Section 5:

UNI Signalling

5.1 General

This section specifies the procedures for dynamically establishing, maintaining and clearing ATM connections at the User-Network Interface. The procedures are defined in terms of messages and the information elements used to characterize the ATM connection and ensure interoperability.

5.1.1 Scope

This Implementation Agreement is based on a subset of the broadband signalling protocol standards that are currently under development (and currently identified as Q.2931 [29]). Additions to this subset have been made where necessary to support capabilities identified by the ATM Forum as important for early deployment and interoperability of ATM equipment. The primary areas where the standard has been supplemented are to support point-to-multipoint connections, additional traffic descriptors, and private network addressing.

The procedures included in this Implementation Agreement apply to the interface between terminal or endpoint equipment and a public network, referred to as Public UNI, and terminal or endpoint equipment connected to a private network, referred to as Private UNI.

The term “Phase 1” is used to refer to the protocol as described in this document. This term is used to make an explicit distinction between the protocol as specified here and any future releases of this protocol.

Note 1 - The subsections of §5 and the annexes of this document are numbered, where both practical and useful, to follow the section numbering in the Q.2931 draft standard at the time this document was produced.

Note 2 - The convention of highlighting requirements and options with (R) and (O), respectively, used elsewhere in this document, is not used in §5 or in the Signalling annexes and appendicies. This is done to maintain a higher degree of similarity between the specification of signalling as found in this Implementation Agreement and that found in the emerging Q.2931 standard.

5.1.1.1 Reference Configuration

The protocol will be valid for the private and public UNI as defined in Figure 1-3. Moreover, based on the requirement that the protocol be symmetrical, it will also apply in the configuration ATM Endpoint to ATM Endpoint.

The purpose of a reference configuration for the UNI signalling specification is to list all the elements of an ATM network and the links between them, to which this specification will apply.

Network elements in this context are:

- endpoint equipment
- private ATM network
- public ATM network.

For the purpose of this section, a network, public or private, consists of one or more ATM switching platforms under the same administration.

The possible reference configurations that apply to this Implementation Agreement are illustrated in Table 5-1. The table entries 'Public UNI' and 'Private UNI' refer to Phase 1 only.

Table 5-1 Reference Configurations

BETWEEN -> | V	End-point equipment	Private ATM network	Public ATM network
Endpoint equipment	Private UNI	Private UNI	Public UNI
Private ATM network	Private UNI	Note 1	Public UNI
Public ATM network	Public UNI	Public UNI	Note 2

Note 1 - Private ATM networks may be connected using the private UNI signalling. However, features specific to private network interworking are not a requirement for Phase 1 of the protocol. In releases after Phase 1, such internetworking features may be implemented in a private NNI specification.

Note 2 - The table entry for the connection between public networks is outside the domain of the UNI specification. It is addressed by the B-ICI (Broadband Intercarrier Interface) specification of the ATM Forum.

5.1.2 Capabilities Supported by Phase 1 Signalling

The basic capabilities supported by the Phase 1 Signalling specified in this document are listed below:

1. Demand (switched) channel connections.
2. Point-to-point and point-to-multipoint switched channel connections.
3. Connections with symmetric or asymmetric bandwidth requirements.
4. Single-connection (point-to-point or point-to-multipoint) calls.

5. Basic signalling functions via protocol messages, information elements, and procedures.
6. Class X, Class A, and Class C ATM Transport services.
7. Request and Indication of signalling parameters.
8. VPCI/VPI/VCI assignment.
9. A single, statically defined out-of-band channel for all signalling messages.
10. Error recovery.
11. Public UNI and Private UNI addressing formats for unique identification of ATM endpoints.
12. A client registration mechanism for exchange of addressing information across a UNI.
13. End-to-end Compatibility Parameter Identification.

The following sections describe each capability in more detail.

5.1.2.1 Support of Demand (Switched) Channel Connections

The purpose of this specification is to support demand (switched) channel connections. These connections are established in real time using signalling procedures. Demand connections can remain active for an arbitrary amount of time but would not automatically be re-established after a network failure.

In contrast, permanent connections are those that are set up and torn down via provisioning. Permanent connections generally remain established for long periods of time and should automatically be re-established in the event of network failure. The Phase 1 Signalling specified in this document does not support permanent connections.

5.1.2.2 Support of Point-to-Point and Point-to-Multipoint Channel Connections

A Point-to-Point Connection is a collection of associated ATM virtual channel (VC) or virtual path (VP) links that connect two endpoints. The Phase 1 Signalling specified in this document supports point-to-point virtual channel (VC) connections.

5.1.2.2.1 Definition of Point-to-Multipoint Connection

A Point-to-Multipoint Connection is a collection of associated ATM VC or VP links, with associated endpoint nodes, with the following properties:

1. One ATM link, called the Root Link, serves as the root in a simple tree topology. When the Root node sends information, all of the remaining nodes on the connection, called Leaf Nodes, receive copies of the information.
2. For Phase 1, only zero return bandwidth (i.e., from the Leaves to the Root) is supported.
3. The Leaf Nodes can not communicate directly to each other with this connection type.
4. A distributed implementation can be used to connect leaves to the tree.

5.1.2.2.2 Support of Point-to-Multipoint Channel Connections

The Phase 1 Signalling specified in this document supports point-to-multipoint virtual channel (VC) connections as follows:

A point-to-multipoint connection is set up by first establishing a point-to-point connection between the root node and one leaf node. After this set up is complete, additional leaf nodes can be added to the connection by "add party" requests from the root node. The Phase 1 Signalling specified in this document supports the ability of the root to have multiple "add party" requests pending at one time (that is, the root node does not have to wait for a response from one "add party" request before issuing the next). The "add party" response identifies the leaf that was added (or that failed to be added) so that responses can be paired with requests. Note that the root node could choose to add leaf nodes serially (that is, the root could wait for each "add party" to complete before issuing the next), even though the network allows leaf nodes to be added in parallel.

A leaf node may be added or dropped from a point-to-multipoint connection at any time after the establishment of the connection. A new leaf node can be added to an existing connection via the root node issuing an "add party" request, as described above. A leaf node can be dropped from a connection as a result of a request sent by either the root node or by the leaf node to be dropped (but not by another leaf).

Note - Multipoint-to-Multipoint connections are not supported in Phase 1. Instead, techniques such as the following, involving point-to-multipoint connections, can be used:

A. Each node in a group that wishes to communicate can establish a Point-to-Multipoint connection to all of the other nodes in the group. For a group of N nodes, this requires N Point-to-Multipoint connections.

B. Each node in the group that wishes to communicate can establish a Point-to-Point connection to a "Multicast Server." The Multicast Server is the Root Node in a Point-to-Multipoint connection to each node in the group. Any information sent by a node in the group to the Multicast Server is transmitted back from the Multicast Server through the Point-to-Multipoint connection to each of the nodes in the group. For a group of N nodes, this requires N Point-to-Point connections and one Point-to-Multipoint connection.

5.1.2.3 Support of Connections with Symmetric or Asymmetric Bandwidth

Phase 1 Signalling specified in this document supports point-to-point, bi-directional connections that have bandwidth specified independently in the forward and backward directions. The forward direction is from the calling party to the called party, while the backward direction is from the called party to the calling party.

For point-to-multipoint connections, the Phase 1 Signalling specified in this document supports only non-zero, identical bandwidth in the forward direction from the root node to each leaf node, and zero bandwidth in the backward direction from each leaf node to the root node.

5.1.2.4 Support of a Single Connection per Call

The Phase 1 Signalling specified in this document will support one and only one connection per call. The single connection can be either a point-to-point or point-to-multipoint (as described in §5.1.2.2.2) connection.

5.1.2.5 Protocol Support for Basic Signalling Functions

The signalling protocol supports the following basic functions at the UNI interface:

Connection/Call Setup	This is the aspect of the protocol which supports the establishment of a connection/call between different parties. It includes Connection/Call Request and Connection/Call Answer.
Connection/Call Request	This protocol function allows an originating party to request the establishment of a connection/call to a certain destination. In this request the originating party may provide information related to the connection/call.
Connection/Call Answer	This protocol function allows the destination party to respond to an incoming connection/call request. The destination party may include information related to the connection/call. (Rejecting the connection/call request is considered part of the Connection/ Call Clearing function).
Connection/Call Clearing	This protocol function allows any party involved in a connection/call to initiate its removal from an already established connection/call. If the connection/call is between two parties only, then the whole connection/call is removed. This function also allows a destination party to reject its inclusion in a connection/call.
Reason for Clearing	This protocol function allows the clearing party to indicate the cause for initiating its removal from a connection/call.
Out of Band Signalling	This function specifies that connection/call control information uses a channel different from the channels used for exchanging data information between the end-parties (i.e., a specific VPCI/ VCI value will be used for the connection/call control signalling channel).

5.1.2.6 Support of Class X, Class A, and Class C ATM Transport Services

Class X service is a connection oriented ATM transport service where the AAL, traffic type (VBR or CBR) and timing requirements are user defined (i.e., transparent to the network). The user chooses only the desired bandwidth and QoS with appropriate information elements in a SETUP message to establish a class X connection.

Class A service is a connection oriented, constant bit rate ATM transport service. Class A service has end-to-end timing requirements. Class A service may require stringent cell loss, cell delay and cell delay variation performance. The user chooses the desired bandwidth and the appropriate QoS in the SETUP message to establish a class A connection.

Class C service is a connection oriented, variable bit rate ATM transport service. Class C service has no end-to-end timing requirements. The user chooses the desired bandwidth and QoS with appropriate information elements in a SETUP message to establish a class C connection.

The Phase 1 Signalling specified in this document supports class X, class A and class C service. Class D service is not directly supported by signalling. It can be supported via a class X or class C connection to a connectionless server.

5.1.2.7 Support of Signalling Parameter "Request and Indication"

The Phase 1 Signalling specified in this document does not provide support for the negotiation of signalling parameters (e.g., QoS, cell transfer rate) between the users and the network. Instead, the sender chooses a value for each parameter to be sent in the connection setup request, and the receiver indicates whether or not the chosen values can be accommodated.

5.1.2.8 VPI/VPCI/VCI Support

The Phase 1 Signalling specified in this document supports the VPCI as the way of identifying the virtual path across the UNI, with the restriction that there is a one-to-one mapping between VPCI and VPI, hence values beyond 8 bits are restricted.

The following list describes the Phase 1 Signalling capabilities with respect to VPIs, VPCIs, and VCIs. The Phase 1 Signalling specified in this document:

1. provides for the identification of virtual paths (using VPCIs) and virtual connections within virtual paths (using VCIs);

2. does not (in Phase 1) include negotiations of VPCIs and/or VCIs, but does not preclude negotiation in future releases;

3. does not (in Phase 1) include provisions to negotiate or modify allowed ranges for VPCIs and/or VCIs within virtual paths but does not preclude this in future releases. (Negotiation and/or provisioning of VPCI/VCI ranges is outside the scope of the signalling protocol for Phase 1.)

5.1.2.9 Support of a Single Signalling Virtual Channel

The point-to-point signalling virtual channel (i.e., VCI=5, VPCI=0) will be used for all signalling in Phase 1. The association between signalling entities should be permanently established. Metasignalling is not supported in Phase 1. The broadcast signalling virtual channel is not supported.

5.1.2.10 Support of Error Recovery

The error recovery capabilities of the Phase 1 Signalling specified in this document include:

1. Detailed error handling procedures, including means for one signalling entity to inform its peer when it has encountered a non-fatal error (i.e., insufficiently severe to force call clearing); examples of non-fatal errors are message format errors, message content errors and procedural errors (e.g., messages or message contents received in a state in which they are not expected).

2. Procedures for recovery from signalling AAL reset and failure (and, by extension, from Physical layer outages and glitches).

3. Mechanisms for signalling entities to exchange state information for calls and interfaces, and to recover gracefully if there is a disagreement; these procedures must operate both in error conditions as a side-effect of (1) and on request by either signalling entity (i.e., "status enquiry").

4. Capability to force calls, VCCs, and interfaces to an idle state, either due to manual intervention or as a result of severe errors.

5. Cause and diagnostic information for fault resolution provided with call clearing (see §5.1.3), non-fatal errors, and recovery from errors affecting the whole interface.

6. Mechanisms (e.g., timers and associated procedures) to recover from loss of individual messages.

5.1.2.11 Support of Public UNI and Private UNI ATM Addressing

The Phase 1 Signalling specified in this document supports a number of ATM address formats to be used across the Public UNI and/or Private UNI to unambiguously identify the endpoints in an ATM connection. Refer to §5.1.3 and Annex A for a detailed description of the ATM address formats supported, and for guidelines on their use.

