The ATM Forum

Technical Committee

ATM User-Network Interface (UNI)
Signalling Specification
Version 4.1

af-sig-0061.002

April 2002

(Contents are identical to af-sig-0061.001)

A C K N O W L E D G M E N T S

Preface to SIG 4.1

The SIG 4.1 specification is contained in af-sig-0061.002 and in af-sig-0061.001. The contents of both documents are strictly identical, the only difference being that af-sig-0061.001 contains revision marks to the existing UNI 4.0 signalling text of af-sig-0061.000. **In the unlikely case of discrepancies between the two documents, the text of af-sig-0061.002 has precedence over the text of af-sig-0061.001.**

This new version of UNI Signalling specification, i.e. version 4.1, is comprised of:

- af-sig-0061.000, ATM User-Network Interface (UNI) Signalling Specification, Version 4.0 [33] (1996)
- af-sig-0076.000, Addendum to UNI Signalling V4.0 for ABR parameter negotiation [42]
- af-cs-0107.000, Addressing Addendum to ATM User-Network Interface (UNI) Signalling Specification, Version 4.0 [34]
- Additional technical (see section 1.6) and editorial changes

As a result, this specification supersedes the above three UNI signalling specifications.

The UNI Signalling 4.1 specification also incorporates material from ITU-T Recommendations published since the release of UNI Signalling 4.0 (see Section 1.6 for more details).

The purpose of the UNI Signalling 4.1 specification is to provide an integrated basis for existing and future UNI signalling addenda. The following addenda are not integrated in this specification and are applicable to UNI Signalling 4.1:

- Security Addendum [35],
- PHY/MAC Identifier Addendum [36],
- Network Call Correlation Identifier Addendum [37],
- UBR with MDCR Addendum [38], and
- Modification of an Active Connection Addendum [39]
- Behavior Class Selection [40]
- Guaranteed Frame Rate [41].
- Domain based rerouting [43]
- Operation of the Bearer Independent call control (BICC) Protocol with SIG 4.0/PNNI 1.0/AINI [44]

In af-sig-0061.001 revision marks to better identify changes to the UNI Signalling 4.0 text, text changes are provided in the following manner:

- Additions are shown as underlined blue text (as is this parenthetical note),
- Deletions are shown as struck through red text (as is this parenthetical note), and
- Explanatory footnotes to some deletions are shown as red text as in the following example:
    deleted text [1]

In af-sig-0061.002 no revision marks are present This means that all deletions and related explanatory footnotes, as described above, are removed. Furthermore additions are not identified and thus shown as black text without underline.

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[1] Explanatory footnote to deleted text

Table of Contents

1.0 General

This document is an update to ATM User-Network Interface (UNI) Signalling Specification, Version 4.0 [33]. This document specifies some corrections to UNI 4.0 [33], some additional optional capabilities, and the deletion of the optional Leaf Initiated Join capability. It incorporates and supersedes: the ATM User-Network Interface (UNI) Signalling Specification, Version 4.0 [33], the Addendum to UNI for ABR parameter negotiation [42] and the Addressing Addendum to ATM User-Network Interface [34].

UNI Signalling 4.1 is backward compatible with UNI Signalling 4.0. For this reason, this document does not specify a new protocol version (i.e. the UNI Signalling Version, as indicated by the ILMI procedures, is still 4.0). Section 1.6 provides an overview of the main differences with UNI signalling 4.0.

This Specification provides the signalling procedures for dynamically establishing, maintaining and clearing ATM connections at the ATM User-Network Interface. The procedures are defined in terms of messages and the information elements used to characterize the ATM connection. The procedures included in this Specification 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.

Throughout this document, frequent reference is made to ITU-T Recommendations. In some cases, the ATM Forum UNI Signalling Specification, 4.1 deviates from the ITU-T Recommendations. It should be understood that all ATM Forum modifications apply to the procedures described in this document, even though the ITU-T Recommendations are being referenced directly.

1.1 Reference Configurations

The protocol is valid for the private and public UNI.

The purpose of a reference configuration for the UNI Signalling Specification is to list all the elements of an ATM network and the links among them, to which this Specification applies.

Network elements in this context are:

- Endpoint equipment
- Private ATM network
- Public ATM network.

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

The possible reference configurations that apply to this Specification are given in Table 1-1. Except where noted in this document, the procedures for Public UNI and Private UNI are identical.

