reassembly procedures are underway. If the More_APP_Info indication primitive is received in conjunction with the receipt of an IAM the signaling association must be acknowledged by sending the primitive corresponding to the appropriate first backwards message (e.g., ACM "no indication", CPG or APM) together with the APM_Acknowledgement request primitive to SACF.

7.2.3.3.2 Segmentation Coordination

See Clause 7.2.3.2.2.

7.2.3.3.3 UCEH_Release Indication

On reception of the UCEH_Release indication primitive, a release procedure is initiated with cause dependent on the received Reason parameter value as shown below:

Unidentified context/Addressing Error	79	Service or option not implemented, unspecified
Reassembly error	111	The release of an ISUP basic call is described in ATIS-1000113.2015 – Chapter 4

7.2.4 Primitive Contents

Table 7.2 of ATIS-1000113.2015 – Chapter 7 describes the contents of the primitives passed across interface (a).

The More_APP_Info indication primitive, the APM_Acknowledgement request primitive and the End_APP_Info indication primitives are empty.

Table 7.2 - Contents of the UCEH_Release Ind primitive- ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Reason	M

Table 7.3 - Contents of the APM_Transit Ind/Req primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Transit_Data	M

8 Single Association Control Function (SACF) - SACF

8.1 Introduction

The main objective of SACF is to receive/deliver primitives from/to the appropriate entity and to perform a distribution function where appropriate. The flow of information is from the AP (interface (a) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) towards NI (interface (f) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) or vice versa, therefore the SACF is also responsible to ensure that when multiple primitives are generated by the ASEs towards the AP, that they are delivered across the interface together to ensure the correct associations are maintained. The SACF described here only defines the mapping and functions related to the Application Transport Mechanism. The SACF functionality related specifically to the public basic call functionality or the APM-user application functionality is outside the scope of this American National Standard.

The interfaces referenced herein are illustrated in Clause 6.2, Figure 6.2 of ATIS-1000113.2015 – Chapter 7. Clause 6.2.3 also provides examples of the "Dynamic primitive flows".

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The primitives on the interface between the AP and SACF, interface (a), that are not specifically for the definition of the APM (i.e., ISUP basic call and APM user applications are outside the scope of this standard).

The application specific primitives on the interface between SACF and APM-user ASE, interface (b) are outside the scope of this Standard.

The primitives used on the interface between SACF and EH ASE, interface (c) are defined in Clause 13.3.

The parameters in these primitives are listed in Tables 13.3 to 13.5 of ATIS-1000113.2015 – Chapter 7.

The primitives used on the interface between SACF and APM ASE, interface (d) are defined in Clause 10.1.

The parameters in these primitives are listed in Table 10.3 of ATIS-1000113.2015 – Chapter 7.

The primitives related to ISUP basic call on the interface between SACF and ISUP ASE, interface (e) are outside the scope of this standard. Primitives associated with the APM's use of the ISUP ASE's services are defined in Clause 9.1. Their associated contents are defined in Clause 9.3.

8.2 Information Flows Related to Messages Sent By the Node

On receipt of a primitive (request or response) from the application process (AP), via interface (a) the SACF issues appropriate primitive(s) to the ASEs, populating the parameters in the generated primitives from the appropriate subset of the parameters received from the AP. The SACF also performs a distribution function of the responding primitives received from the ASEs prior to sending the resulting primitive to NI via interface (f).

The APM-user ASE will send application data to the APM ASE, via SACF, using an APM_U_Data request primitive via interface (b). Note that a number of APM-user ASEs may generate the APM_U_Data primitive. A parameter received by the APM ASE within the APM-Data primitive is identifiable through its unique relationship with an application context, and hence the appropriate APM-user ASE. Other APM related primitives on interface (b) are defined in clause 11.1. Their associated contents are defined in clause 11.3. Each APM_U_Data primitive sent by one APM-user ASE shall be handled independently from the APM_U_Data primitives generated by other APM-user ASEs or even the same APM-user ASE.

Table 8.1 to Table 8.5 of ATIS-1000113.2015 – Chapter 7 show the mapping of primitives performed by the SACF.

Table 8.1 - Mapping from APM-user ASE to APM ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (b), APM-user ASE	Interface (d), APM ASE
APM_U_Data	APM_Data

Table 8.2 - Mapping from EH ASE to APM ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (c), EH ASE	Interface (d), APM ASE
APM_U_Data	APM_Data
Send_APM_Transit	Send_APM_Transit

Table 8.3 - Mapping from APM ASE to ISUP ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (d), APM ASE	Interface (e), ISUP ASE
APM_Transfer	APM_Transfer

Table 8.4 - Mapping from AP to APM ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (a), AP ASE	Interface (d), APM ASE
APM_Acknowledgement	APM_Acknowledgement
APM_Transit	APM_Transit

Table 8.5 - Mapping from ISUP ASE to NI primitives - ATIS-1000113.2015 – Chapter 7

Interface (e), ISUP ASE	Interface (f), NI
Transfer	Transfer

8.3 Information Flows Related To Messages Received By the Node

On receipt of a Transfer Indication primitive (see Table 11.4 of ATIS-1000113.2015 – Chapter 7) from the NI, the SACF distributes the contents of the primitive to the ISUP ASE. In the case that an Application Transport Parameter (APP) is present, the ISUP ASE will then pass it to the APM ASE via the APM_Transfer indication primitive (see Table 10.1 of ATIS-1000113.2015 – Chapter 7). More than one APP may be present in the ISUP message; hence multiple APP's may be passed to the APM ASE. When the APM ASE is ready to pass the received information to the APM-user ASE, then it sends the APM_Data indication primitive to SACF. The SACF will distribute the primitive(s) to the appropriate APM-user ASE(s) in the APM_U_Data indication primitive according to the context identifier value which is used to uniquely identify the APM-users.

Table 8.6 to Table 8.10 of ATIS-1000113.2015 – Chapter 7 show the mapping of primitives performed by the SACF. For received messages, the mapping of APM_U_Data and APM_Transfer (Tables 8.1, 8.2, and 8.3 of ATIS-1000113.2015 – Chapter 7) primitives is the reverse to that described in the tables for messages sent by the node in Clause 8.2.