5.1.2.12 Support of a Client Registration Mechanism

This implementation agreement (see §5.8) supports a mechanism for the exchange of identifier and address information between an end system and a switch across a UNI. The basic capability allows a network administrator to manually configure ATM network address

information into a switch port, without having to also configure that information into any terminal that is later attached to that port. Instead, the terminal will use the client registration mechanism to exchange its identifier information for the ATM address information configured in the switch port. The client registration mechanism allows this exchange to take place whenever, for example, the terminal is initialized, re-initialized, or reset.

At the conclusion of the client registration exchange, the terminal will have automatically acquired the ATM network address as configured by the network provider, without any requirement for the same address to have been manually provisioned into the terminal. The terminal can then use and transfer its network address as needed by higher level protocols and applications.

5.1.2.13 Support of End-to-end Compatibility Parameter Identification

On a per-connection basis the following end-to-end compatibility parameters can be specified:

1. The AAL type (e.g., Type 1, 3/4, or 5).

2. The method of protocol multiplexing (e.g., LLC vs. VC).

3. For VC-based multiplexing, the protocol which is encapsulated (e.g., any of the list of known routed protocols or bridged protocols).

4. Protocols above the network layer.

5.1.2.14 Support of Multicast Service Addresses

The use of Multicast Service Addresses is not described in this implementation agreement, but it intended to be specified when this agreement is next revised.

5.1.3 Addressing

5.1.3.1 Private Networks

For the purposes of switched virtual connections established by the procedures of this specification, an ATM endsystem address uniquely identifies an ATM endpoint. The format of an ATM address for endpoints in private ATM networks is modeled after the format of an OSI Network Service Access Point, as specified in ISO 8348 and ITU-T X.213; specifically, using the same structure, abstract semantics, abstract syntax, and preferred binary encoding. The structure of the low-order part (ESI and SEL) of the Domain Specific Part (DSP) is as specified in ISO 10589. Three Initial Domain Identifier (IDI) formats are specified in this implementation agreement. The structure of the ATM address with the IDI in each of these formats is illustrated in Figures 5-1a, 5-1b, and 5-1c.

Note 1 - In the context of OSI Network Layer addressing, an ATM endsystem address is a subnetwork point of attachment. While the ISO NSAP encoding structure is used, in the context of the OSI Network Layer addressing, an ATM endsystem

address is a subnetwork point of attachment. When coding the appropriate signaling messages, the ATM endsystem address will be identified unambiguously as such.

Note 2 - The technical issues surrounding addressing and routing architecture are strongly interrelated. In general, routing has implications on addressing. Further study is needed of the routing architecture.

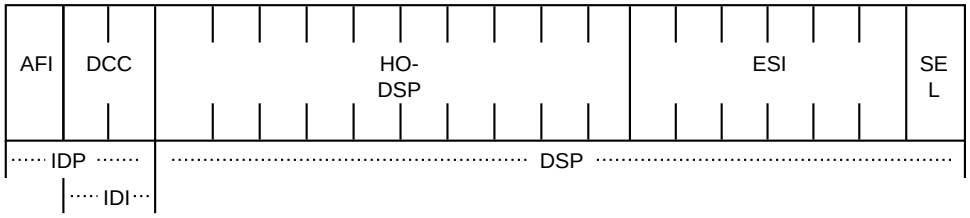


Figure 5-1a DCC ATM Format

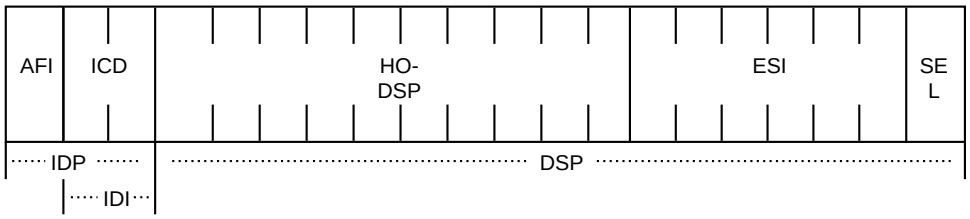


Figure 5-1b ICD ATM Format

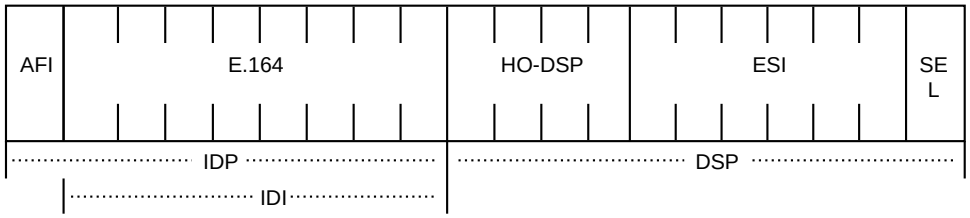


Figure 5-1c E.164 ATM Format

The ability of an endpoint to originate a call to any other endpoint shall be independent of the structure of the ATM address of the called system. All private networks shall be able to accept initial call setup messages containing ATM addresses with any of the IDI formats which are approved in this document, and progress the corresponding call towards the

destination endpoint, if it is reachable. Selection of one of the IDI formats to be used for the addresses of endpoints attached to any particular private ATM network is beyond the scope of this implementation agreement.

In addition to the structure, abstract semantics, abstract syntax, and coding specified in this implementation agreement, endpoints and private networks may, by mutual agreement, support other forms of ATM address. However, the ATM address will always be 20 octets.

Guidelines for ATM addresses are provided in Annex A.

Each of the address fields in the formats above are specified below.

5.1.3.1.1 Initial Domain Part (IDP)

The Initial Domain Part (IDP) uniquely specifies an administrative authority which has the responsibility for allocating and assigning values of the Domain Specific Part (DSP).

The IDP consists of two fields, the Authority and Format Identifier (AFI) and Initial Domain Identifier (IDI).

The AFI identifies the authority allocating the Data Country Code, International Code Designator, or E.164 number; the format of the IDI, and the syntax of the remainder of the address. The length of this field is 1 octet. The digits are encoded in Binary Coded Decimal (BCD) syntax.

The following codes are specified:

AFI	Format of IDI and DSP
39	DCC ATM Format
47	ICD ATM Format
45	E.164 ATM Format

All other code values are reserved.

5.1.3.1.1.1 Data Country Code (DCC)

The Data Country Code specifies the country in which an address is registered. The codes are given in ISO 3166. The length of this field is two octets. The digits of the Data Country Code are encoded in Binary Code Decimal (BCD) syntax. The codes will be left justified and padded on the right with the hexadecimal value ‘F’ to fill the two octets.

5.1.3.1.1.2 International Code Designator (ICD)

The International Code Designator identifies an international organization. The registration authority for the International Code Designator is maintained by the British Standards Institute. The length of this field is two octets. The digits of the International Code Designator are encoded in Binary Coded Decimal (BCD) syntax. The codes will be left justified and padded on the right with the hexadecimal value 'F' to fill the two octets.

5.1.3.1.1.3 E.164 (E.164)

E.164 specifies Integrated Services Digital Network numbers. These numbers include telephone numbers. The international format of these numbers will be used. These numbers can be up to 15 digits long. The length of this field is eight octets. The digits of the E.164 number are encoded in Binary Coded Decimal (BCD) syntax. The E.164 address is padded with leading semi octet 0000 to obtain the maximum length (15 digits). Semi octet value 1111 is used as a pad after the final semi octet to obtain an integral number of octets.

5.1.3.1.2 Domain Specific Part (DSP)

The Domain Specific Part is subdivided into the High Order DSP (HO-DSP) and low order part which consists of the End System Identifier (ESI) and Selector (SEL).

5.1.3.1.2.1 HO-DSP

The coding of this field is specified by the authority identified by the IDP. The authority determines how identifiers will be assigned and interpreted within that domain. The authority can create further subdomains. That is, the authority may define some number of subfields of the HO-DSP and use these to identify a lower authority which in turn defines the balance of the HO-DSP. Sub-fields of the HO-DSP to the left are always more significant than fields to the right. The contents of this field not only describes the hierarchy of addressing authority, but also conveys topological significance. That is, the HO-DSP should be constructed in such a way that routing through interconnected ATM subnetworks is facilitated. Further details on how the HO-DSP is sub-allocated can be found in ISO 8348, RFC 1237 [36], and Annex A of this document.

5.1.3.1.2.2 End System Identifier (ESI)

The end system identifier identifies an end system. This identifier must be unique within a particular value of the IDP + HO-DSP. In addition, to ensure the ability of an end system to autoconfigure its address, this end system identifier can be a globally unique identifier specified by an IEEE MAC address. The length of this field is 6 octets.

5.1.3.1.2.3 Selector

The selector is not used for ATM routing, but may be used by endsystems. The length of this field is 1 octet.

5.1.3.2 Public Networks

The Public UNI shall support one of the following:

1. E.164 address structure:

   Type of Number field = international

   Numbering Plan Indication = E.164

2. Private ATM Address Structure (all 3 formats, as defined in §5.1.3.1):

   Type of Number = Unknown

   Numbering Plan Indication = ATM Endsystem Address, as discussed in §5.1.3.1

3. Both

Note - E.164 numbers are covered by the following definitions:

1. E.164 numbering is defined by ITU-T Recommendation E.164.

2. E.164 numbers are administered by public networks.

3. E.164 numbers uniquely identify interfaces to public networks.

4. Several E.164 numbers can identify the same interface to the public network.

5. Routing internal to public networks based on E.164 is outside the scope of this Implementation Agreement.

5.2 Overview of Call Control

In this Implementation Agreement, the terms “incoming” and “outgoing” are used to describe the call as viewed by the user side of the interface.

This section defines the basic call control states that individual calls may have. These definitions do not apply to the state of the interface itself, any attached equipment, or the signalling virtual channel. Because several calls may exist simultaneously at a User-Network Interface, and each call may be in a different state, the state of the interface cannot be unambiguously defined.

5.2.1 ATM Call States

This section defines the basic call control states for ATM calls.

5.2.1.1 Call States at the User Side of the Interface

The states which may exist on the user side of the user-network interface are defined in this section.

5.2.1.1.1 Null (U0)

No call exists.

5.2.1.1.2 Call Initiated (U1)

This state exists for an outgoing call when the user requests call establishment from the network.

5.2.1.1.3 Outgoing Call Proceeding (U3)

This state exists for an outgoing call when the user has received acknowledgment that the network has received all call information to effect call establishment.

5.2.1.1.4 Call Delivered (U4)

Not supported in this Implementation Agreement.

5.2.1.1.5 Call Present (U6)

This state exists for an incoming call when the user has received a call establishment request but has not yet responded.

5.2.1.1.6 Call Received (U7)

Not supported in this Implementation Agreement.

5.2.1.1.7 Connect Request (U8)

This state exists for an incoming call when the user has answered the call and is waiting to be awarded the call.

5.2.1.1.8 Incoming Call Proceeding (U9)

This state exists for an incoming call when the user has sent acknowledgment that the user has received all call information necessary to effect call establishment.

5.2.1.1.9 Active (U10)

This state exists for an incoming call when the user has received an acknowledgment from the network that the user has been awarded the call. This state exists for an outgoing call when the user has received an indication that the remote user has answered the call.

5.2.1.1.10 Release Request (U11)

This state exists when the user has requested the network to clear the end-to-end connection (if any) and is waiting for a response.

5.2.1.1.11 Release Indication (U12)

This state exists when the user has received an invitation to disconnect because the network has disconnected the end-to-end connection (if any).

5.2.1.2 Call States at the Network Side of the Interface

The call states that may exist on the network side of the user-network interface are defined in this section.

5.2.1.2.1 Null (N0)

No call exists.

5.2.1.2.2 Call Initiated (N1)

This state exists for an outgoing call when the network has received a call establishment request but has not yet responded.

5.2.1.2.3 Outgoing Call Proceeding (N3)

This state exists for an outgoing call when the network has sent acknowledgment that the network has received all call information to effect call establishment.

5.2.1.2.4 Call Delivered (N4)

Not supported in this Implementation Agreement.

5.2.1.2.5 Call Present (N6)

This state exists for an incoming call when the network has sent a call establishment request but not yet received a satisfactory response.

5.2.1.2.6 Call Received (N7)

Not supported in this Implementation Agreement.

5.2.1.2.7 Connect Request (N8)

This state exists for an incoming call when the network has received an answer but the network has not yet awarded the call.

5.2.1.2.8 Incoming Call Proceeding (N9)

This state exists for an incoming call when the network has received acknowledgment that the user has received all call information necessary to effect call establishment.

5.2.1.2.9 Active (N10)

This state exists for an incoming call when the network has awarded the call to the called user. This state exists for an outgoing call when the network has indicated that the remote user has answered the call.

5.2.1.2.10 Release Request (N11)

This state exists when the network has received a request from the user to clear the end-to-end connection (if any).

5.2.1.2.11 Release Indication (N12)

This state exists when the network has disconnected the end-to-end connection (if any) and has sent an invitation to disconnect the user-network connection.

5.2.1.2.12 Call Abort (N22)

Not supported in this Implementation Agreement.