Table 1-1 Reference Configurations

BETWEEN → ↓	End-point Equipment	Private ATM Network	Public ATM Network
End-point Equipment	Note 1	Private UNI	Public UNI
Private ATM Network	Private UNI	Note 1	Public UNI
Public ATM Network	Public UNI	Public UNI	Note 1

Note 1 -   The table entry for this connection is outside the domain of this Specification.

1.2 UNI Signalling 4.1 Capabilities

Table 1-2 shows the capabilities available within the ATM Forum UNI Signalling Specification, 4.1. Capabilities are listed as applicable to a terminal equipment and a network node (switching system) and are categorized as mandatory (M) or optional (O).

Implementations claiming conformance to the UNI Signalling Specification, Version 4.1, shall support the capabilities listed as Mandatory in table 1-2; i.e., by implementing the procedures of the corresponding sections of this Specification. Some capabilities that are categorized as mandatory in this Specification are not provided in the UNI 3.1 Specification, the B-ICI 2.0 Specification and/or the relevant ITU-T Recommendations. Procedures are provided in this Specification to support interworking across such interfaces. UNI Signalling 4.1 implementations shall support at least these procedures and recognize the corresponding information elements.

Table 1-2 UNI Signalling 4.1 Capabilities

No.	Capability	Terminal Equipment	Switching System
1.	Point-to-point Calls	M	M
2.	Point-to-multipoint Calls	O	M
3.	Signalling of Individual QoS Parameters	M	M
5.	ATM Anycast	O	Note 1
6.	ABR Signalling for Point-to-point Calls	O	O
7.	Generic Identifier Transport	O	O
8.	Virtual UNIs	O	O
9.	Switched Virtual Path (VP) service	O	O
10.	Proxy Signalling	O	O
11.	Frame Discard	O	O(Note 2)
12.	Traffic Parameter Negotiation	O	O
13.	Supplementary Services	-	-
13.1	Direct Dialing In (DDI)	O	O
13.2	Multiple Subscriber Number (MSN)	O	O
13.3	Calling Line Identification Presentation (CLIP)	O	O
13.4	Calling Line Identification Restriction (CLIR)	O	O
13.5	Connected Line Identification Presentation (COLP)	O	O
13.6	Connected Line Identification Restriction (COLR)	O	O
13.7	Subaddressing (SUB)	O	Note 3
13.8	User-user Signalling (UUS)	O	O
14.	Security [35]	O	O
15.	PHY/MAC Identifier [36]	O	O

16.	Network Call Correlation Identifier [37]	O	O
17.	UBR with MDCR [38]	O	O
18.	Modification of an Active Connection [39]	O	O
19.	Domain based rerouting [43]	O	O
20.	Behavior Class Selector Signalling [40]	O	O
21.	Guaranteed Frame Rate [41]	O	O
22.	Soft Permanent Virtual Connections (Soft PVC)	O	O
23.	Enhanced Status Enquiry	O	O
24.	OAM Traffic Descriptor	O	O
25.	End-to-end connection completion indication	O	O
26.	Handling of Frame Discard Indication considering the AAL type	O	O

Note 1 -   This capability is optional for public networks/switching systems and is mandatory for private networks/switching systems.

Note 2 -   Transport of the Frame Discard indication is Mandatory.

Note 3 -   This capability is mandatory for networks/switching systems (public and private) that support only native E.164 address formats.

1.3 References

Only the specific versions of the following referenced documents and the specific versions of the documents referenced within these documents are applicable to this Specification.