Table 8.6 - Mapping from EH ASE to APM-user ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (c), EH ASE	Interface (b), APM-user ASE
APM_Error	APM_U_Error

Table 8.7 - Mapping from EH ASE to AP primitives - ATIS-1000113.2015 – Chapter 7

Interface (c), EH ASE	Interface (a), AP
UCEH_Release	UCEH_Release

Table 8.8 - Mapping from APM ASE to AP primitives - ATIS-1000113.2015 – Chapter 7

Interface (d), APM ASE	Interface (a), AP
APM_Transit	APM_Transit
More_APP_Info	More_APP_Info
End_APP_Info	End_APP_Info

Table 8.9 - Mapping from APM ASE to EH ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (d), APM ASE	Interface (c), EH ASE
APM_UCEH_Error	APM_UCEH_Error

Table 8.10 - Mapping from NI to ISUP ASE primitives - ATIS-1000113.2015 – Chapter 7

Interface (f), NI	Interface (e), ISUP ASE
Transfer	Transfer

9 ISDN User Part ASE (ISUP ASE)

The ISUP ASE is defined in ATIS-1000113.2015 – Chapter 4. Its main responsibilities are basic call procedures and the handling of protocol errors and unrecognized information handling. The monolithic nature of this Standard means that both ISUP Call Control and Protocol Control functionality are defined together. It is not the intention of this chapter to redefine ISUP basic call in ALS format; therefore they are referenced en-bloc as the ISUP ASE. Conceptually, this should be considered to represent a logical division between the protocol control functionality within the ISUP ASE and its associated call control functionality within the application process. The modeling and interfaces with respect to this are outside the scope of this Standard.

9.1 Primitive Interface

The SACF uses the services provided by the ISUP ASE primitive interface (interface (e) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) as listed in Table 9.1 of ATIS-1000113.2015 – Chapter 7.

Table 9.1 - Primitives between ISUP ASE and SACF - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
APM_Transfer	Indication/Request	→ / ←

NOTE - Primitive flow from SACF to ISUP ASE - ←
 Primitive flow from ISUP ASE to SACF - →

ISUP ASE uses the SACF service primitives: Transfer request/indication.

It is also a receiver of the indications: Remote_Status, Destination_Available, Destination_Unavailable.

9.2 Procedures

The procedures of the ISUP ASE are defined in ATIS-1000113.2015 – Chapter 4. With respect to the Application Transport mechanism, on reception of APM_Transfer request primitive(s), it is the responsibility of the ISUP ASE to include the APP(s) within a suitable call control message, when available, or alternatively to generate an Application Transport Message (APM; see ATIS-1000113.2015 – Chapter 3). Similarly it must handle the reception of the APP parameter(s) and the transfer of the received data in the APM_Transfer indication primitive(s). The APM message can only be sent/received on a non-idle circuit and does not cause a state change. In the case that a message contains more than one APP, then the ATII settings for each APP will be set according to the needs of each APM-user application. A guide to the use of the ATII is contained in Annex B of ATIS-1000113.2015 – Chapter 7.

9.3 Primitive Contents

Table 9.2 - Contents of the APM_Transfer Ind/Req primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional	Reference
Application Transport (APP)	M	(See ATIS-1000113.2015 – Chapter 3)

10 Application Transport Mechanism ASE (APM ASE)

The APM ASE specifies the extensions to ISUP in order to provide the underlying services to the APM-user ASE(s) and support the application's (APM-user's) information flows. The APM ASE is responsible for the signaling procedures and the parameters specific to the Application Transport mechanism.

The APM ASE provides a segmentation mechanism to the APM-user(s) such that the ISUP message length limitation does not restrict the APM-user information flows. The maximum supported size of APM-user information is 2048 octets in length, due to Application Information field length limitations (see Clause 10.2.4.1). The APM ASE may serve many APM-users which are differentiated by their Context Identifiers.

10.1 Primitive Interface

The ISUP SACF uses the services provided by the APM ASE primitive interface (interface (d) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) as listed in Table 10.1 of ATIS-1000113.2015 – Chapter 7.

Table 10.1 - Primitives between APM ASE and ISUP SACF - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
More_APP_Info	Indication	→
End_APP_Info	Indication	→
APM_Transit	Indication / Request	→ / ←
APM_Acknowledgement	Request	←
APM_UCEH_Error	Indication	→
APM_Data	Indication/Request	→ / ←
Send_APM_Transit	Request	→

NOTE - Primitive flow from APM ASE to SACF - →
 Primitive flow from SACF to APM ASE - ←

The APM ASE uses the services provided by the ISUP SACF primitive interface (interface (d) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) as listed in Table 10.2 of ATIS-1000113.2015 – Chapter 7.

Table 10.2 - Primitives between ISUP SACF and APM ASE - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
APM_Transfer	Indication/Request	→ / ←

NOTE - Primitive flow from SACF to APM ASE - →
Primitive flow from APM ASE to SACF - ←

10.2 Procedures

10.2.1 Normal Procedures - Sending

On receipt of an APM_Data request primitive, the APM ASE constructs the Application Transport Parameter (APP) according to the definition in ATIS-1000113.2015 – Chapter 3. The context identifier is set based on the APM-user. The Application Transport Instruction indicators are supplied by the APM-user.

For APM-user applications using explicit addressing, the APM-user shall supply the address of the AAN and should supply the address of the AIN.

NOTE – If the address of the AIN is not supplied in the case of explicit addressing, then the AAN may be unable to address error notifications or other application information towards the AIN. Problems are also likely to arise with the segmentation and reassembly procedures.

If no originating (destination) address is supplied by the AMP-user, then the originating (destination) address field in the APP parameter will be of zero length. When provided by the APM-user, the originating and destination addresses shall uniquely identify the AIN and AAN respectively.

The APM Segmentation indicator is set to zero (0), the Sequence Indicator field is coded "new sequence" and the Segmentation Local Reference is absent, unless segmentation procedures apply (see Clause 10.2.4). APM segmentation procedures shall only apply if it is not possible to transfer all parameters in the IAM, ACM, ANM, or PRI message and SGM, if simple segmentation procedures are used, because the 272 octet MTP limit would be exceeded.

NOTE – The threshold for the initiation of the APM segmentation procedure may alternatively depend on network characteristics. The value of this threshold may vary per traffic relation depending on the typical network configuration and interconnection arrangements. Based on the set of services supported (e.g., ISDN end-to-end information, Call Diversion, User-to_user, etc.) and the set of APM applications, e.g., BICC, the exchange performing the segmentation is able to calculate the maximum length of the first segment to leave enough space in a message for use by any subsequent exchange. This maximum length may vary per traffic relation depending on the typical network configuration and interconnection arrangements.

The Application Data received from the APM-user is encapsulated and the whole APP is transferred in the APM_Transfer request primitive.

On receipt of an APM_Transit request primitive the APM ASE transfers the received information transparently in an APM_Transfer request primitive.

10.2.2 Normal Procedures - Receiving

On receipt of an APM_Transfer indication primitive, the subsequent action depends on the Application Context Identifier associated to the received APP.

10.2.2.1 Reception of the APM_Transfer Primitive

On receipt of an APM_Transfer indication, the APM ASE checks whether this is a "pass-on" node for this context. If so, the APP parameter is passed on unchanged within an APM_Transit indication primitive. A pass-on node does not verify the contents of the Transit_Data parameter.