5.2.2 ATM Call States Relating to Interworking Requirements

Not supported in this Implementation Agreement.

5.2.3 States Associated with the Global Call Reference

This section defines the states that the protocol may adopt using the global call reference. The procedures for use of the global call reference for restart procedures are contained in §5.5.5.

There is only one global call reference per interface.

5.2.3.1 Call States at the User Side of the Interface

The states which may exist on the user side of the user-network interface are defined in this section.

5.2.3.1.1 Null (Rest 0)

No transaction exists.

5.2.3.1.2 Restart Request (Rest 1)

This state exists for a restart transaction when the user has sent a restart request but has not yet received an acknowledgment response from the network.

5.2.3.1.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the network and responses have not yet been received from all locally active call references.

5.2.3.2 Call States at the Network Side of the Interface

The states which may exist on the network side of the user-network interface are defined in this section.

5.2.3.2.1 Null (Rest 0)

No transaction exists.

5.2.3.2.2 Restart Request (Rest 1)

This state exists for a restart transaction when the network has sent a restart request but has not yet received an acknowledgment response from the user.

5.2.3.2.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the user and a response has not yet been received from all locally active call references.

5.3 Message Functional Definitions and Contents

This section provides an overview of the message structure, which highlights the functional definitions and information content (i.e., semantics) of each message. Each definition includes:

1. A brief description of the message direction and use, including whether the message has:

   a) Local significance, i.e., relevant only in the originating or terminating access;

   b) Access significance, i.e., relevant in the originating and terminating access, but not in the network;

   c) Dual significance, i.e., relevant in either the originating or terminating access and in the network; or

   d) Global significance, i.e., relevant in the originating and terminating access and in the network.

Note - Messages of access significance and dual significance are not supported in this Implementation Agreement

2. A table listing the codeset 0 (ITU-T [ITU-T] standardized) information elements. For each information element the table indicates:

   a) the section of this Implementation Agreement describing the information element;

   b) the direction in which it may be sent; i.e., user to network (‘u -> n’), network to user (‘n -> u’), or both;

Note - The user-network terminology in this section refers to the interface structures between ATM terminal equipment and ATM public or private network (TE-LCRF/CN) and between ATM customer network and ATM public network (CN-LCRF); the terms TE, CN, and LCRF being used as defined in ITU-T Recommendation I.327.

c) whether inclusion is mandatory ('M') or optional ('O'), with a reference to notes explaining the circumstances under which the information element shall be included; and

d) the length of the information element (or permissible range of lengths), in octets.

3. Further explanatory notes, as necessary.

5.3.1 Messages for ATM point-to-point call and connection control

Table 5-2 summarizes the messages for ATM point-to-point call and connection control.

Table 5-2 Messages for ATM Call and Connection Control

Message	Reference
Call establishment messages:	
CALL PROCEEDING	5.3.1.2
CONNECT	5.3.1.3
CONNECT ACKNOWLEDGE	5.3.1.4
SETUP	5.3.1.7
Call clearing messages:	
RELEASE	5.3.1.5
RELEASE COMPLETE	5.3.1.6
Miscellaneous messages:	
STATUS	5.3.1.8
STATUS ENQUIRY	5.3.1.9

5.3.1.1 ALERTING

Not supported in this Implementation Agreement.

5.3.1.2 CALL PROCEEDING

This message is sent by the called user to the network or by the network to the calling user to indicate that the requested call establishment has been initiated and no more call establishment information will be accepted.

The sending of this message is optional; the receiving of this message is required (see §5.5.)

Message Type: CALL PROCEEDING
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Connection identifier	5.4.5.16	both	O(1)	4-9
Endpoint reference	5.4.8.1	both	O(2)	4-7

Note 1 - Mandatory in the network-to-user direction if this message is the first message in response to a SETUP message. It's mandatory in the user-to-network direction if this message is the first response to a SETUP message, unless the user accepts the connection identifier indicated in the SETUP message.

Note 2 - Mandatory if an Endpoint reference was included in the SETUP message.

Figure 5-2 CALL PROCEEDING Message Contents

5.3.1.3 CONNECT

This message is sent by the called user to the network and by the network to the calling user to indicate call acceptance by the called user.

Message Type: CONNECT
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
AAL parameters	5.4.5.5	both	O(1)	4-11
Broadband low layer information	5.4.5.9	both	O(2)	4-17
Connection identifier	5.4.5.16	both	O(3)	4-9
Endpoint reference	5.4.8.1	both	O(4)	4-7

Note 1 - Included in the user to network direction when the called user wants to pass ATM adaptation layer parameters information to the calling user, and the ATM adaptation layer parameters information element was present in the SETUP message. Included in the network to user direction if the called user included an ATM adaptation layer parameters information element in the CONNECT message. The ATM adaptation layer parameters information element shall not be present when the endpoint reference information element was present in the SETUP message and contained a non-zero value.

Note 2 - Included in the user-to-network direction when the answering user wants to return low layer information to the calling user. Included in the network-to-user direction if the user awarded the call included a Broadband low layer information element in the CONNECT message. Optionally included for Broadband low layer information negotiation, but some networks may not transport this information element to the calling user (see Annex C).

Note3 - Mandatory in the network-to-user direction if this message is the first message in response to a SETUP message. It's mandatory in the user-to-network direction if this message is the first response to a SETUP message, unless the user accepts the connection identifier indicated in the SETUP message.

Note4 - Mandatory if the Endpoint reference was included in the SETUP message.

Figure 5-3 CONNECT Message Contents

5.3.1.4 CONNECT ACKNOWLEDGE

This message is sent by the network to the called user to indicate the user has been awarded the call. It is also sent by the calling user to the network to allow symmetrical call control procedures.

Message Type: CONNECT ACKNOWLEDGE
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2

Figure 5-4 CONNECT ACKNOWLEDGE Message Contents

5.3.1.5 RELEASE

This message is sent by the user to request the network to clear the end-to-end connection (if any) or is sent by the network to indicate that the end-to-end connection is cleared and that the receiving equipment should release the virtual channel and prepare to release the call reference after sending a RELEASE COMPLETE.

Message Type: RELEASE
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Cause	5.4.5.15	both	M	6-34

Figure 5-5 RELEASE message content

5.3.1.6 RELEASE COMPLETE

This message is sent by the user or the network to indicate that the equipment sending the message has released the virtual channel (if any) and call reference, the virtual channel is available for reuse, and the receiving equipment shall release the call reference.

Message Type: RELEASE COMPLETE
Significance: local (1)
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Cause	5.4.5.15	both	O(2)	4-34

Note 1 - This message has local significance; however, it may carry information of global significance when used as the first call clearing message.

Note 2 - Mandatory in the first call clearing message; including when the RELEASE COMPLETE message is sent as a result of an error condition.

Figure 5-6 RELEASE COMPLETE message content

5.3.1.7 SETUP

This message is sent by the calling user to the network and by the network to the called user to initiate call establishment.

Message Type: SETUP
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
AAL parameters	5.4.5.5	both	O(1)	4-21
ATM traffic descriptor	5.4.5.6	both	M	12-30
Broadband bearer capability	5.4.5.7	both	M	6-7
Broadband high layer information	5.4.5.8	both	O(2)	4-13
Broadband repeat indicator	5.4.5.19	both	O(3)	4-5
Broadband low layer information	5.4.5.9	both	O(4)	4-17
Called party number	5.4.5.11	both	M	(5)
Called party subaddress	5.4.5.12	both	O(6)	4-25
Calling party number	5.4.5.13	both	O(7)	4-26
Calling party subaddress	5.4.5.14	both	O(8)	4-25
Connection identifier	5.4.5.16	N -> U	M	9
QoS parameter	5.4.5.18	both	M	6
Broadband sending complete	5.4.5.21	both	O(9)	4-5
Transit network selection	5.4.5.22	U -> N	O(10)	4-8
Endpoint reference	5.4.8.1	both	O(11)	4-7

Note 1 - Included in the user-to-network direction when the calling user wants to pass ATM adaptation layer parameters information to the called user. Included in the network-to-user direction if the calling user included an ATM adaptation layer parameters information element in the SETUP message.

Note 2 - Included in the user-to-network direction when the calling user wants to pass broadband high layer information to the called user. Included in the network-to-user direction if the calling user included a Broadband high layer information information element in the SETUP message.

Note 3 - Included when two or more Broadband low layer information information elements are included for Broadband low layer information negotiation.

Note 4 - Included in the user-to-network direction when the calling user wants to pass broadband low layer information to the called user. Included in the network-to-user direction if the calling user included a Broadband low layer information information element in the SETUP message. Two or three information elements may be included in descending order of priority, i.e., highest priority first, if the Broadband low layer information negotiation procedures are used (see Annex C).

Note 5 - Minimum length depends on the numbering plan. Maximum length is 25 octets.

Note 6 - Included in the user-to-network direction when the calling user wants to indicate the called party subaddress. Included in the network-to-user direction if the calling user included a Called party subaddress information element in the SETUP message.

Note 7 - May be included by the calling user or by the network to identify the calling user.

Note8 - Included in the user-to-network direction when the calling user wants to indicate the calling party subaddress. Included in the network-to-user direction if the calling user included a Calling party subaddress information element in the SETUP message.

Note 9 - It is optional for the user to include the Broadband sending complete information element when enbloc sending procedures (i.e., complete address information is included) are used; its interpretation by the network is optional. It is optional for the network to include the Broadband sending complete information element when enbloc receiving procedures (i.e., complete address information is included) are used.

Note 10 - Included by the calling user to select a particular transit network (see Annex D.)

Note 11 - Not used for point-to-point connection establishment. Must be included in SETUP messages involved in point-to-multipoint connection establishment.

Figure 5-7 SETUP message content

5.3.1.8 STATUS

This message is sent by the user or the network in response to a STATUS ENQUIRY message or at any time to report certain error conditions listed in §5.5.

Message type: STATUS
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Call state	5.4.5.10	both	M	5
Cause	5.4.5.15	both	M	6-34
Endpoint reference	5.4.8.1	both	O(1)	4-7
Endpoint state	5.4.8.2	both	O(2)	4-5

Note 1 - Included when responding to a status enquiry about a party state or at any time to report certain error conditions in the point-to-multipoint procedures.

Note 2 - Included when the Endpoint reference information element is included.

Figure 5-8 STATUS message content

5.3.1.9 STATUS ENQUIRY

The STATUS ENQUIRY message is sent by the user or the network at any time to solicit a STATUS message from the peer layer 3 entity. Sending a STATUS message in response to a STATUS ENQUIRY message is mandatory.

Message type: STATUS ENQUIRY
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Endpoint reference	5.4.8.1	both	O(1)	4-7

Note 1 - Included when enquiring about a party state in the point-to-multipoint procedures.

Figure 5-9 STATUS ENQUIRY message content

5.3.2 Messages for the Support of 64 kbit/s based ISDN Circuit Mode Services

Not supported in this Implementation Agreement.

5.3.3 Messages Related to Release 1 Supplementary Services

Not supported in this Implementation Agreement.

5.3.4 Messages Used with the Global Call Reference

Table 5-3 Messages Used with the Global Call Reference

Message	Reference
RESTART	5.3.4.1
RESTART ACKNOWLEDGE	5.3.4.2
STATUS	5.3.1.8

5.3.4.1 RESTART

This message is sent by the user or the network to request the recipient to restart (i.e., release all resources associated with) the indicated virtual channel or all virtual channels controlled by the Signalling Virtual Channel.

Message type: RESTART
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M(1)	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Connection identifier	5.4.5.16	both	O(2)	4-9
Restart indicator	5.4.5.20	both	M	5

Note 1 - This message is sent with the global call reference defined in §5.4.3.

Note 2 - Included when necessary to indicate the particular virtual channel to be restarted.

Figure 5-10 RESTART message content

5.3.4.2 RESTART ACKNOWLEDGE

This message is sent to acknowledge the receipt of a RESTART message and to indicate that the requested restart is complete.

Message type: RESTART ACKNOWLEDGE
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M(1)	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Connection identifier	5.4.5.16	both	O(2)	4-9
Restart indicator	5.4.5.20	both	M	5

Note 1 - This message is sent with the global call reference defined in §5.4.3.

Note 2 - Included when necessary to indicate the particular virtual channel which has been restarted.

Figure 5-11 RESTART ACKNOWLEDGE message content

5.3.5 Messages for Point-to-multipoint call and connection control

Table 5-4 Messages Used with ATM Point-to-multipoint call and connection control

Message	Reference
ADD PARTY	5.3.5.1
ADD PARTY ACKNOWLEDGE	5.3.5.2
ADD PARTY REJECT	5.3.5.3
DROP PARTY	5.3.5.4
DROP PARTY ACKNOWLEDGE	5.3.5.5

5.3.5.1 ADD PARTY

This message is sent to add a party to an existing connection (see §5.6).