1.   ITU-T Recommendation E.164 (1997)   International Public Telecommunication Numbering Plan
2.   ITU-T Recommendation I.361 (1999) B-ISDN ATM Layer Specification
3.   ITU-T Recommendation I.363.5 (1996)   B-ISDN ATM Adaptation Layer Type 5 Specification
4.   ITU-T Recommendation Q.2110 (1994)   B-ISDN ATM adaptation layer - Service Specific Connection Oriented Protocol (SSCOP)
5.   ITU-T Recommendation Q.2130 (1994)   B-ISDN SAAL Service Specific Coordination Function for support of signalling at the user-network interface (SSCF at the UNI)
6.   ITU-T Recommendation Q.2610 (1999)   B-ISDN Usage of Cause and Location in B-ISDN User Part and DSS2
7.   ITU-T Recommendation Q.2931 (1995)   B-ISDN DSS2 User-Network Interface (UNI) Layer 3 Specification for Basic Call/Connection Control
8.   ITU-T Recommendation Q.2951 (1995)   Stage 3 Description for Number Identification Supplementary Services Using B-ISDN DSS2 Basic Call
9.   ITU-T Recommendation Q.2957 (1995)   B-ISDN, Stage 3 Description for Additional Information Transfer Supplementary Services Using B-ISDN DSS 2, Basic Call Clause 1 – User-to-user signalling (UUS)
10.   ITU-T Recommendation Q.2961.1 (1995)   B-ISDN DSS2 - Additional Traffic Parameters
11.   ITU-T Recommendation Q.2962 (1998)   B-ISDN DSS2 Connection Characteristics Negotiation During Call/Connection Establishment Phase
12.   ITU-T Recommendation Q.2971 (1995)   B-ISDN DSS2 UNI Layer 3 Specification for Point-to-Multipoint Call/Connection Control
13.   af-uni-0010.002   User-Network Interface, Version 3.1, (1994).
14.   af-vtoa-0078.000   Circuit Emulation Service Interoperability Specification 2.0, (1997)
15.   af-saa-0048-000   Native ATM Services: Semantic Description, Version 1.0 Specification, (1996).
16.   af-pnni-0055.002   Private Network-Network Interface Specification, Version 1.1, (2002)

17. af-tm-0121.000   Traffic Management Specification Version 4.1, (1999)
18. af-ilmi-0065.000   Integrated Local Management Interface (ILMI) Specification Version 4.0, (1996)
19. af-saa-0049.000   Audiovisual Multimedia Services :Video on Demand Specification Version 1.0, (1995)
20. ISO/IEC 6523-1984   Data Interchange - Structure for the identification of organizations
21. ISO/IEC 8348-1983   Information Technology - Telecommunications and Information Exchange Between Systems - Network Service Definition, 1993.
22. ITU-T Recommendation Q.2931 Amendment 2 (1999) Amendment 2 (03/99) to Recommendation Q.2931 - Digital Subscriber Signalling System No. 2 - User-Network Interface (UNI) Layer 3 specification for basic call/connection control
23. ITU-T Recommendation Q.2931 Amendment 4 (1999) Amendment 4 to Recommendation Q.2931 - Digital Subscriber Signalling System No. 2 - User-Network Interface (UNI) Layer 3 specification for basic call/connection control
24. ITU-T Recommendation Q.2931 Amendment 2 Corrigendum 1 (2000)   Digital Subscriber Signalling System No. 2 - User-Network Interface (UNI) Layer 3 specification for basic call/connection control, Amendment 2, Corrigendum 1
25. ITU-T Recommendation Q.2971 Corrigendum 1(1999) Broadband Integrated Services Digital Network (B-ISDN) Digital Subscriber Signalling System No. 2 (DSS 2): User-Network Interface (UNI) Layer 3 specification for point-to-multipoint call/connection control - Corrigendum 1
26. ITU-T Recommendation Q.2941.2 (1999) Broadband Integrated Services Digital Network (B-ISDN) Digital Subscriber Signalling System No. 2 (DSS 2): Generic Identifier Transport Extensions
27. ITU-T Recommendation Q.2941.3 (2000) Broadband Integrated Services Digital Network (B-ISDN) Digital Subscriber Signalling System No. 2 (DSS 2): Generic Identifier Transport Extension for support of Bearer Independent Call Control.
28. ITU-T Recommendation Q.2951.9 (1999), B-ISDN DSS 2 Support of ATM end system addressing format by Number identification supplementary services
29. ITU-T Recommendation Q.2957 Amendment 1 (1999) Amendment 1 to Recommendation Q.2957 STAGE 3 Description for Additional Information Transfer Supplementary Services using B-ISDN Digital Subscriber Signalling System No. 2 (DSS 2) – basic call
30. ITU-T Recommendation Q.2965.2 (1999)   Digital Subscriber Signalling System No. 2 – Signalling of individual Quality of Service parameters
31. ITU-T Report of the meeting held in Geneva from 1-19 September 1997 - Part 1 - Implementor's guide (Version 9/97) for Q.2110 (07/94).
32. af-ra-0106.000   Addressing: Reference Guide version 1.0 (1999), ATM Forum Technical Committee, (1999).
33. af-sig-0061.000   ATM User-Network Interface (UNI) Signalling Specification, Version 4.0, (1996).
34. af-cs-0107.000   Addressing Addendum to ATM User-Network Interface (UNI) Signalling Specification, Version 4.0, (1999).
35. af-cs-0117.000   UNI Signalling 4.0 Security Addendum, (1999).
36. af-cs-0135.000   PHY/MAC Identifier Addendum to UNI Signalling 4.0, (1999).
37. af-cs-0140.000   Network Call Correlation Identifier v1.0, (2000).
38. af-cs-0147.000   UBR with MDCR Addendum to UNI Signalling 4.0, PNNIv1.0, and AINI, (2000).
39. af-cs-0148.001   Modification of Traffic Parameters for an Active Connection Signalling Specification (PNNI, AINI, and UNI) Version 2.0, (2001).
40. af-cs-0159.000   Behavior Class Selector Signalling Specification v1.0, (2000).
41. af-cs-0167.000   Guaranteed Frame Rate (GFR) Signalling Specification (PNNI, AINI, and UNI), v1.0, (2001).
42. af-sig-0076.000   Addendum to UNI Signalling V4.0 for ABR parameter negotiation, (1997).
43. af-cs-0173.000   Domain-based rerouting for active point-to-point calls version 1.0, (2001).