If not, the action depends on whether the context in question is supported at this node:

If the context is supported:

- If the node addressed by the destination address field contained in the APP (in case of explicit addressing), or if no destination address field is contained in the APP, the APM ASE checks whether it is expecting for the received context an acknowledgement to an initial segment sent at call setup according to the segmentation procedure of Clause 10.2.4:
 - If so, the segmentation procedures apply.
 - If the APM ASE is not expecting such an acknowledgement, the parameter is checked to see if segmentation has occurred. If so the segmentation reassembly procedure applies (see Clause 10.2.4) and the completely reassembled Application Information is sent in the APM_Data indication primitive.
- If the node is not addressed by the destination address field contained in the APP parameter in case of explicit addressing then:
 - If the node is not an APM end node, the APP parameter is passed on unchanged within an APM_Transit indication primitive.
 - If the node is an APM end node, then an APM_UCEH_Error indication primitive is sent. The Originating Address, the Application Context and the Application Transport Instruction Indicators are set as received in the APM_Transfer primitive, the Reason is set to "Unidentified Context/Addressing Error".

If the context is not supported:

- If the node is not an APM end node, then the APM ASE notes that this node is a "pass-on" node for this context and transfers the APP parameter unchanged in an APM_Transit indication primitive.
- If the node is an APM end node, then if this is the first or only segment of a sequence, an APM_UCEH_Error indication primitive is sent. The Originating Address (if received), the Application Context and Application Transport Instruction Indicators are set as received in the APM_Transfer primitive and the Reason is set to "Unidentified Context/Addressing Error". If the parameter had been segmented the APM ASE notes that the reassembly procedure for this sequence has been abandoned. Subsequent segments in this case are discarded.

10.2.2.2 Reception of the Send_APM_Transit Primitive

On receipt of the Send_APM_Transit primitive, the contents shall be passed unchanged in the APM_Transit primitive.

10.2.3 Sending of Acknowledgement

On receipt of an APM_Acknowledgement request primitive, an APP will be constructed for each sequence currently under reassembly.

NOTE – The ATII will be set to "release call" and "do not send notification" and the Application Information field shall be empty.

The originating address field and the destination address field will contain the destination address and the originating address respectively, received in the segments currently under reassembly. The address fields will be of zero length if no addresses are contained in the segments currently under reassembly.

This APP will then be sent in an APM_Transfer request primitive.

NOTE – One acknowledgement only is sent for sequences associated with the same application context identifier, originating address and destination address.

10.2.4 Segmentation

Segmentation procedures may be separately and simultaneously applied to multiple application data fields generated by one or several APM-user applications. The procedures in Clause 10.2.4.1 describe the handling of segmentation and reassembly for application information sent in one APM_Data_request primitive. It should be noted that when multiple APM-users are utilizing the services of the APM for a single call, that the procedures may be applied concurrently and independently with respect to each APM-user and that each application data field sent by one APM-user shall be handled independently from any other application data field generated by the same or any other APM-user.

The initial segment of each sequence must be transported in the first message and this initial segment size may be of zero length. In case that segmentation is applied on different application data fields simultaneously it must start in the same message. The first message may be an IAM, ACM, CPG, ANM, or PRI message (when available) and this procedure ensures that the reassembling node is able to associate the APM information with the first ISUP message. A maximum of one such message can be associated with the transport of segmented application data. Any additional segments will be included in the APP within subsequent APM message(s). In order to associate all the reassembled application data with the first ISUP message the AP is informed when reassembly procedures are invoked by sending the More_APP_Info indication primitive. On completion of reassembly for all sequences for which initial segments were received in the first message, the End_APP_Info indication primitive is sent.

NOTE – In the case of the first message being a PRI message, the End_APP_Info indication primitive indicates to the AP that all the APP information relating to the subsequent REL message has been received.

There would be a possibility that user information segments could be lost when sent forward during call setup if sent before the receipt of a first backwards message. To avoid this situation occurring, the AIN shall not send subsequent segments to an IAM message until a backward message is received containing an empty APP implicitly indicating that a path has been successfully routed through the network to the AAN. The AAN initiates the backwards acknowledgement indication only in the case that an IAM is received containing an APP which indicates that segmentation has occurred.

For segmented application data associated with an ACM, CPG, ANM or PRI message, this message shall be sent first, followed by the SGM message (when ISUP Simple segmentation applies to remaining information in the ISUP message), and then followed by the APM messages containing subsequent segments. In case a PRI message is sent, the REL message shall be sent following the APM message containing the last segment.

10.2.4.1 Procedures for Segmentation

The following rules apply when Application Information in an APM_Data request primitive has to be segmented:

- a) The maximum number of segments is 10 (one initial, possibly empty, segment plus up to 9 segments). The maximum size of Application Information that can be supported is 2048 octets. If the Application Information is too long to be segmented, then the local maintenance function shall be notified, and the APM_Data request primitive is discarded.
- b) The Encapsulated Application Information field in the first segment shall begin with the first octet of the application Information and sequentially fill the Encapsulated Application Information field. (Alternatively the first segment may contain zero octets of Application Information, and the second segment is filled as described.) The Sequence Indicator field will be set to indicate "new sequence", the APM segmentation indicator field will indicate the number of segments that remain to be sent and a Segmentation Local Reference value included that is unique to the call.
- c) The encapsulated information field in each subsequent segment shall begin with the first octet following the last octet transmitted in the previous segment, thus continuing segmentation until no further encapsulated application data octets remain. The Sequence indicator field shall indicate "subsequent segment to first segment" and the APM segmentation indicator field shall be decremented to indicate the number of segments that remain to be sent and the Segmentation Local Reference shall have the same values as sent in the first segment.

- d) Once the first segment has been transmitted, then all remaining segments of that Application Information shall be sent except in the case that the first segment is sent in an IAM in which case the reception of an empty APP is awaited prior to the sending of subsequent segments. This acknowledgement must originate from the AAN for the segmentation sequence.
- e) Only failure conditions shall cause the transmission of a segmented message to be aborted. In this case the maintenance function is to be notified.
- f) The ATII, the originating address and the destination address should be set as provided by the APM-user in the APM-Data request primitive for the first and all subsequent segments.

NOTE – The address fields will be of zero length if they are not provided by the APM-user.

10.2.4.2 Procedures for Reassembly

Reassembly procedures may be simultaneously applied to multiple sequences related to the same or different contexts. Each sequence characterized by its Application Context Identifier, its originating address (possibly absent) and its Segmentation Local Reference is handled by one reassembly function. Each segment is therefore directed towards a specific reassembly function according to the Application Context Identifier, the originating address and the Segmentation Local reference it contains.