Message type: ADD PARTY
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
AAL parameters	5.4.5.5	both	O(1)	4-20
Broadband high layer information	5.4.5.8	both	O(2)	4-13
Broadband low layer information	5.4.5.9	both	O(3)	4-17
Called party number	5.4.5.11	both	M	(4)
Called party subaddress	5.4.5.12	both	O(5)	4-25
Calling party number	5.4.5.13	both	O(6)	4-26
Calling party subaddress	5.4.5.14	both	O(7)	4-25
Broadband sending complete	5.4.5.21	both	O(8)	4-5
Transit network selection	5.4.5.22	U->N	O(9)	4-8
Endpoint Reference	5.4.8.1	both	M(10)	7

Note 1 - Included in the user-to-network direction when the calling user wants to pass ATM adaptation layer parameters information to the called user. Included in the network-to-user direction if the calling user included an ATM adaptation layer parameters information element in the ADD PARTY message. Must be the same as in the initial SETUP of the call, but is not checked by the network.

Note 2 - Included in the user-to-network direction when the calling user wants to pass broadband high layer information to the called user. Included in the network-to-user direction if the calling user included a Broadband high layer information information element in the ADD PARTY message. Must be the same as in the initial SETUP of the call, but is not checked by the network.

Note 3 - Included in the user-to-network direction when the calling user wants to pass broadband low layer information to the called user. Included in the network-to-user direction if the calling user included a Broadband low layer information information element in the ADD PARTY message. Must be the same as the one negotiated during the initial SETUP of the call, but is not checked by the network. Only one Broadband low layer information information element is permitted in the ADD PARTY message.

Note 4 - Minimum length depends on the numbering plan. Maximum length is 25 octets.

Note 5 - Included in the user-to-network direction when the calling user wants to indicate the called party subaddress. Included in the network-to-user direction if the calling user included a Called Party Subaddress information element in the ADD PARTY message.

Note 6 - May be included by the calling user, or by the network to identify the calling user.

Note 7 - Included in the user-to-network direction when the calling user wants to indicate the calling party subaddress. Included in the network-to-user direction if the calling user included a Calling Party Subaddress information element in the ADD PARTY message.

Note 8 - It is optional for the user to include the Broadband sending complete information element when enbloc sending procedures (i.e., complete address information is included) are used; its interpretation by the network is optional. It is optional for the network to include the Broadband sending complete information element when enblock receiving (i.e., complete address information is included) are used.

Note 9 - Included by the calling user to select a particular transit network (see Annex D.)

Note 10 - The endpoint reference must be unique within a given call reference on a given link.

Figure 5-12 ADD PARTY message content

5.3.5.2 ADD PARTY ACKNOWLEDGE

This message is sent to acknowledge that the ADD PARTY request was successful.

Message type: ADD PARTY ACKNOWLEDGE
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Endpoint reference	5.4.8.1	both	M(1)	7

Note 1 - The endpoint reference must be the same value as in the ADD PARTY message being responded to.

Figure 5-13 ADD PARTY ACKNOWLEDGE message content

5.3.5.3 ADD PARTY REJECT

This message is sent to acknowledge that the ADD PARTY request was not successful.

Message type: ADD PARTY REJECT
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Cause	5.4.5.15	both	M	6-34
Endpoint reference	5.4.8.1	both	M(1)	7

Note 1 - The endpoint reference must be the same value as in the ADD PARTY message being responded to.

Figure 5-14 ADD PARTY REJECT message content

5.3.5.4 DROP PARTY

This message is sent to drop (clear) a party from an existing point-to-multipoint connection.

Message type: DROP PARTY
Significance: global
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Cause	5.4.5.15	both	M	6-34
Endpoint reference	5.4.8.1	both	M	7

Figure 5-15 DROP PARTY message content

5.3.5.5 DROP PARTY ACKNOWLEDGE

This message is sent in response to a DROP PARTY message to indicate that the party was dropped from the connection.

Message type: DROP PARTY ACKNOWLEDGE
Significance: local
Direction: both

Information Element	Reference	Direction	Type	Length
Protocol discriminator	5.4.2	both	M	1
Call reference	5.4.3	both	M	4
Message type	5.4.4.1	both	M	2
Message length	5.4.4.2	both	M	2
Cause	5.4.5.15	both	O(1)	4-34
Endpoint reference	5.4.8.1	both	M	7

Note 1 - Mandatory when DROP PARTY ACKNOWLEDGE is sent as a result of an error condition.

Figure 5-16 DROP PARTY ACKNOWLEDGE message content

5.4 General Message Format and Information Element Coding

The figures and text in this section describe message contents.

5.4.1 Overview

Within this protocol, every message shall consist of the following parts:

a) protocol discriminator;
b) call reference;
c) message type;
d) message length;
e) variable length information elements, as required.

Information elements a), b), c), and d) are common to all the messages and shall always be present, while information element e) is specific to each message type.

This organization is illustrated in the example shown in Figure 5-17.

Protocol discriminator								1
0	0	0	0	Length of call reference value (in octets)				2
Flag	Call reference value							3
Call reference value (continued)								4
Call reference value (continued)								5
Message type								6
Message type (continued)								7
Message length								8
Message length (continued)								9
Variable length information elements as required								etc.

Figure 5-17 General Message Organization Example

A particular message may contain more information than a particular (user or network) equipment needs or can understand. All equipment shall be able to ignore any extra information, present in a message, which is not required for the proper operation of that equipment. For

example, a user may ignore the calling party number if that number is of no interest to the user when a SETUP message is received.

Unless specified otherwise, a particular information element may be present only once in a given message.

The term “default” implies that the value defined should be used in the absence of any assignment, or the negotiation of alternative values.

When a field, such as the message length, extends over more than one octet, the order of bit values progressively decreases as the octet number increases. The least significant bit of the field is represented by the lowest numbered bit of the highest-numbered octet of the field.

5.4.2 Protocol Discriminator

The purpose of the protocol discriminator is to distinguish messages for user-network call control from other messages (to be defined) within this Implementation Agreement. It also distinguishes messages of this Implementation Agreement from those OSI network layer protocol units which are coded to other ITU-T Recommendations and other standards.

The protocol discriminator is the first part of every message. The protocol discriminator is coded according to Figure 5-18.

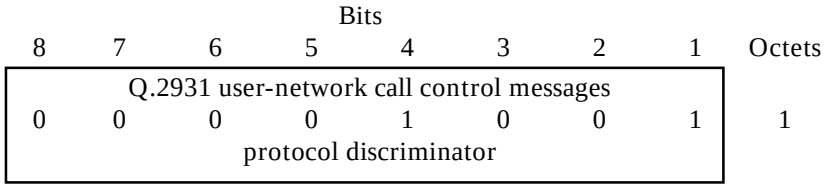


Figure 5-18 Protocol Discriminator

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0 through 0 0 0 0 0 1 1 1	assigned in §4.5.30/Q.931; not available for use in the message protocol discriminator
0 0 0 0 1 0 0 0	Q.931/(I.451) user-network call control messages
0 0 0 0 1 0 0 1	Q.93B user-network call control messages
0 0 0 1 0 0 0 0 through 0 0 1 1 1 1 1 1	reserved for other network layer or layer 3 protocols, including Recommendation X.25 (Note)
0 1 0 0 0 0 0 0 through 0 1 0 0 1 1 1 1	national use
0 1 0 1 0 0 0 0 through 1 1 1 1 1 1 1 0	reserved for other network layer or layer 3 protocols, including Recommendation X.25 (Note)

All other values are reserved

Note - These values are reserved to discriminate these protocol discriminators from the first octet of a Recommendation X.25 packet including general format identifier.

5.4.3 Call Reference

The purpose of the call reference is to identify the call at the local user-network interface to which the particular message applies. The call reference does not have end-to-end significance across ATM networks.

The call reference is the second part of every message. The call reference is coded as shown in Figure 5-19. The length of the call reference value is indicated in octet 1, bits 1-4. The length of the call reference information element is four octets long. The actions taken by the receiver are based on the numerical value of the call reference and are independent of the length of the call reference information element.

The call reference information element includes the call reference value and the call reference flag.

Call reference values are assigned by the originating side of the interface for a call. These values are unique to the originating side only within a particular signalling virtual channel. The call reference value is assigned at the beginning of a call and remains fixed for the

lifetime of a call. After a call ends, the associated call reference value may be reassigned to a later call. Two identical call reference values on the same signalling virtual channel may be used when each value pertains to a call originated at opposite ends of the signalling virtual channel.

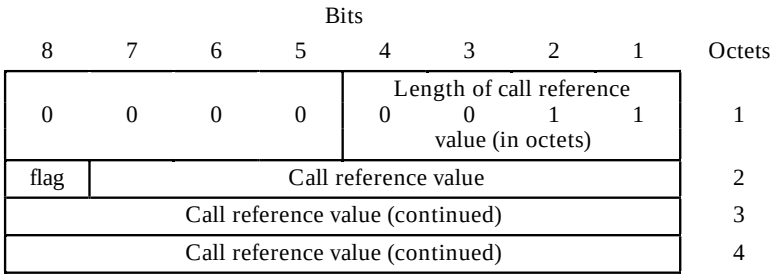
Note - To avoid race conditions in certain SAAL error scenarios, it is suggested that implementors avoid immediate reuse of the call reference values after they are released.

The call reference flag can take the values "0" or "1". The call reference flag is used to identify which end of the signalling virtual channel originated a call reference. The origination side always sets the call reference flag to "0". The destination side always sets the call reference flag to a "1".

Hence the call reference flag identifies who allocated the call reference value and the only purpose of the call reference flag is to resolve simultaneous attempts to allocate the same call reference value. The call reference flag also applies to functions which use the global call reference (e.g., restart procedures).

The dummy call reference is coded with all bits of the call reference value set to 1, as shown in Figure 5-20b. The dummy call reference shall not be used for call establishment and is reserved for future uses. For the dummy call reference, the flag is also used as specified above.

Note - The numerical value of the global call reference is zero. The equipment receiving a message containing the global call reference should interpret the message as pertaining to all call references associated with the appropriate signalling virtual channel. See Figure 5-20a.



Call reference flag (octet 2)

Bit 8	Meaning
0	the message is sent from the side that originates the call reference.
1	the message is sent to the side that originates the call reference.

Figure 5-19 Call Reference Information Element

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	0	0	Length of call reference value 0	1	1	1
0/1 flag	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	4

Figure 5-20a Encoding for Global Call Reference

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	0	0	Length of call reference value 0	1	1	1
0/1 Flag	1	1	1	1	1	1	1	2
1	1	1	1	1	Call reference value	1	1	3
1	1	1	1	1	1	1	1	4

Figure 5-20b Encoding of the Dummy Call Reference

5.4.4 Message Type and Message Length

5.4.4.1 Message Type

The purpose of the message type is to identify the function of the message being sent and to allow the sender of a message to indicate explicitly the way the receiver should handle unrecognized messages.

The message type is the third part of every message. The message type is coded as shown in Figure 5-21.

Bits 8	7	6	5	4	3	2	1	Octets
Message type								1
1 ext	0 Spare	0	Flag	0 Spare	0 Spare	Action Indicator		2

Figure 5-21 Message Type

Message Type (Octet 1)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 - - - - -	Call establishment messages:
0 0 0 1 0	CALL PROCEEDING
0 0 1 1 1	CONNECT
0 1 1 1 1	CONNECT ACKNOWLEDGE
0 0 1 0 1	SETUP
0 1 0 - - - - -	Call clearing messages:
0 1 1 0 1	RELEASE
1 1 0 1 0	RELEASE COMPLETE
0 0 1 1 0	RESTART
0 1 1 1 0	RESTART ACKNOWLEDGE
0 1 1 - - - - -	Miscellaneous messages:
1 1 1 0 1	STATUS
1 0 1 0 1	STATUS ENQUIRY
1 0 0 - - - - -	Point-to-Multipoint messages:
0 0 0 0 0	ADD PARTY
0 0 0 0 1	ADD PARTY ACKNOWLEDGE
0 0 0 1 0	ADD PARTY REJECT
0 0 0 1 1	DROP PARTY
0 0 1 0 0	DROP PARTY ACKNOWLEDGE

Flag (Octet 2) (Note 1)

Bit 5	Meaning
0	Message instruction field not significant (regular error handling procedures apply)
1	Follow explicit instructions (supersedes regular error handling procedures)

Action Indicator (Octet 2) (Note 1)

Bits 2 1	Meaning
0 0	Clear call
0 1	Discard and ignore
1 0	Discard and report status
1 1	Reserved

Note 1 - For this Implementation Agreement, the Flag field (bit 5) and Action Indicator field (bits 2-1) shall be coded to zero. If any other codings are received, the following procedures apply:

- If the Flag field is set to zero, the receiving entity shall ignore the content of the Action Indicator field.

- If the Flag field is set to one, the receiving entity shall either treat the message as if the Flag field is coded to zero or shall follow the explicit instruction in the Action Indicator field.