44.   af-cs-vmoa-0146.000   Operation of the Bearer Independent call control (BICC) Protocol with SIG 4.0/PNNI 1.0/AINI, (2000)
45.   ITU-T Recommendation Q.2961.2 (1997)   B-ISDN DSS2 Additional traffic parameters: Support of ATM transfer capability in the broadband bearer capability information element
46.   ITU-T Recommendation Q.2965.1 (1999)   B-ISDN DSS2 Support of Quality of Service Classes
47.   af-vtoa-0084.000   Voice and Telephony over ATM to the Desktop specification (1999)
48.   ITU-T Recommendation Q.2951 Corrigendum 1(1998) Stage 3 Description for Number Identification Supplementary Services Using B-ISDN Digital Subscriber Signalling System No. 2 (DSS 2) - Basic Call - Corrigendum 1

1.4 Document Organization

Table 1-3 offers a brief overview of the organization of this document.

Table 1-3 UNI Signalling 4.1 Document Organization

Section	Description
1	UNI Signalling 4.1 Specification scope, capabilities and references
2	Messages and procedures for point-to-point calls
3	Addressing considerations for public and private networks
4	Definition of the Signalling ATM Adaptation Layer (SAAL)
5	Procedures for point-to-multipoint calls
6	
7	ATM Anycast capability
8	Connection Characteristics (Traffic Parameters) Negotiation
9	Signalling of individual QoS Parameters
10	Point-to-point ABR Connections
Annex 1	Guidelines for use of ATM address formats
Annex 2	Proxy signalling capability
Annex 3	
Annex 4	Supplementary service support
Annex 5	
Annex 6	Connection scope selection for the Anycast capability
Annex 7	Procedures when optional capabilities are not supported
Annex 8	Use of Virtual UNIs
Annex 9	Guidelines on use of Bearer Class, Traffic Parameters and Quality of Service
Annex 10	Handling of the RM Fixed Round Trip Time for ABR Connections
Annex 11	Soft PVCs
Annex 12	Status Enquiry for multiple calls/parties in one message
Annex 13	Handling of Frame Discard Indication considering the AAL type
Appendix A	Examples of codings for SIG 4.1
Appendix B	
Appendix C	Information on Cell Replication for point-to-multipoint connections
Appendix D	Known Differences between Q.2931 and Section 8.
Appendix E	Known Differences with UNI 3.1
Appendix F	Overview of Some Referenced ITU-T Documents

It should be noted that the sections 1 - 10 and the Annexes 1 - 13 form the normative part of this Specification. The Appendices are for informative purposes.