The following rules apply to the receipt and reassembly of segmented Application Information:

- a) A reassembly function, on receiving an APM_Transfer indication primitive containing an APP with the Sequence indicator field indicating "new sequence" and the APM segmentation indicator field set to a value greater than zero (0), and not exceeding nine(9), shall treat that Encapsulated Application Information as a valid first segment and save the segment contents, the Application Context Identifier, the originating address (if received – see 10.2.1) and the received Segmentation Local Reference value. (The first segment may have zero octets of Encapsulated Application Information.) Timer T_{reass} shall be started on receipt of a valid first segment.
- b) A reassembly function, on receiving a subsequent segment with the Sequence Indicator field indicating "subsequent segment to first segment" and the APM segmentation indicator field set to a value one less than the value in the previously received segment, the same Application Context Identifier, the same originating address (if received – see 10.2.1) and the same Segmentation Local Reference value as received in the first segment shall treat the segment as a valid next segment.
- c) A reassembly function, on receiving a valid next segment in which the APM segmentation indicator field has a value greater than zero, shall save the segment contents along with the saved contents of the previous segment or segments. If the segment contents would cause the new saved contents to exceed the Application Information field limit of 2048 octets, the reassembly function shall discard all segments received for the current sequence and send the APM_UCEH_Error indication primitive indicating "reassembly error".
- d) A reassembly function, on receiving a valid next segment in which the APM segmentation indicator field has a value equal to zero, final segment, shall deliver the accumulated segments, including the last segment, as the complete Application Information to the APM-user with the APM_Data indication primitive. Timer T_{reass} shall be stopped on receipt of the final segment of the sequence.
- e) A reassembly function, in which no reassembly process is active, shall discard any received segment which is not a valid first segment and send the APM_UCEH_Error Indication primitive indicating "reassembly error".

This applies to:

- Segments with a Sequence Indicator coded "Subsequent segment to first segment".
 - Segments in which the APM segmentation indicator field has a value exceeding 9.
- f) A reassembly function shall discard the received and any saved segments on receipt of any subsequent segment which is not a valid next segment and send the APM_UCEH_Error Indication primitive indicating "reassembly error" for both reassembly sequences.

This applies to segments with a segmentation indicator field value that is not decremented from the value of the previous segment.

- g) A reassembly function shall discard any saved segments on receipt of any subsequent segment which is not a valid next segment and send the APM_UCEH_Error Indication primitive indicating "reassembly error".

This applies to segments with a Sequence Indicator coded "New sequence".

- h) On expiry of timer T_{reass} , the reassembly function shall discard all segments received for the current sequence and send the APM_UCEH_Error indication primitive indicating "reassembly error".
- i) In the case that an APM_UCEH_Error indication primitive indicating "reassembly error" is sent, the ATII settings shall reflect those applicable to the sequence undergoing the reassembly procedure.

10.3 Primitive Contents

The following primitives are already defined elsewhere:

APM_Transfer primitive is defined in Table 9.2 - ATIS-1000113.2015 – Chapter 7.

More_APP_Info primitive is defined in Clause 7.2.4.

End_APP_Info primitive is defined in Clause 2.4.

APM_Acknowledgement primitive is defined in Clause 7.2.4.

APM_Transit primitive is defined in Table 7.3 of ATIS-1000113.2015 – Chapter 7.

APM_UCEH_Error primitive is defined in Table 13.4 of ATIS-1000113.2015 – Chapter 7.

Send_APM_Transit primitive is defined in Table 13.5 of ATIS-1000113.2015 – Chapter 7.

Table 10.3 of ATIS-1000113.2015 – Chapter 7 defines the primitive used across the SACF/APM ASE interface (d).

Table 10.3 - Contents of the APM_Data Ind/Req primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Application Context Identifier	M
Application Transport Instruction Indicators	M
Originating Address	O
Destination Address	O
Application Information	M

11 Application Transport Mechanism User ASE (APM-user ASE)

The APM-user ASE is responsible for the detailed protocol control signaling aspects specific to the application it represents. The definition of the application is outside the scope of this Standard. The APM-user ASE utilizes a specific interface towards SACF in order to access the services of the APM ASE.

An APM-user is uniquely identified by the SACF through its "context identifier value". This represents the application that it supports and defines the "context" in which this APM-user operates.

11.1 Primitive Interface

The SACF/APM-user ASE interface (interface (b) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7), is application specific and therefore outside the scope of this Standard, except for the primitive interface part used to access the services of the APM ASE. The Application Transport mechanism specific primitives are listed in Table 11.1 of ATIS-1000113.2015 – Chapter 7.

Table 11.1 - Primitives between APM-user ASE and SACF - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
APM_U_Data	Indication/Request	→ / ←
APM_U_Error	Indication	→

NOTE - Primitive flow from SACF to APM-user - →
 Primitive flow from APM-user to SACF - ←

APM-user ASE may be a receiver of the SACF service primitive indications: Remote_Status, Destination_Available, Destination_Unavailable dependant on the needs of the given application.

Multiple APM_U_Data request primitives may be sent from the APM-user ASE to the SACF. The procedures are applied concurrently and independently with respect to each primitive.

11.2 Procedures

11.2.1 General

The procedures for the APM-user ASE are application specific and therefore outside the scope of this Standard.

11.2.2 Signaling Congestion

In order to avoid congestion in the SS7 signaling network, it is necessary that applications that contribute signaling load towards a congested destination limit their signaling traffic in a controlled manner. As the AP makes use of the ISUP ASE, the ISDN User Part signaling congestion control procedure (see ATIS-1000113.2015 – Chapter 4) may reduce traffic towards an affected destination. As such new call attempts may temporarily be rejected.

Since this mechanism does not restrict the signaling load being generated by already established calls, APM-users should consider the inclusion of procedures to restrict the application's request for generating signaling load. For this purpose the APM-user ASE would subscribe to the "Remote_Status" primitive.

11.2.3 Handling of Unrecognized Signaling Information

APM-users should consider the inclusion of procedures for the handling of unrecognized signaling information carried in the Encapsulated Application Information field of the Application Transport parameter (APP).

11.3 Primitive Contents

Table 11.2 - Contents of the APM_U_Data Ind/Req primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Application Context Identifier	M
Application Transport Instruction Indicators	M
Originating Address	O
Destination Address	O
Application Data	M

Table 11.3 - Contents of the APM_U_Error Ind primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Notification	M

12 Network Interface function

12.1 Introduction

The Network Interface (NI) function is the part of ISUP that provides a transport interface for instances of the ISUP AEI. The MTP-3 Service Primitive interface is a single interface within an exchange, but multiple instances of signaling associations exist within one exchange. NI associates the signaling instance representation (session layer, see ITU-T Recommendation Q.1400) of the external interface to the internal instances. NI also represents the presentation layer (see ITU-T Recommendation Q.1400) for ISUP.