5.4.4.2 Message Length

The purpose of the message length is to identify the length of the contents of a message. It is the binary coding of the number of octets of the message contents, excluding the octets used for "protocol discriminator", "call reference", "message type" and for the message length indication itself.

If the message contains no further octets, the message length value is coded to all "0's".

The message length is the fourth information element of every message. The message length is a 16-bit value, coded as shown in Figure 5-22.

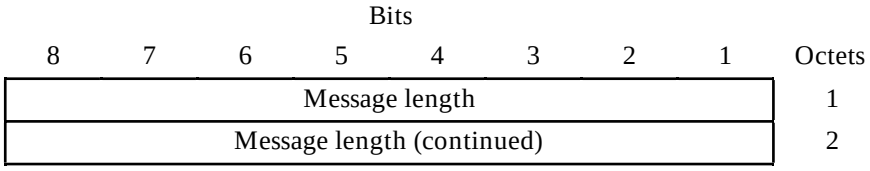


Figure 5-22 Message Length

5.4.5 Variable Length Information Elements

5.4.5.1 Coding Rules

The coding of variable length information elements follows the coding rules described below. These rules are formulated to allow each equipment which processes a message to find information elements important to it, and yet remain ignorant of information elements not important to that equipment.

For the information elements listed below, the coding of the information element identifier bits is summarized in Table 5-5 and Figure 5-23.

The descriptions of the information elements in this section are organized in alphabetical order.

The specific variable length information elements within a message may appear in any order except for the following:

a. If information elements are repeated without using the Broadband repeat indicator information element, the following rules applies: The second occurrence of a repeated information element must immediately follow the first occurrence of the repeated information element. The third occurrence of a repeated information element must immediately follow the second occurrence of the repeated information element. Etc.

b. When information elements are repeated and the Broadband repeat indicator information element is used, the following rules apply:

   - The Broadband repeat indicator must immediately precede the first occurrence of the repeated information element.

   - The first occurrence of the repeated information element (immediately following the Broadband repeat indicator) is interpreted as the highest priority. The second, third, fourth, etc., occurrences of the repeated information element are interpreted in descending order of priority.

   - The second occurrence of the repeated information element must immediately follow the first occurrence of the repeated information element. The third occurrence of the repeated information element must immediately follow the second occurrence of the repeated information element. Etc.

c. Repetition rules with respect to locking shift are not supported in this Implementation Agreement. See §5.4.5.3.

d. Repetition rules with respect to non-locking shift are not supported in this Implementation Agreement. See §5.4.5.4.

Where the description of information elements in this Implementation Agreement contains spare bits, these bits are indicated as being set to “0”. In order to allow compatibility with future implementation, messages should not be rejected simply because a spare bit is set to “1”.

The second octet group of an information element contains the information element compatibility instruction indicator. The coding of the information element compatibility instruction indicator is shown in Table 5-6.

The third octet group of an information element indicates the length of that information element. The length of an information element does not include the length of the information element identifier field, the length of the information element compatibility instruction indicator, or the length of the length field itself. The information element length indication has a fixed length of 2 octets (16 bit value). The coding of the information element length follows the coding rules for integer values described in item g) below.

An optional information element may be present, but empty. For example, a SETUP message may contain a calling party number information element, the content of which is of zero length. This should be interpreted by the receiver as equivalent to that information element being absent. Similarly, an absent information element should be interpreted by the receiver as equivalent to that information element being empty.

An empty information element is an information element that satisfies the following conditions: has a valid information element identifier and has an information element length set to 0.

The following rules apply for the coding of information elements (octets 5, etc.):

a) The first digit in the octet number identifies one octet or a group of octets.

b) Each octet group is a self contained entity. The internal structure of an octet group may be defined in alternative ways.

c) An octet group is formed by using some extension mechanism. The preferred extension mechanism is to extend an octet (N) through the next octet(s) (Na, Nb, etc.) by using bit 8 in each octet as an extension bit. The bit value "0" indicates that the octet group continues through the next octet. The bit value "1" indicates that this octet is the last octet. If one octet (Nb) is present, also the preceding octets (N and Na) must be present.

   In the format descriptions appearing in §5.4.5.5, etc., bit 8 is marked:

   "0 ext" if another octet of this octet group always follows,
   "1 ext" if this is the last octet in this group,
   "0/1 ext" if other octets of this group may or may not follow.

   Additional octets may be defined later ("1 ext" changed to "0/1 ext") and equipment shall be prepared to receive such additional octets although the equipment need not be able to interpret or act upon the content of these octets.

d) In addition to the extension mechanism defined above, an octet (N) may be extended through the next octet(s) (N.1, N.2, etc.) by indications in bits 7-1 (of octet N).

e) The mechanisms in c) and d) may be combined.

f) Optional octets are marked with asterisks (*).

g) Unless specified otherwise, integers are coded such that the Most Significant Bit (MSB) is placed in the highest order bit (excluding the extension bit, if used) in the first octet containing the integer (e.g., bit 8, octet 1 for Message Length), and the Least Significant Bit is placed in the lowest order bit in the last octet containing the

integer (e.g., bit 1, octet 2 for Message Length). Where integer values are represented by a variable number of octets (e.g., by using bit 8 as an extension mechanism), the integer value shall be coded with a minimum number of octets (i.e., no leading all-zero octets are present).

Note 1 - It is not possible to use mechanism c) repeatedly, i.e., it is not possible to construct an octet 4aa as this would become octet 4b.

Note 2 - Protocol designers should exercise care in using multiple extension mechanisms to insure that a unique interpretation of the resultant coding is possible.

Note 3 - For all information elements there is a field that defines the coding standard. When the coding standard defines a national standard it is recommended that the national standard be structured similar to the information element defined in ITU-T draft Recommendation Q.2931 [29].

Table 5-5 Information Element Identifier Coding (Codeset 0)

Bits 8 7 6 5	Bits 4 3 2 1	Information Element	Section Reference	Max Length	Max no. of occurrences
0 0 0 0	1 0 0 0	Cause(1)	5.4.5.15	34	2
0 0 0 1	0 1 0 0	Call state	5.4.5.10	5	1
0 1 0 1	0 1 0 0	Endpoint reference	5.4.8.1	7	1
0 1 0 1	0 1 0 1	Endpoint state	5.4.8.2	5	1
0 1 0 1	1 0 0 0	ATM adaptation layer parameters	5.4.5.5	20	1
0 1 0 1	1 0 0 1	ATM traffic descriptor	5.4.5.6	30	1
0 1 0 1	1 0 1 0	Connection identifier	5.4.5.16	9	1
0 1 0 1	1 1 0 0	Quality of service parameter	5.4.5.18	6	1
0 1 0 1	1 1 0 1	Broadband high layer information	5.4.5.8	13	1
0 1 0 1	1 1 1 0	Broadband bearer capability	5.4.5.7	7	1
0 1 0 1	1 1 1 1	Broadband low-layer information(2)	5.4.5.9	17	3
0 1 1 0	0 0 0 0	Broadband locking shift	5.4.5.3	5	-
0 1 1 0	0 0 0 1	Broadband non-locking shift	5.4.5.4	5	-
0 1 1 0	0 0 1 0	Broadband sending complete	5.4.5.21	5	1
0 1 1 0	0 0 1 1	Broadband repeat indicator	5.4.5.19	5	1
0 1 1 0	1 1 0 0	Calling party number	5.4.5.13	26	1
0 1 1 0	1 1 0 1	Calling party subaddress	5.4.5.14	25	1
0 1 1 1	0 0 0 0	Called party number	5.4.5.11	25	1
0 1 1 1	0 0 0 1	Called party subaddress	5.4.5.12	25	1
0 1 1 1	1 0 0 0	Transit network selection	5.4.5.22	8(3)	1
0 1 1 1	1 0 0 1	Restart indicator	5.4.5.20	5	1

Note 1 - This information element may be repeated without the Broadband repeat indicator information element.

Note 2 - This information element may be repeated in conjunction with the Broadband repeat indicator information element.

Note 3 - The Transit network selection information element will be expanded to 9 octets to allow for the planned expansion of Carrier Identification Codes (CICs) in the first half of 1995. Carrier Identification Codes (CICs) are currently 3 digits in length. The length of CICs will be expanded to 4 digits in 1995.

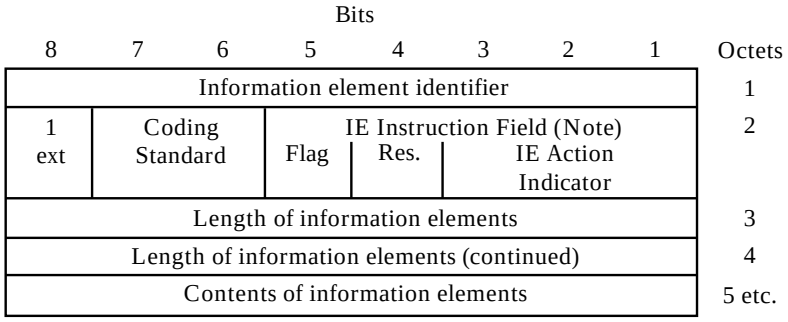


Figure 5-23 General Information Element Format

Note - The IE instruction field (Bits 5-1 of octet 2) is only interpreted in case of unrecognized information element identifier or unrecognized information element contents. For the information elements in this Implementation Agreement, the allocation of values to the IE instruction field is restricted (see Table 5-6).

The ITU-T standardized escape for extension mechanism for the information element identifier (octet 1) is not supported in this Implementation Agreement.

Table 5-6 General Information Element Format

Coding Standard (octet 2) (Note 1)

Bits 7 6	Meaning
0 0	ITU-T standardized
1 1	Standard defined for the network (either public or private) present on the network side of the interface. (Note 2)

Flag (octet 2) (Note 3)

Bit 5	Meaning
0	IE instruction field not significant (regular error handling procedures apply)
1	Follow explicit instructions (supersedes regular error handling procedures)

Reserved (octet 2) (Note 4)

Bit 4	Meaning
0	Reserved

IE Action Indicator (octet 23) (Note 3)

Bits 321	Meaning
000	Clear call
001	Discard Information Element, and proceed
010	Discard Information Element, proceed, and report status
101	Discard message and ignore
110	Discard message and report status
All others	Reserved

Note 1 - For this Implementation Agreement, the coding standard shall be coded as "ITU-T Standardized" or "Standard defined for the network (either public or private) present on the network side of the interface" as defined by each information element. If an information element is received with an invalid coding standard, the receiving entity shall follow procedures for information element content error as described in §§ 5.5.6.7.2 and 5.5.6.8.2.

Note 2 - This coding standard should be used only when the information element contents cannot be represented with the ITU-T standardized coding.

Note 3 - For this Implementation Agreement, the Flag field (bit 5) and Action Indicator field (bits 3-1) shall be coded to zero. If any other codings are received, the following procedures apply:

- If the Flag field is set to zero, the receiving entity shall ignore the content of the Action Indicator field.

- If the Flag field is set to one, the receiving entity shall either treat the message as if the Flag field is coded to zero or shall follow the explicit instruction in the Action Indicator field.

Note 4 - This field is reserved for a possible use of indicating a pass along request.

5.4.5.2 Extension of Codesets

This Implementation Agreement does not support the Broadband locking shift and Broadband non-locking shift information elements since it is not necessary to use information elements in codesets other than codeset 0. For this Implementation Agreement, it is necessary to recognize the Broadband locking shift and Broadband non-locking shift information elements to allow the proper interpretation of the receipt of non-ITU-T standardized information elements.

For additional details on codesets, see §4.5.2 of ITU-T draft Recommendation Q.2931 [29].

5.4.5.3 Broadband Locking Shift Procedures

If a Broadband locking shift information element is received, the Broadband locking shift information element and all information elements in the new active codeset are discarded and the procedures in §5.5.6.8.1 are followed, with the exception that only the Broadband locking shift information element identifier is returned in the diagnostic field of the Cause information element. The information element identifier(s) of the information element(s) in the new codeset are not included.

For additional details of the Broadband locking shift information element, see §4.5.3 of ITU-T draft Recommendation Q.2931 [29].

5.4.5.4 Broadband Non-Locking Shift Procedures

If a Broadband non-locking shift information element is received, the Broadband non-locking shift information element and the information element that follows it are discarded and the procedures in §5.5.6.8.1 are followed, with the exception that only the Broadband non-locking shift information element identifier is returned in the diagnostic field of the Cause information element. The information element identifier of the information element in the new codeset is not included.

For additional details of the Broadband non-locking shift information element, see §4.5.4 of ITU-T draft Recommendation Q.2931 [29].

5.4.5.5 ATM Adaptation Layer Parameters

The purpose of the ATM adaptation layer parameters information element is to indicate the requested ATM adaptation layer parameter values (end-to-end significance) for the ATM connection. It contains the parameters selectable by the user for all AAL sublayers.