1.5 Acronyms

AAL   ATM Adaptation Layer
ABR   Available Bit Rate
ADTF   Allowed Cell Rate Decrease Time Factor
AESA   ATM EndSystem Address
ATC   ATM Transfer Capability
ATM   Asynchronous Transfer Mode
BBC   Broadband Bearer Capability
BCOB   Broadband Connection Oriented Bearer class

BICC	Bearer Independent Call Control
B-ISDN	Broadband Integrated Services Digital Network
B-LLI	Broadband low layer information
BNC-id	Backbone Network Connection Identifier
CBR	Constant Bit Rate
CDF	Cutoff Decrease Factor
CDV	Cell Delay Variation
CLIR	Calling Line Identification Restriction
CLP	Cell Loss Priority
CLR	Cell Loss Ratio
COLP	Connected Line Identification Presentation
COLR	Connected Line Identification Restriction
CTD	Cell Transfer Delay
DBR	Deterministic Bit Rate
DDI	Direct Dialling In
DSM-CC	Digital Storage Media Command & Control
ICR	Initial Cell Rate
ILMI	Integrated Local Management Interface
IE	Information Element
ID	Identifier
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
maxCTD	Maximum Cell Transfer Delay
MBS	Maximum Burst Size
MCR	Minimum Cell Rate
MIB	Management Information Base
MPLS	Multi-Protocol Label Switching
MPOA	Multi-Protocol Over ATM
MSN	Multiple Subscriber Number
NI	network interface
N-ISDN	Narrowband Integrated Services Digital Network
NNI	Network-to-Network Interface
NSAP	Network Service Access Point
OAM	Operations Administration and Maintenance
PBX	Private Branch Exchange
PCR	Peak Cell Rate
PNNI	Private Network-to-Network Interface
PSA	Proxy Signalling Agent
PTI	Payload Type Identifier
PVC	Permanent Virtual Connection
PVCC	Permanent Virtual Channel Connection
PVPC	Permanent Virtual Path Connection
QoS	Quality of Service
RDF	Rate Decrease Factor
RIF	Rate Increase Factor
RM	Resource Management
SAAL	Signalling ATM Adaptation Layer
SBR	Statistical Bit Rate
SCR	Sustainable Cell Rate
SRTD	signalling round trip delay
SSCF	Service Specific Coordination Function
SSCOP	Service Specific Connection Oriented Protocol
SSCS	Service Specific Convergence Sublayer
SUB	Subaddressing
SVC	Switched Virtual Connection

SVCC	Switched Virtual Channel Connection
SVPC	Switched Virtual Path Connection
TBE	Transient Buffer Exposure
UBR	Unspecified Bit Rate
UNI	User-Network Interface
UUS	User to User Signalling
VBR	Variable Bit Rate
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VF	Variance Factor
VP	Virtual Path
VPC	Virtual Path Connection
VPCI	Virtual Path Connection Identifier
VPI	Virtual Path Identifier
VPN	Virtual Private Network

1.6 Known differences with UNI Signalling 4.0 (UNI 4.0)

The UNI Signalling 4.1 specification is an update to UNI Signalling 4.0. The main difference with UNI Signalling 4.0 is that it includes:

- Updated information from the following ITU-T Documents (see Appendix F for an overview of the content of these documents)
  - Second Edition of Q.2610 [6]
  - Q.2931 Amendment 2 [22]
  - Q.2931 Amendment 4 [23]
  - Corrigendum 1 to Q.2931 Amendment 2 [24]
  - Q.2971 Corrigendum 1[25]
  - Q.2941.2 [26]
  - Q.2941.3 [27]
  - Q.2951.9 [28]
  - Q.2957 Amendment 1 [29]
  - Implementors' Guide For Q.2110 [31].
  - Q.2951 Corrigendum 1 [48]
- Corrections to the ABR negotiation procedures from the Addendum to UNI for ABR parameter negotiation [42].
- Changes from the Addressing Addendum to ATM User-Network Interface [34] (Including replacement of the content of section 3.1 and 7.1 with a reference to the ATM Forum Addressing: Reference Guide [32] removal of Annex 5 and revisions to Annex 1).
- Discontinued Support for Leaf Initiated Join Capability (including removal of section 6, Annex 3, and Appendix B).
- Inclusion of Soft PVC capability in Annex 11.
- Inclusion of Status Enquiry procedure for multiple calls/parties in one message in Annex 12.
- Renaming of the ABR setup parameter and ABR additional parameters information elements to ATC setup parameter and ATC additional parameters information elements, respectively.
- Correction of the ambiguity for the coding standard to be used for the ATC setup parameters, the Generic identifier transport, and the Minimum acceptable ATM traffic descriptor information elements.
- Elimination of the option that allowed the inclusion of information elements with length of 0 in messages.
- Increase in the maximum length of the B-LLI and AAL information elements.
- The capability at the T_B reference point of relaying ATC values in the B-BC information element that are not allowed to be transmitted by SIG 4.1 endsystems at the S_B or coincident S_B and T_B reference points.