12.2 Primitive Interfaces

12.2.1 MTP Interface

The interface (interface (g) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) to the MTP-3 is the Service Primitive interface defined in ATIS-1000113.2015 – Chapter 1.

12.2.2 AEI Interface

The primitives listed in Table 12.1 of ATIS-1000113.2015 – Chapter 7 are present on the interface between the NI and the SACF in the ISUP AE (interface (f) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7).

Table 12.1 - Primitive between NI and SACF - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
Transfer	Request/Indication	→ / ←
Remote_Status	Indication	←
Destination_Unavailable	Indication	←
Destination_Available	Indication	←

NOTE - Primitive flow from SACF to NI - →
 Primitive flow from NI to SACF - ←

12.3 Procedures

12.3.1 Formats & Codes

The NI performs the presentation layer (see ITU-T Recommendation Q.1400) function for the ISUP. The details of ISUP formats and codes can be found in ATIS-1000113.2015 – Chapter 3.

MTP_Transfer indication primitives received from the MTP, (interface (g) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) are decoded according to the formatting rules defined in ATIS-1000113.2015 – Chapter 3 and procedures defined in ATIS-1000113.2015 – Chapter 4.

12.3.2 Distribution

MTP_Transfer indication primitives received from the MTP are distributed to AEIs. Before this distribution can be performed, the circuit to which the incoming message is addressed must be tied to an AEI. Through the use of the CIC, NI, OPC and DPC values of the circuit, AEI identity mapping is performed according to the following rules:

- If the circuit value corresponds to an existing ISUP AEI the message is distributed to that AEI.
- If the circuit value does not correspond to an existing ISUP AEI, a new instance of ISUP AEI is created.

When a Transfer request primitive is received from an ISUP AEI it is mapped into a MTP_Transfer request primitive. The AEI identity to which the message is associated is used to identify the CIC, NI, OPC and DPC values to use when sending the message. The SIO and SLS fields are completed as specified in ATIS-1000113.2015 – Chapter 3.

12.3.3 Primitive Mapping

Tables 12.2 and 12.3 of ATIS-1000113.2015 – Chapter 7 show the primitive mapping performed by the NI.

Table 12.2 - NI primitive mappings from MTP to SACF - ATIS-1000113.2015 – Chapter 7

Interface (g) from MTP	Interface (f) to SACF
MTP_Transfer indication	Transfer Indication
MTP_Status indication	Remote_Status Indication
MTP_Pause indication	Destination_Unavailable Indication
MTP_Resume indication	Destination_Available Indication

Table 12.3 - NI primitive mappings from SACF to MTP - ATIS-1000113.2015 – Chapter 7

Interface (f) from SACF	Interface (g) to MTP
Transfer request	MTP_Transfer request

13 Errors Handling ASE (EH ASE)

The EH ASE handles error cases such as unidentified context values, addressing errors and reassembly errors. The EH ASE takes action according to the ATII received together with the application information in the APP. Based on the Release Call Indicator, the call may be released or allowed to proceed. The Send Notification Indicator determines if a notification is sent. On reception of such a notification at the node which sent the original application information, the EH ASE is responsible for informing the appropriate APM-user application that the error has occurred (e.g., to notify the application located at the AIN that the desired context identifier value was not supported at the AAN). The EH ASE is a mandatory ASE in the AEI that supports the APM ASE.

13.1 Introduction of Unidentified Context & Addressing Errors Handling Mechanism

The unidentified context and Addressing Errors handling mechanism describes the cases when:

Application Information generated by an exchange (AIN), supporting an application identified by a specific context identifier, is received by an APM end node which has the APM capability but does not support the application indicated by the context identifier or which is not the node addressed by the Destination Address received in the APP parameter (in case of explicit addressing).

The unidentified context and addressing errors handling mechanism ensures these situations are handled according to the specific needs of the initiating application.

13.1.1 Unidentified Context & Addressing Errors Handling – Local Error Handling

1. When an exchange is the addressed node for an APP but does not support the specified context, or
2. When an APM end node receives an unidentified context identifier value or a destination address which is not its own,

The EH ASE takes action according to the ATII. Based on the Release Call Indicator, the call may be released or allowed to proceed. The Send Notification Indicator determines if a notification is sent back from these exchanges towards the AIN.

Figure 13.1 of ATIS-1000113.2015 – Chapter 7 illustrates the dynamic flow of information from the point where the APM ASE identifies that the APM-user is not supported or that the node is not addressed (in the case of explicit addressing). In the case that there is no APM-user supporting the context identifier of a received APP or that the node is not addressed by the Destination Address contained in the APP, then the APM ASE sends an APM_UCEH_Error indication primitive indicating the context identifier received and supplies the received Originating Address (if available) and ATII. This initiates the unidentified context and addressing errors handling procedures. These procedures can be seen as a user of the APM mechanism by the manner in which the notification is transported.