The ATM adaptation layer parameters information element may also be included in the CONNECT message to indicate that the called party to a point-to-point call (or the first leaf of a point-to-multipoint call) wishes to indicate the Forward and Backward Maximum CPCS-SDU size (for AAL 3/4 and AAL5), reduce the value of the MID (for AAL 3/4), or indicate user-defined AAL information.

Note - Other uses of the ATM adaptation layer parameters information element in the connect message (e.g., for interworking) are for further study.

The contents of this information element is transparent for the network, except for the case of interworking.

Bits								
8	7	6	5	4	3	2	1	Octets
ATM adaptation layer parameters 0	1	0	1	1	0	0	0	1
Information element identifier								
1 ext	Coding Standard	IE Instruction Field						2
Length of AAL parameters contents								3
Length of AAL parameters contents (continued)								4
AAL Type								5
Further content depending upon AAL type								6 etc.

Figure 5-24 ATM Adaptation Layer Parameters Information Element (For all AAL Types)

Bits 8	7	6	5	4	3	2	1	Octets
Subtype identifier								6
1	0	0	0	0	1	0	1	
Subtype								6.1
CBR Rate Identifier								7
1	0	0	0	0	1	1	0	
CBR Rate								7.1
Multiplier Identifier								8* (Note 1)
1	0	0	0	0	1	1	1	
Multiplier								8.1* (Note 1)
Multiplier (continued)								8.2* (Note 1)
Source Clock Frequency Recovery Method Identifier								9*
1	0	0	0	1	0	0	0	
Source Clock Frequency Recovery Method								9.1*
Error Correction Method Identifier								10*
1	0	0	0	1	0	0	1	
Error Correction Method								10.1*
Structured Data Transfer Blocksize Identifier								11*
1	0	0	0	1	0	1	0	
Structured Data Transfer Blocksize								11.1*
Structured Data Transfer Blocksize (continued)								11.2*
Partially Filled Cells Identidier								12*
1	0	0	0	1	0	1	1	
Partially Filled Cells Method								12.1*

Note 1 - These octets are only present if octet 7.1 indicates “n x 64 kbit/s” or “n x 8 kbps”.

Figure 5-25 ATM Adaptation Layer Parameters Information Element (Octet Groups 6-12 for AAL Type 1)

Bits 8	7	6	5	4	3	2	1	Octets
Forward Maximum CPCS-SDU Size Identifier								6* (Note 1)
1	0	0	0	1	1	0	0	
Forward Maximum CPCS-SDU Size								6.1*
Forward Maximum CPCS-SDU Size (continued)								6.2*
BackwardMaximum CPCS-SDU Size Identifier								7* (Note 1)
1	0	0	0	0	0	0	1	
BackwardMaximum CPCS-SDU Size								7.1*
BackwardMaximum CPCS-SDU Size (continued)								7.2*
MID Range Identifier								8*
1	0	0	0	0	0	1	0	
MID Range (lowest MID value)								8.1*
MID Range (lowest MID value) (continued)								8.2*
MID Range (highest MID value)								8.3*
MID Range (highest MID value) (continued)								8.4*
SSCS Type Identifier								9*
1	0	0	0	0	1	0	0	
SSCS Type								9.1*

Note 1 - If the Forward Maximum CPCS-SDU Size is included, the Backward Maximum CPCS-SDU size shall be included. If the Backward Maximum CPCS-SDU Size is included, the Forward Maximum CPCS-SDU Size shall be included.

Figure 5-26 ATM Adaptation Layer Parameters Information Element (Octet Groups 6-9 for AAL Type 3/4)

Bits 8	7	6	5	4	3	2	1	Octets
Forward Maximum CPCS-SDU Size Identifier								6* (Note 1)
1	0	0	0	1	1	0	0	
Forward Maximum CPCS-SDU Size								6.1*
Forward Maximum CPCS-SDU Size (continued)								6.2*
BackwardMaximum CPCS-SDU Size Identifier								7* (Note 1)
1	0	0	0	0	0	0	1	
BackwardMaximum CPCS-SDU Size								7.1*
BackwardMaximum CPCS-SDU Size (continued)								7.2*
SSCS Type Identifier								8*
1	0	0	0	0	1	0	0	
SSCS Type								8.1*

Note 1 - If the Forward Maximum CPCS-SDU Size is included, the Backward Maximum CPCS-SDU size shall be included. If the Backward Maximum CPCS-SDU Size is included, the Forward Maximum CPCS-SDU Size shall be included.

Figure 5-27 ATM Adaptation Layer Parameters Information Element (Octet Groups 6-8 for AAL Type 5)

Bits 8	7	6	5	4	3	2	1	Octets
User Defined AAL Information								6*
User Defined AAL Information								6.1*
User Defined AAL Information								6.2*
User Defined AAL Information								6.3*

Figure 5-28 ATM Adaptation Layer Parameters Information Element (Octet Group 6 for User Defined AAL)

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized

IE Instruction Field (octet 2)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

AAL type (octet 5)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 1	AAL type 1
0 0 0 0 0 0 1 1	AAL type 3/4
0 0 0 0 0 1 0 1	AAL type 5
0 0 0 1 0 0 0 0	User-Defined AAL

Subtype (octet 6.1 for AAL type 1)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	Null
0 0 0 0 0 0 0 1	Voice-band single transport, (see Rec. G.711/G.722)
0 0 0 0 0 0 1 0	Circuit transport (see Rec. I.363, Sec. 2.5.1.1)
0 0 0 0 0 1 0 0	High-quality audio signal transport
0 0 0 0 0 1 0 1	Video signal transport

CBR rate (octet 7.1 for AAL type 1)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 1	64 kbit/s
0 0 0 0 0 1 0 0	1544 kbit/s (DS1)
0 0 0 0 0 1 0 1	6312 kbit/s (DS2)
0 0 0 0 0 1 1 0	32064 kbit/s
0 0 0 0 0 1 1 1	44736 kbit/s (DS3)
0 0 0 0 1 0 0 0	97728 kbit/s
0 0 0 1 0 0 0 0	2048 kbit/s (E1)
0 0 0 1 0 0 0 1	8448 kbit/s (E2)
0 0 0 1 0 0 1 0	34368 kbit/s (E3)
0 0 0 1 0 0 1 1	139264 kbit/s
0 1 0 0 0 0 0 0	n x 64 kbit/s
0 1 0 0 0 0 0 1	n x 8 kbit/s

Multiplier (octets 8.1 and 8.2 for AAL type 1 and nx64kbit/s or n x 8 kbit/s indication in octet 7.1)

Integer representation of multiplier values between 2 and 2^{16}-1 for n x 64 kbits; integer representation of multiplier values between 1 and 7 for n x 8 kbit/s.

Source Clock Frequency Recovery Method (octet 9.1 for AAL type 1)

Bits 8765 4321	Meaning
0000 0001	Null (Synchronous circuit transport)
0000 0001	(Synchronous Residual Time Stamp) (SRTS) method (Asynchronous circuit transport) (cf. Rec. I.363 Section 2.5.2.2.1)
0000 0010	Adaptive Clock method (cf. Rec. I.363 Section 2.5.2.2.1)

Error Correction Method (octet 10.1 for AAL type 1)

Bits 8765 4321	Meaning
0000 0000	Null (no error correction is provided)
0000 0001	A forward error correction method for loss sensitive signal transport (cf. I.363)
0000 0010	A forward error correction method for delay sensitive signal transport

Structured Data Transfer Blocksize (octet 11.1 and 11.2 for AAL type 1)

16-bit integer representation of values between 1 and 65,535, i.e., 2^{16}-1. This parameter represents the blocksize of SDT CBR service,

Partially Filled Cells Method (octet 12.1 for AAL type 1)

Bits 8765 4321	Meaning
0000 0001 through 0010 1111	Integer representation of the number of leading octets of SAR-PDU payload in use (values between 1 and 47)

Forward Maximum CPCS-SDU Size (octets 6.1 and 6.2 for AAL type 3/4 and type 5)

16 bit integer representation of the values between 0 and 65,535, i.e., 2^{16}-1. This parameter indicates the Maximum CPCS-SDU size sent in the direction from the calling user to the called user.

Backward Maximum CPCS-SDU Size (octets 7.1 and 7.2 for AAL type 3/4 and type 5)

16 bit integer representation of the values between 0 and 65,535, i.e., 2^{16}-1. This parameter indicates the Maximum CPCS-SDU size sent in the direction from the called user to the calling user.

MID Range (octets 8.1 and 8.2 for AAL type 3/4)

Integer representation of the lowest MID value (octet 8.1 and 8.2) and the highest MID value (octets 8.3 and 8.4) of the MID range; only values between 0 and 1023 are valid.

SSCS Type (octet 10.1 for AAL type 3/4; octet 9.1 for AAL type 5)

Bits 8 7 6 5	Bits 4 3 2 1	Meaning
0 0 0 0	0 0 0 0	Null
0 0 0 0	0 0 0 1	Data SSCS based on SSCOP (assured operation)
0 0 0 0	0 0 1 0	Data SSCS based on SSCOP (non-assured operation)
0 0 0 0	0 1 0 0	Frame relay SSCS

User Defined AAL Information (octets 6 to 6.3 for User-Defined AAL)

The use and coding of octets 6-6.3 is according to user defined requirements.

5.4.5.6 ATM Traffic Descriptor

The purpose of the ATM traffic descriptor information element is to specify the set of traffic parameters which, together, specify a traffic control capability.

Bits 8	7	6	5	4	3	2	1	Octets
ATM user cell rate 0	1	0	1	1	0	0	1 Information element identifier	1
1 ext	Coding Standard		IE Instruction Field					2
Length of ATM user cell rate contents								3
Length of ATM user cell rate contents (continued)								4
1	0	0	0	0	0	1	0 Forward Peak Cell Rate Identifier (CLP=0)	5*
Forward Peak Cell Rate								5.1*
Forward Peak Cell Rate (continued)								5.2*
Forward Peak Cell Rate (continued)								5.3*
1	0	0	0	0	0	1	1 Backward Peak Cell Rate Identifier (CLP=0)	6*
Backward Peak Cell Rate								6.1*
Backward Peak Cell Rate (continued)								6.2*
Backward Peak Cell Rate (continued)								6.3*
1	0	0	0	0	1	0	0 Forward Peak Cell Rate Identifier (CLP=0+1)	7 (Note 3)
Forward Peak Cell Rate								7.1 (Note 3)
Forward Peak Cell Rate (continued)								7.2 (Note 3)
Forward Peak Cell Rate (continued)								7.3 (Note 3)
1	0	0	0	0	1	0	1 Backward Peak Cell Rate Identifier (CLP=0+1)	8 (Notes 3,4)
Backward Peak Cell Rate								8.1 (Notes 3,4)
Backward Peak Cell Rate (continued)								8.2 (Notes 3,4)
Backward Peak Cell Rate (continued)								8.3 (Notes 3,4)
1	0	0	0	1	0	0	0 Forward Sustainable Cell Rate Identifier (CLP=0)	9* (Note 5)
Forward Sustainable Cell Rate								9.1* (Note 5)
Forward Sustainable Cell Rate (continued)								9.2* (Note 5)

Forward Sustainable Cell Rate (continued)	9.3* (Note 5)
1 0 0 0 1 0 0 1 Backward Sustainable Cell Rate Identifier (CLP=0)	10* (Note 5)
Backward Sustainable Cell Rate	10.1* (Note 5)
Backward Sustainable Cell Rate (continued)	10.2* (Note 5)
Backward Sustainable Cell Rate (continued)	10.3* (Note 5)
1 0 0 1 0 0 0 0 Forward Sustainable Cell Rate Identifier (CLP=0+1)	11* (Note 5)
Forward Sustainable Cell Rate	11.1* (Note 5)
Forward Sustainable Cell Rate (continued)	11.2* (Note 5)
Forward Sustainable Cell Rate (continued)	11.3* (Note 5)
1 0 0 1 0 0 0 1 Backward Sustainable Cell Rate Identifier (CLP=0+1)	12* (Note 5)
Backward Sustainable Cell Rate	12.1* (Note 5)
Backward Sustainable Cell Rate (continued)	12.2* (Note 5)
Backward Sustainable Cell Rate (continued)	12.3* (Note 5)
1 0 1 0 0 0 0 0 Forward Maximum Burst Size Identifier (CLP=0)	13* (Note 5)
Forward Maximum Burst Size	13.1* (Note 5)
Forward Maximum Burst Size (continued)	13.2* (Note 5)
Forward Maximum Burst Size (continued)	13.3* (Note 5)
1 0 1 0 0 0 0 1 Backward Maximum Burst Size Identifier (CLP=0)	14* (Note 5)
Backward Maximum Burst Size	14.1* (Note 5)
Backward Maximum Burst Size (continued)	14.2* (Note 5)
Backward Maximum Burst Size (continued)	14.3* (Note 5)
1 0 1 1 0 0 0 0 Forward Maximum Burst Size Identifier (CLP=0+1)	15* (Note 5)
Forward Maximum Burst Size	15.1* (Note 5)
Forward Maximum Burst Size (continued)	15.2* (Note 5)
Forward Maximum Burst Size (continued)	15.3* (Note 5)
1 0 1 1 0 0 0 1 Backward Maximum Burst Size Identifier (CLP=0+1)	16* (Note 5)
Backward Maximum Burst Size	16.1* (Note 5)
Backward Maximum Burst Size (continued)	16.2* (Note 5)
Backward Maximum Burst Size (continued)	16.3* (Note 5)

1	0	1	1	1	1	1	0	17* (Note 6)
Best Effort Indicator								
1	0	1	1	1	1	1	1	18* (Note 7)
Traffic Management Options Identifier								
0	0	0	0	0	0	Tagging Backward	Tagging Forward	18.1* (Note 7)
Reserved								

Note 1 - All the parameters are position independent. The term “Forward” indicates the direction from calling user to the called user. The term “Backward” indicates the direction from the called user to the calling user.