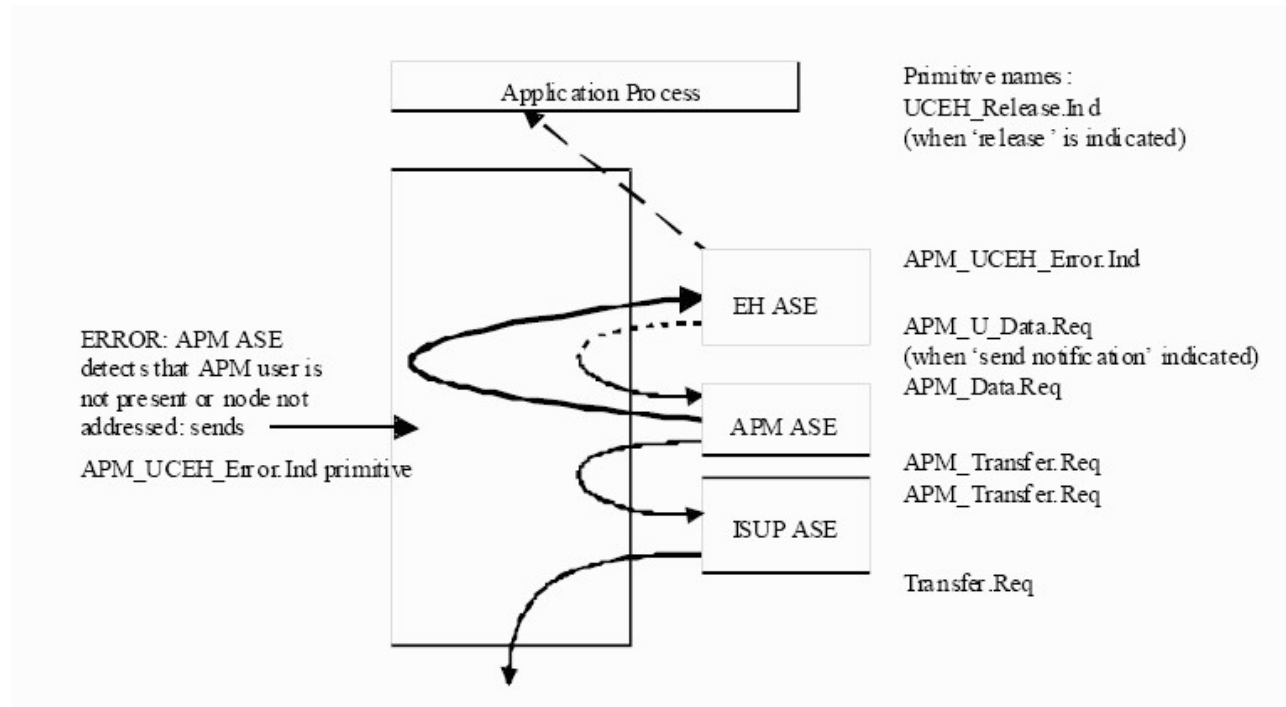


Figure 13.1 - Dynamic flow in exchange when an unidentified context or addressing error is detected - ATIS-1000113.2015 – Chapter 7

13.1.2 Unidentified Context & Addressing Errors Handling – Remote Error Handling

When an APP is received with Context Identifier "Unidentified Context and Error Handling ASE", the contents are passed to the EH ASE in the same manner as any other APM-user. The procedures described in Clauses 13.4.1 are then applied.

When an APP is received with Context Identifier "Enhanced Unidentified Context and Error Handling ASE", the procedures described in Clause 10.2.2.2 are applied. If the node is addressed by the destination address received in the APP, the contents are passed to the EH ASE and the procedures described in Clause 13.4.1 are then applied.

13.2 Reassembly Error Handling

When a reassembly error occurs in the APM ASE, the APM_UCEH_Error primitive is sent, via SACF, to the EH ASE indicating "reassembly error". The application context identifier and the originating address (if available) are supplied by the APM ASE. Actions taken by the EH ASE are according to the ATII. If a notification is to be sent, the reason given indicates "reassembly error". A reassembly error may occur for any segmented message in either an AIN or an AAN; therefore the procedures are equally applicable to both.

13.3 Primitive Interface

The SACF use the services provided by the EH ASE primitive interface (interface (c) in Figure 2 of ATIS-1000113.2015 – Chapter 7) as listed in Table 13.1 of ATIS-1000113.2015 – Chapter 7.

Table 13.1 - Primitives between EH ASE and SACF - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
APM_Error	Indication	→
UCEH_Release	Indication	→

NOTE - Primitive flow from EH ASE to SACF - →

The EH ASE use the services provided by the SACF primitive interface (interface (c) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7) as listed in Table 13.2 of ATIS-1000113.2015 – Chapter 7.

Table 13.2 - Primitives between SACF and EH ASE - ATIS-1000113.2015 – Chapter 7

Primitive name	Types	Direction (note)
APM_UCEH_Error	Indication	→
APM_U_Data	Indication/Request	→ / ←
Send_APM_Transit	Request	←

NOTE - Primitive flow from SACF to EH ASE - →
Primitive flow from EH ASE to SACF - ←

13.4 Procedures

13.4.1 Normal Procedures - Remote Error Handling

When the EH ASE receives an APM_U_Data indication primitive with Context Identifier “EUCEH ASE”, the ASE checks whether each context indicated in the “APM-user Context Identifier” field within the Application Transport Notification Information is supported by the node. If the APM-user indicated by the Context Identifier does not exist, then the associated Notification parameter within the Application Transport Notification Information will be discarded. For the received contexts which are supported by the node, the associated APM-users are notified: an APM_Error indication primitive is sent to each APM-user via SACF indicating the Reason for the error. The maintenance function will be notified. Figure 13.2 of ATIS-1000113.2015 – Chapter 7 illustrates the dynamic flow of information when the notification is sent to the APM-user.

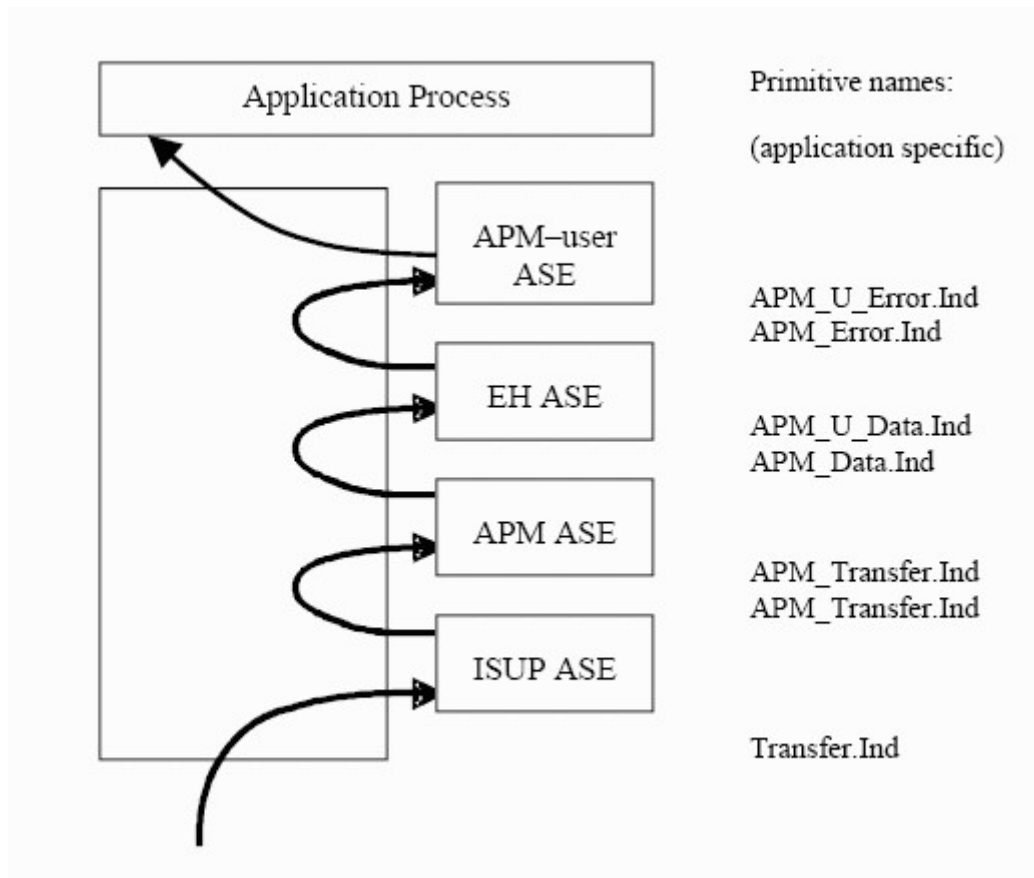


Figure 13.2 - Dynamic flow in AIN to handle reception of APM notification - ATIS-1000113.2015 – Chapter 7

13.4.2 Normal Procedures - Local Error Handling

When one or more APM_UCEH_Error indication primitive(s) are received by the EH ASE, the Application Transport Instruction Indicators of each are checked to determine the appropriate actions. If any "send notification" bit is set then a single Notification (Clause 14) is constructed indicating the context and associated reason for each APM_UCEH_Error indication whose ATII indicated 'send notification'. The following procedures for the sending of a notification depend on the presence of the originating address (address of the AIN) in the received APM_UCEH_Error indication primitives:

- The notification parameters associated to APM_UCEH_Error indication primitives which did not contain any originating address are concatenated to construct an Application Transport Notification information field which is then set to "release call" and "do not send notification". The application context identifier is set to "unidentified Context and Error Handling ASE".
- Each notification parameter associated to APM_UCEH_Error indication primitives containing the same originating address are concatenated to construct an Application Transport Notification information field which is then sent to the APM ASE via the APM_U_data request primitive for transport. The destination address sent by the EH ASE in the APM_U_Data request primitive is the originating address previously received in the APM_UCEH_Error indication primitive. The address of the node is supplied by the EH ASE in the originating address field of the APM_U_Data request primitive. The ATII is set to "release call" and "do not send notification" and the application context identifier is set to "Enhanced Unidentified Context and Error Handling ASE".
- For each of the received APM_UCEH_Error indications indicating "release call", a UCEH_Release indication primitive is sent to the AP via SACF. The maintenance function will be notified.

13.4.3 Exceptional Procedures - Context Identifier Error

If a context identifier is received as "no information" then the information is discarded and the maintenance function will be notified.

13.4.4 Exceptional Procedures - Unrecognized Reason Value

If an Unrecognized Reason value is received in the Application Transport Notification Information parameter then the information is discarded and the maintenance function will be notified.

13.5 Primitive Contents

Tables 27 to 29 of ATIS-1000113.2015 – Chapter 7 define the primitives used across the SACF/EH ASE interface (interface (c) in Figure 6.2 of ATIS-1000113.2015 – Chapter 7). The APM_U_Data primitive is described in Table 20 of ATIS-1000113.2015 – Chapter 7. The UCEH_Release primitive is described in Table 2 of ATIS-1000113.2015 – Chapter 7.

Table 13.3 - Contents of the APM_Error Ind primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Notification	M

Table 13.4 - Contents of the APM_UCEH_Error Ind primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Reason	M
Application Context Identifier	M
Application Transport Instruction Indicators	M
Originating Address	O

Table 13.5 - Contents of the Send_APM_Transit Request primitive - ATIS-1000113.2015 – Chapter 7

Parameter	Mandatory/Optional
Application Context Identifier	M
Application Transport Instruction Indicators	M
Application Data	M

14 Application Transport Notification Information

This information is carried within the Encapsulated Information field of the Application Transport Parameter (APP), when the context identifier value is set to "EUCEH ASE".

Each Notification parameter within the Application Transport Notification Information field consists of the APM-user Context Identifier and the Reason of the error.

Application Transport Notification Information

	8	7	6	5	4	3	2	1
1	Ext/1	APM-user Context Identifier						
2	Ext/1	Reason						
3	Ext/1	APM-user Context Identifier						
4	Ext/1	Reason						
n-1	Ext/1	APM-user Context Identifier						
n	1	Reason						

NOTE - n is even and greater than or equal to 2

a) *Extension indicators*

- 0 further octet exists
- 1 last octet

b) *APM-user Context Identifier*

- 0 No Information
- 1-16383 Refer to "Application Context Identifier" field in the Application Transport Parameter (see ATIS-1000113.2015 – Chapter 3)

c) *Reason*

- 0 No Information
- 1 Unidentified Context/Addressing Error
- 2 Reassembly Error
- 3-127 Spare

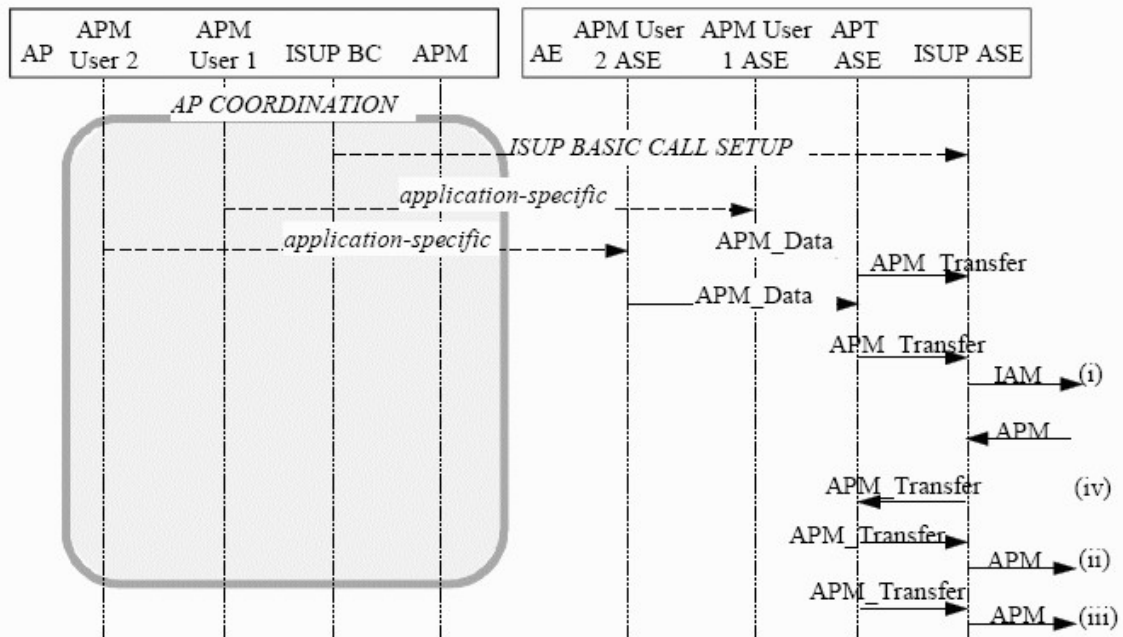
15 Timers

Table 15.1 - Timers - ATIS-1000113.2015 – Chapter 7

Symbol	Time-out value	Cause for initiation	Normal termination	At expiry	Reference
T _{reass}	10-18 sec	receipt of APP indicating "new sequence" for reassembly	receipt of last segment	apply "reassembly error handling"	10.2.4.2