Note 2 - The OAM traffic descriptor information element is not supported in this implementation agreement. The ATM Traffic Descriptor specified by the user shall include both user traffic and the end-to-end F5 OAM traffic. The user cells and the end-to-end F5 OAM cells shall be policed together. If the use of fault management procedures is anticipated, the user shall allocate at least one cell per second in the Peak Cell Rate and one cell per second in the Sustainable Cell Rate (when applicable) to accommodate the fault management traffic. If higher end-to-end F5 OAM cell rate is expected, the user shall allocate higher Peak Cell Rate (when applicable) accordingly to accommodate it.

Note 3 - If only Peak cell rate for CLP = 0+1 is specified, the network resource allocation will assume the entire peak cell rate can be used for CLP=0.

Note 4 - For point-to-multipoint calls (see §5.6), the backward peak cell rate (CLP=0+1) value shall be coded as zero. No other backwards traffic descriptors shall be included.

Note 5 - If either forward sustainable cell rate (CLP=0), forward sustainable cell rate (CLP=0+1), backward sustainable cell rate (CLP=0), or backward sustainable cell rate (CLP=0+1) are included, the corresponding maximum burst size shall be included. Similarly, if forward maximum burst size (CLP=0), forward maximum burst size (CLP=0+1), backward maximum burst size (CLP=0), or backward maximum burst size (CLP=0+1) are included, the corresponding sustainable cell rate shall be included.

Note 6 - QoS class 0 is used with the best effort indication. The interpretation of the Forward Peak Cell Rate (CLP=0+1) parameter and the Backward Peak Cell Rate (CLP=0+1) parameter is modified by the best effort indication (see §3.6.2.4).

Note 7 - When these octets are not present, it is assumed that tagging is not requested.

Figure 5-29 ATM Traffic Descriptor Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized (Note 1)
1 1	Standard defined for the network (either public or private) present on the network side of the interface. (Note 2)

Note 1 - This codepoint is used when the combinations of traffic parameter subfields in Tables 5-7 and 5-8 are used.

Note 2 - This codepoint can be used to specify additional experimental parameters. These parameters may be used to provide a more detailed traffic characterization (e.g., Average cell rate, Average burst size, etc.)

IE Instruction Field (octet 3)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

Forward/Backward Peak Cell Rate
(octets i.1 - i.3, where i may have values 5, 6, 7, or 8)
The forward and backward peak cell rate parameters indicate the peak cell rate (see §3.6), expressed in cells per second. It is coded as a 24-bit binary integer, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit.

Forward/Backward Sustainable Cell Rate
(octets i.1 - i.3, where i may have values 9, 10, 11, or 12)
The forward and backward sustainable cell rate parameters indicate the sustainable cell rate (see §3.6), expressed in cells per second. It is coded as a 24-bit binary integer, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit.

Forward/Backward Maximum Burst Size
(octets i.1 - i.3, where i may have values 13, 14, 15, or 16)
The forward and backward maximum burst size parameters indicate the maximum burst size (see §3.6), expressed in cells. It is coded as a 24-bit binary integer with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit.

Best Effort Indication (octet 17)
This octet is included when best effort is requested (see §3.6).

Tagging Backward (octet 18.1) (Note)

Bit 2	Meaning
0	Tagging not requested
1	Tagging requested

Note - The tagging backward parameter is coded as a one (1) when the tagging is requested and is coded as a zero (0) when tagging is not requested. (See §3.6 for more information.)

Tagging Forward (octet 18.1) (Note)

Bit 1	Meaning
0	Tagging not requested
1	Tagging requested

Note - The tagging forward parameter is coded as a one (1) when the tagging is requested and is coded as a zero (0) when tagging is not requested. (See §3.6 for more information.)

The valid combinations of the traffic descriptor subfields in the ATM traffic descriptor information element are shown in Tables 5-7 and 5-8. Table 5-7 shows the valid combinations of traffic parameter subfields for a given direction (i.e., the forward direction may use one combination of traffic descriptors, while the backward direction uses a different combination of traffic descriptors). Total information element length will depend upon the combinations of traffic parameter subfields chosen for each direction. Table 5-8 shows the valid combination of traffic parameter subfields for best effort (best effort always applies to both directions of the connection).

Table 5-7 Allowable Combinations of Traffic Parameters in a Given Direction

Allowable Combinations of Traffic Parameter Subfields in the ATM User Cell Rate Information Element for a Given Direction
Peak Cell Rate CLP=0 Peak Cell Rate CLP=0+1
Peak Cell Rate CLP=0 Peak Cell Rate CLP=0+1 Tagging=tagging requested
Peak Cell Rate CLP=0+1 Sustainable Cell Rate CLP=0 Maximum Burst Size CLP=0
Peak Cell Rate CLP=0+1 Sustainable Cell Rate CLP=0 Maximum Burst Size CLP=0 Tagging=tagging requested
Peak Cell Rate CLP=0+1
Peak Cell Rate CLP=0+1 Sustainable Cell Rate CLP=0+1 Maximum Burst Size CLP=0+1

Table 5-8 Combination of Traffic Parameters for Best Effort

Combination of Traffic Parameter Subfields in the ATM User Cell Rate Information Element for Best Effort	Total information element length in octets (including overhead)
Peak Cell Rate Forward CLP=0+1 Peak Cell Rate Backward CLP=0+1 Best Effort Indication	13

5.4.5.7 Broadband Bearer Capability

The purpose of the Broadband bearer capability information element is to indicate a requested broadband connection oriented bearer service (see ITU-T Recommendation F.811) to be provided by the network.

Bits 8	7	6	5	4	3	2	1	Octets
Broadband bearer capability 0	1	0	1	1	1	1	0 Information element identifier	1
1 ext	Coding Standard		IE Instruction Field					2
Length of B-BC contents								3
Length of B-BC contents (continued)								4
0/1 ext	0 0 Spare		Bearer Class					5
1 ext	0 0 Spare		Traffic Type			Timing Requirements		5a* (Note 1)
1 ext	Susceptibility to clipping		0 0 0 Spare			User plane connection configuration		6

Note 1 - This octet may only be present if Bearer Class X is indicated in Octet 5 (see Appendix G).

Figure 5-30 Broadband Bearer Capability Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized

IE Instruction Field (octet 2)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

Bearer Class (octet 5)

Bits 5 4 3 2 1	Meaning
0 0 0 0 1	BCOB-A
0 0 0 1 1	BCOB-C
1 0 0 0 0	BCOB-X

Traffic Type (octet 5a)

Bits 5 4 3	Meaning
0 0 0	No indication
0 0 1	Constant bit rate
0 1 0	Variable bit rate

Timing Requirements (octet 5a)

Bits 2 1	Meaning
0 0	No indication
0 1	End-to-end timing required
1 0	End-to-end timing not required
1 1	Reserved

Susceptibility to clipping (octet 6)

Bits 7 6	Meaning
0 0	Not susceptible to clipping
0 1	Susceptible to clipping

User plane connection configuration (octet 6)

Bits 2 1	Meaning
0 0	Point-to-point
0 1	Point-to-multipoint

5.4.5.8 Broadband High Layer Information

The purpose of the Broadband high layer information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g., a remote user or an interworking unit or a high layer function network node addressed by the calling user). The Broadband high layer information element is transferred transparently by an ATM network between the call originating entity (e.g., the calling user) and the addressed entity. For the Public UNI, the availability of this information element must be negotiated with the network provider. At the Public UNI, the network provider has the option of not supporting this element in the SETUP message. At the Private UNI, support for this information element is mandatory.

Bits 8	7	6	5	4	3	2	1	Octets
Broadband high layer information 0	1	0	1	1	1	0	1 Information element identifier	1
1 ext	Coding Standard	IE Instruction Field						2
Length of B-HLI contents								3
Length of B-HLI contents (continued)								4
1 ext	High Layer Information Type							5
High Layer Information								6-13*

Figure 5-31 Broadband High Layer Information Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized

IE Instruction Field (octet 2)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

High Layer Information Type (octet 5)

Bits 7 6 5	Bits 4 3 2 1	Meaning
0 0 0	0 0 0 0	ISO (Note 1)
0 0 0	0 0 0 1	User Specific (Note 2)
0 0 0	0 0 1 1	Vendor-Specific Application identifier (Note 3)

Note 1 - This codepoint is reserved for use as specified in ISO/IEC standards.

Note 2 - The exact coding of octets 6-13, when this higher layer information type is used, is user-defined. The use of this codepoint requires bilateral agreement between the two end users.

Note 3 - Vendor-Specific Application identifier: consists of a 7-byte field; the left-most three octets consist of a globally-administered Organizationally Unique Identifier (OUI) (as per IEEE standard 802-1990), the right-most four octets are an application identifier, which is administered by the vendor identified by the OUI.

High Layer Information (octets 6-13)

The contents of these octets depends on the high layer information type.

5.4.5.9 Broadband Low Layer Information

The purpose of the Broadband low layer information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g., a remote user or an interworking unit or a high layer function network node addressed by the calling user). The Broadband Low layer information information element is transferred transparently by an ATM network between the call originating entity (e.g., the calling user) and the addressed entity. Support of this information element by the network is mandatory.

Bits 8	7	6	5	4	3	2	1	Octets
Broadband low layer information 0	1	0	1	1	1	1	1 Information element identifier	1
1 ext	Coding Standard		IE Instruction Field					2
Length of B-LLI contents								3
Length of B-LLI contents (continued)								4
1 ext	0	1 Layer 1 id	User information layer 1 protocol					5*
0/1 ext	1	0 Layer 2 id	User information layer 2 protocol					6*
0/1 ext	Mode		0	0	0 Spare	Q.933 use		6a* (Note 1)
1 ext	Window size (k)							6b* (Note 1)
1 ext	User specified layer 2 protocol information							6a* (Note 2)
0/1 ext	1	1 Layer 3 id	User information layer 3 protocol					7*
0/1 ext	Mode		0	0	0	0	0 Spare	7a* (Note 3)
0/1 ext	0	0	0 Spare	Default Packet Size				7b* (Note 3)
1 ext	Packet window size							7c* (Note 3)
1 ext	User specified layer 3 protocol information							7a* (Note 4)
0 ext	ISO/IEC TR 9577 Initial Protocol Identifier (IPI) (bits 8-2)							7a* (Note 5)
1 ext	IPI (bit1)	0	0	0	0	0	0 Spare	7b* (Note 5)
1 ext	0	0 SNAP ID	0	0	0	0	0 Spare	8* (Note 6)
OUI Octet 1								8.1*
OUI Octet 2								8.2*
OUI Octet 3								8.3*
PID Octet 1								8.4*
PID Octet 2								8.5*

Note 1 - This octet may be present only if octet 6 indicates certain acknowledged mode HDLC elements of procedures as indicated in User information layer 2 protocol (octet 6).

Note 2 - This octet may be present only if octet 6 indicates user specified layer 2 protocol.

Note 3 - This octet may be present only if octet 7 indicates a layer 3 protocol based on Recommendation X.25, ISO/IEC 8208, or X.223/ISO 8878 as indicated in User information layer 3 protocol (octet 7).

Note 4 - This octet may be present only if octet 7 indicates user specified layer 3 protocol.

Note 5 - These octets may be present only if octet 7 indicates ISO/IEC TR 9577.

Note 6 - This octet group shall be present only if octet 7 indicates ISO/IEC TR 9577 and octets 7a and 7b indicate IEEE 802.1 SNAP.

Figure 5-32 Broadband Low Layer Information Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized

IE Instruction Field (octet 2)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

User information layer 1 protocol (octet 5)

Use of this octet is not supported in this Implementation Agreement.

User information layer 2 protocol (octet 6)

Bits 5 4 3 2 1	Meaning
0 0 0 0 1	Basic mode ISO 1745
0 0 0 1 0	ITU-T Recommendation Q.921
0 0 1 1 0	ITU-T Recommendation X.25, link layer (Note 1)
0 0 1 1 1	ITU-T Recommendation X.25 multilink (Note 1)
0 1 0 0 0	Extended LAPB; for half duplex operation
0 1 0 0 1	HDLC ARM (ISO 4335 (Note 1)
0 1 0 1 0	HDLC NRM (ISO 4335 (Note 1)
0 1 0 1 1	HDLC ABM (ISO 4335 (Note 1)
0 1 1 0 0	LAN logical link control (ISO 8802/2)
0 1 1 0 1	ITU-T Recommendation X.75, single link procedure (SLP)
0 1 1 1 0	ITU-T Recommendation Q.922 (Note 1)
1 0 0 0 0	User specified (Note 2)
1 0 0 0 1	ISO 7776 DTE-DTE operation (Note 1)

Note 1 - When this coding is included, octets 6a and 6b with ITU-T encoding may be included.

Note 2 - When this coding is included, octet 6a will include user coding for the user specified layer 2 protocol.

Octet 6a for ITU-T codings

Mode of operation (octet 6a)

Bits 7 6	Meaning
0 1	normal mode of operation
1 0	extended mode of operation

Q.933 use (octet 6a)

Bits 2 1	Meaning
0 0	for use when the coding defined in Recommendation Q.933 is not used.

Window size (k) (octet 6b)

Binary coding of k parameter value in the range from 1 to 127.

Octet 6a for user protocol

User specified layer 2 protocol information (octet 6a)

The use and coding of octet 6a is according to user defined requirements.

User information layer 3 protocol (octet 7)

Bits 5 4 3 2 1	Meaning
0 0 1 1 0	ITU-T Recommendation X.25, packet layer (Note 1)
0 0 1 1 1	ISO/IEC 8208 (X.25 packet level protocol for data terminal equipment) (Note 1)
0 1 0 0 0	X.223/ISO 8878 (use of ISO/ISO 8208 [41] and ITU-T X.25 to provide the OSI-CONS) (Note 1)
0 1 0 0 1	ISO/IEC 8473 (OSI connectionless mode protocol)
0 1 0 1 0	CCITT Recommendation T.70 minimum network layer
0 1 0 1 1	ISO/IEC TR 9577 (Protocol Identification in the Network Layer) (Note 2)
1 0 0 0 0	User specified (Note 3)

Note 1 - When this coding is included, octets 7a, 7b, and 7c with ITU-T encoding may be included.

Note 2 - If extension octets (7a-7b) are not included, the Layer 3 protocol(s) carried in the user plane are identified by examining each layer 3 protocol data unit, according to ISO/IEC TR 9577. More than one layer 3 protocol may thus be carried on a connection.

If extension octets are present, the ISO/IEC TR 9577 Initial Protocol Identifier (IPI) is not carried in the user plane.

Note 3 - When this coding is included, octet 7a will include user coding for the user specified layer 3 protocol.

Octet 7a for ITU-T codings

Mode of operation (octet 7a)

Bits 7 6	Meaning
0 1	normal packet sequence numbering
1 0	extended packet sequence numbering

Default packet size (octet 7b)

Bits 4 3 2 1	Meaning
0 1 0 0	default packet size 16 octets
0 1 0 1	default packet size 32 octets
0 1 1 0	default packet size 64 octets
0 1 1 1	default packet size 128 octets
1 0 0 0	default packet size 256 octets
1 0 0 1	default packet size 512 octets
1 0 1 0	default packet size 1024 octets
1 0 1 1	default packet size 2048 octets
1 1 0 0	default packet size 4096 octets

Packet window size (octet 7c, bits 7-1)

Binary coding of packet window size value in the range 1 to 127.

Octet 7a for user protocol

User specified layer 3 protocol identification (octet 7a)

The use and coding of octet 7a depends on user defined requirements.

ISO/IEC TR 9577 Network Layer Protocol Identifier (NLPID) and IEEE 802.1 SNAP identifier (octets 7a-7b, 8-8.5)

Octet 7a and bit 8 of octet 7b indicate the ISO/IEC TR 9577 Initial Protocol Identifier (IPI) for the protocol to be carried in the user plane. If octets 7a and 7b are coded as '10000000', indicating an IEEE 802.1 SNAP identifier (see Annex D of ISO/IEC TR 9577), Octets 8.1-8.5 will contain a 40 bit SNAP identifier, consisting of a 24-bit organization unique identifier (OUI) and a 16-bit protocol identifier (PID). The NLPID coding shall only be used if there is no ITU-T standardized coding for the layer 3 protocol being used, and an ISO/IEC TR 9577 or SNAP coding applies for that protocol. The SNAP coding shall be used for a layer 3 protocol only if ISO has not assigned an NLPID for the layer 3 protocol. The SNAP coding can also be used to indicate that bridged LAN frames are to be carried in the user plane.

5.4.5.10 Call State

The purpose of the Call state information element is to describe the current status of a call or a global interface state.

Bits 8	7	6	5	4	3	2	1	Octets
Call state 0	0	0	1	0	1	0	0	1
Information element identifier								
1 ext	Coding Standard		IE Instruction Field					2
Length of call state contents								3
Length of call state contents (continued)								4
0 Spare	0	Call state value/ global interface state value						5

Figure 5-33 Call State Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized

IE Instruction Field (octet 2)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

Call State Value (octet 5)

Bits 6 5 4 3 2 1	Meaning: User state	Meaning: Network state
0 0 0 0 0 0	U0 - Null	N0 - Null
0 0 0 0 0 1	U1 - Call initiated	N1 - Call initiated
0 0 0 0 1 1	U3 - Outgoing call proceeding	N3 - Outgoing call proceeding
0 0 0 1 1 0	U6 - Call present	N6 - Call present
0 0 1 0 0 0	U8 - Connect request	N8 - Connect request
0 0 1 0 0 1	U9 - Incoming call proceeding	N9 - Incoming call proceeding
0 0 1 0 1 0	U10 - Active	N10 - Active
0 0 1 0 1 1	U11 - Release request	N11 - Release request
0 0 1 1 0 0	U12 - Release indication	N12 - Release indication

Global Interface State Value (octet 5)

Bits 6 5	4 3 2 1	Meaning
0 0	0 0 0 0	REST 0 - Null
1 1	1 1 0 1	REST 1 - Restart request
1 1	1 1 1 0	REST 2 - Restart

5.4.5.11 Called Party Number

The purpose of the Called party number information element is to identify the called party of a call.

Bits

8	7	6	5	4	3	2	1	Octets
Called party number								
0	1	1	1	0	0	0	0	1
Information element identifier								
1 ext	Coding Standard		IE Instruction Field					2
Length of called party number contents								3
Length of called party number contents (continued)								4
1 ext	Type of number			Addressing/numbering plan identification				5
0	Address/Number Digits (IA5 characters)							6 etc. Note 1
ATM Endsystem Address Octets								6 etc. Note 2

Note 1 - If the use of the E.164 numbering plan is indicated in the addressing/numbering plan identification, the number digits appear in multiple octet 6's in the same order in which they would be entered on a numeric keypad; i.e., the number digit which would be entered first is located in first octet 6. Digits are coded in IA5 characters. Bit 8 is set to 0.

Note 2 - If the use of ATM Endsystem Address is indicated in the addressing/numbering plan identification, the address is coded as described in ISO 8348/AD 2, using the preferred binary encoding of the ISO NSAP format.

Figure 5-34 Called Party Number Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized

IE Instruction Field (octet 2)

Bits 5 4 3 2 1	Meaning
0 0 0 0 0	IE instruction field not significant

Type of Number (octet 5)

Bits 7 6 5	Meaning
0 0 0	Unknown
0 0 1	International number

Addressing/Numbering Plan Identification (octet 5)

Bits 4 3 2 1	Meaning
0 0 0 1	ISDN/telephony numbering plan (Recommendation E.164) (Note 1)
0 0 1 0	ATM Endsystem Address (Note 2)

Note 1 - If the E.164 numbering plan is used, "Type of Number" shall be coded as "International Number"

Note 2 - If the ATM Endsystem Address addressing format is used, "Type of Number" shall be coded as "Unknown"

Address (octet 6, etc.)

If the coding "international number/ISDN/telephony numbering plan (Recommendation E.164)" is used, the address is coded as IA5 characters according to the format specified in the numbering plan. If the coding "unknown/ATM Endsystem Address" is used, the address is coded as described in ISO 8348, Addendum 2, using the preferred binary encoding.

5.4.5.12 Called Party Subaddress

The purpose of the Called party subaddress information element is to identify the subaddress of the called party of a call. It is used in this Implementation Agreement only to convey an ATM address in the ATM Endsystem Address format across a public network which supports only E.164 addresses. The ATM Endsystem Address is based on the ISO NSAP format but is not an ISO NSAP. Support of this information element by the network is mandatory.

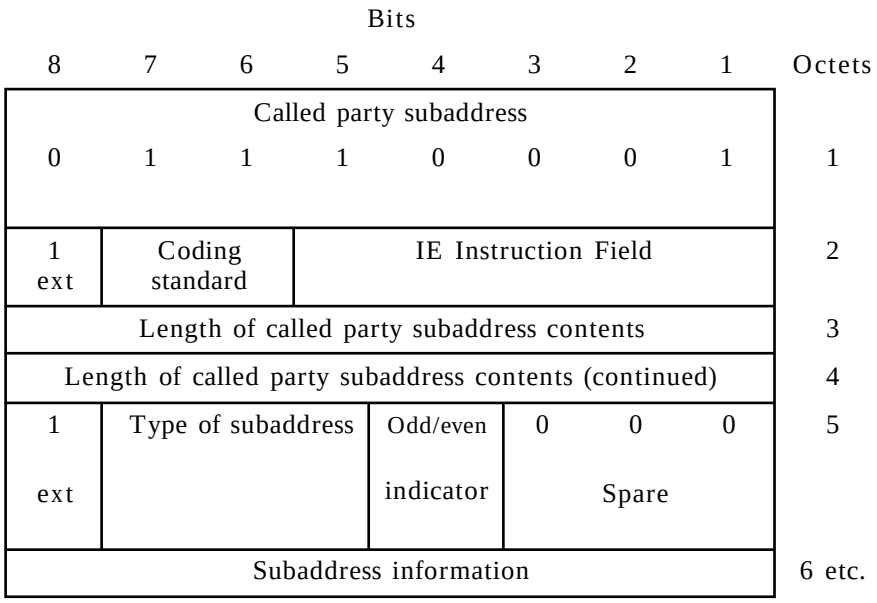


Figure 5-35 Called Party Subaddress Information Element

Coding Standard (octet 2)

Bits 76	Meaning
00	ITU-T standardized

IE Instruction Field (octet 2)

Bits 54321	Meaning
00000	IE instruction field not significant

Type of Subaddress (octet 5)

Bits 765	Meaning
000	NSAP (X.213/ISO 8348 AD2)
001	ATM Endsystem Address

Odd/even Indicator (octet 5)

The Odd/even indicator is not used in this Implementation Agreement.

Subaddress information (octet 6)

The NSAP X.213/ISO8348AD2 address, shall be formatted as specified by octet 6 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in X.213/ISO 8348 AD2. For the definition of this type of subaddress, see Recommendation I.334.

The ATM Endsystem Address shall be formatted as specified by octet 6 which contains the Authority and Format Identifier (AFI) and is formatted as defined in Section 5.1.3.1 of this Implementation Agreement. The encoding is made according to the "preferred binary encoding" as defined in X.213/ISO 8348. The ATM Endsystem Address uses the code point defined as "User specified, ATM Endsystem Address" in ITU-T Recommendation Q.2931.

5.4.5.13 Calling Party Number

The purpose of the calling party number information element is to identify the origin of a call.

Bits 8	7	6	5	4	3	2	1	Octets
Calling party number								
0	1	1	0	1	1	0	0	1
Information element identifier								
1 ext	Coding Standard		IE Instruction Field					2
Length of calling party number contents								3
Length of calling party number contents (continued)								4
0/1 ext	Type of number			Addressing/numbering plan identification				5
1 ext	Presentation Indicator		0	0	0	Screening Indicator		5a*
0	Address/number digits (IA5 characters)							6* etc. Note 1
ATM Endsystem Address Octets								6* etc. Note 2

Note 1 - If the use of the E.164 numbering plan is indicated in the addressing/numbering plan identification, the number digits appear in multiple octet 6's in the same order in which they would be entered on a numeric keypad; i.e., the number digit which would be entered first is located in first octet 6. Digits are coded in IA5 characters. Bit 8 is set to 0.

Note 2 - If the use of ATM Endsystem Address is indicated in the addressing/numbering plan identification, the address is coded as described in ISO 8348/AD 2, using the preferred binary encoding of the ISO NSAP format.

Figure 5-36 Calling Party Number Information Element