Annex A: Example Sequence Diagrams of APM Segmentation

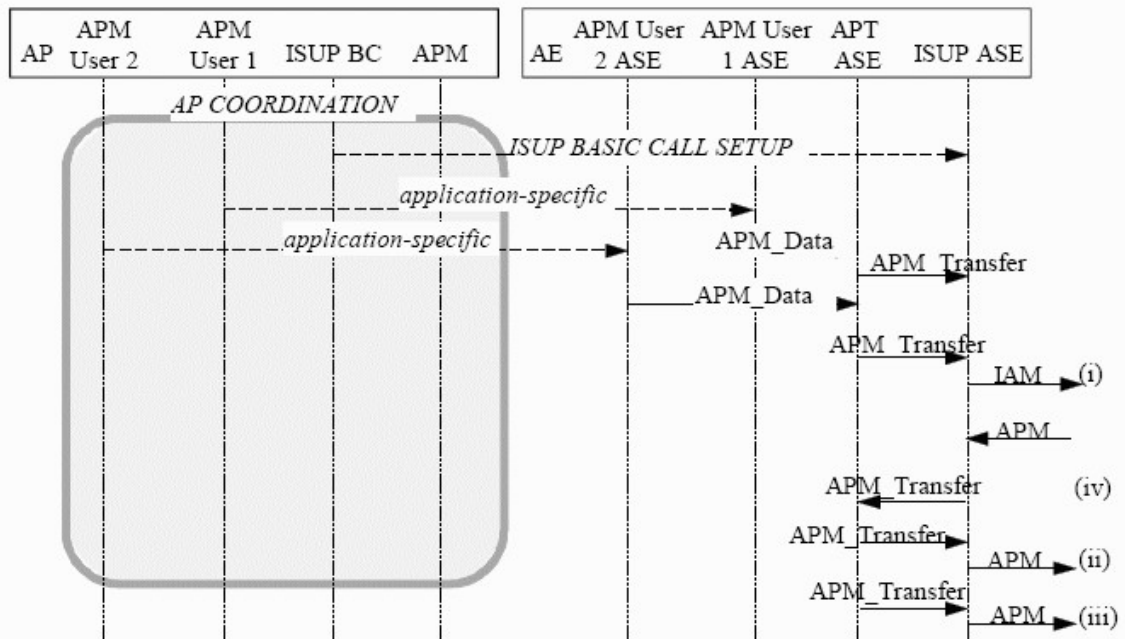
(informative)



NOTES:

- i) IAM includes initial APP for each APM User, these may be "empty".
- ii) APM includes last APP segment for APM User 1.
- iii) APM includes last APP segment for APM User 2.
- iv) Will be repeated for each context that is being segmented.

Figure A.1 - Sending of an IAM containing initial APM segments for 2 Applications - ATIS-1000113.2015 – Chapter 7



NOTES:

- i) IAM includes initial APP for each APM User, these may be "empty".
- ii) APM includes last APP segment for APM User 1.
- iii) APM includes last APP segment for APM User 2.
- iv) Will be repeated for each context that is being segmented.

Figure A.2 - Receipt of an IAM containing initial APM segments for 2 Applications - ATIS-1000113.2015 – Chapter 7

Annex B: Setting of Parameter & Message Instruction Indicators

(informative)

NOTE - The following tables for PCII and MCII show recommended mappings from the ATII value provided by an application. These tables do not define a definitive coding but should be read as a guide to derive compatibility information from the ATII.

ATII provided by application		PCII sent for APP parameter							
A	B	A	B	C	D	E	GF	H <i>Note 1</i>	JI <i>Note 1</i>
Release	Notify	Transit	Release	Notify	Discard message	Discard parameter	PONP	EXT	B/N I/W
0	0	0	0	0	0	0	10	1 or 0	00
0	1	0	0	1	0	0	10	1 or 0	00
1	0	0	0 or 1 <i>Note 2</i>	0	0	0	00 or 10 <i>Note 2</i>	1 or 0	00
1	1	0	0 or 1 <i>Note 2</i>	1	0	0	00 or 10 <i>Note 2</i>	1 or 0	00

NOTES -

- If bits JI are sent then they should be set as shown, and bit H is set accordingly.
- Two options are identified for the settings of B and GF :
 - B=1 and GF=10, i.e., release call at any type A exchange (setting of GF is arbitrary, but proposed value is simplest.)
 - B=0 and GF=00, i.e., release call at type A exchange only if pass on is not possible.

The choice between a) and b) may depend on the types of application deployed in the network, e.g., if a network specific context value is being used, or if only the internationally standardized context values are being used. In the absence of any network specific consideration option b) is proposed to be employed.

ATII provided by application		MCII sent for APM or PRI containing an APP (<i>Note 2</i>)						
A	B	A	B	C	D	E	GF	H
Release	Notify	Transit	Release	Notify	Discard message	PONP	B/N i/w	EXT
0	0	0	0	0	0	1	00	1
0	1	0	0	1	0	1	00	1
1	0	0	0 or 1 <i>Note 1</i>	0	0	0 or 1 <i>Note 1</i>	00	1
1	1	0	0 or 1 <i>Note 1</i>	1	0	0 or 1 <i>Note 1</i>	00	1

NOTES -

- Two options are identified for the settings of B and E :
 - B=1 and E=1 i.e., release call at any type A exchange (setting of E is arbitrary, but proposed value is simplest.)

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b) B=0 and E=0 i.e., release call at type A exchange only if pass on is not possible.

The choice between a) and b) may depend on the types of application deployed in the network, e.g., if a network specific context value is being used, or if only the internationally standardized context values are being used. In the absence of any network specific consideration option b) is proposed to be employed.

2. If the message is also being used to carry other parameters with a more stringent compatibility requirement the MCII setting shown may be overridden.

Annex C: Pre-Release Mechanism

(normative)

This capability allows information to be transported at Release in a manner which is compatible with the 2000 version and subsequent versions of the ANSI ISUP protocol.

Since additional parameters can not be carried in the Release message (REL) due to the possibility of their loss at an intermediate exchange, an exchange wishing to send such parameters at release time shall include them instead within a Pre-release Information message (PRI) which shall be sent immediately prior to the Release message. In the case that segmentation of the pre-release information is necessary, the subsequent segments will be sent between the PRI and REL message.

An exchange receiving a Pre-release Information message shall determine whether to store the received information and process it upon release of the call or pass on the PRI without awaiting REL, depending on the parameters received and the application present for the call at that exchange.