- Clarification of the general VPCI/VCI assignment procedures and clarification of the VPCI/VCI assignment procedures at the destination interface for proxy signalling.
- Addition of a Notification information element codepoint for adaptive timing recovery.
- Support for the OAM traffic descriptor information element.
- Extension to the negotiation procedures in section 8 for the Minimum ATM traffic descriptor to apply to all traffic parameters.
- Addition of two ATC values in the B-BC information element for non-real time VBR using the VBR.2 and VBR.3 conformance definitions.
- Inclusion of procedures for handling of frame discard taking the ATM Adaptation Layer into account (Annex 13).

1.7 Support for UNI Signalling 4.0 Addenda

The extensions to UNI Signalling 4.0 in the following documents apply.

- Security Addendum [35],
- PHY/MAC Identifier Addendum [36],
- Network Call Correlation Identifier Addendum [37],
- UBR with MDCR Addendum [38], and
- Modification of an Active Connection Addendum [39]
- Behavior Class Selector [40]
- Guaranteed Frame Rate [41].
- Domain based rerouting [43]
- Operation of the Bearer Independent call control (BICC) Protocol with SIG 4.0/PNNI 1.0/AINI [44]

with the following changes:

- all references to UNI 4.0 [33] in these documents are replaced by a reference to this document (i.e. to SIG 4.1).
- all modifications to table 2-1 of UNI 4.0 [33]   shall be deleted since these modifications are incorporated in section 2 §4.5.1/Q.2931 of this document (i.e. SIG 4.1)
- The following portions of the Guaranteed Frame Rate Specification [41] document are superseded since they have been incorporated in this document:
    1. In 2.2.1.2/[41], deleted the first bullet item.
    2. In 2.2.1.4/[41] Octet groups 11 through 14 are renumbered to be Octet groups 23-26, respectively.
    3. In 2.2.1.4/[41], the specified replacement of the last paragraph of 8.1.2.2 is not applicable, since the change is incorporated in this document.
    4. In 3.1.3/[41], the 2 general changes specified in the bullet items and the deletion of the last sentence of the 2nd paragraph of section 8 are not applicable, since the changes are incorporated in this document.
    5. The changes in 3.2/[41] are not applicable, since the changes are incorporated in this document.
- The following portions of the Operation of the Bearer Independent call control (BICC) Protocol with SIG 4.0/PNNI 1.0/AINI [44] document are superseded since the coding of the referenced coding of the Generic Identifier Transport information element has been incorporated in this document:
    1. Replace all references to Q.2941.3 with a reference to this document (i.e. to SIG 4.1).
    2. Replace the content of section 5.1 and all of its subsections with: "The necessary extensions to the Generic Identifier Transport information element are specified in SIG 4.1".

2.0 Basic Point-to-Point Call

When setting up a point-to-point call, the ITU-T Recommendations Q.2931 [7] as modified by Amendment 2 of Q.2931 [22], Corrigendum 1 to Amendment 2 of Q.2931 [24], and Amendment 4 of Q.2931 [23], and Q.2961.1 [10] shall apply, with the exceptions stated in this section.

Although there is also an Amendment 1 and an Amendment 3 to Q.2931, they are not referenced here. This specification contains the material which applies in place of that which is contained within those amendments.

All clauses, annexes and appendices of Recommendations:
- *Q.2931 [7] as modified by Amendment 2 of Q.2931 [22], Corrigendum 1 to Amendment 2 of Q.2931 [24], and Amendment 4 of Q.2931 [23],*
- *and Q.2961.1 [10]*

shall apply.

Only the subclauses/annexes/appendices of these Recommendations that have been modified by this document are given below. In this Specification, subclauses, annexes, appendices, etc. of referenced documents, such as Q.2931, are identified by the actual subclause/annex/appendix number from that document, the document number and the title of the subclause/annex/appendix. For example, an exception to procedures in section 3.1.3 of Q.2931 is identified below by a statement titled "3.1.3/Q.2931 CONNECT". References to a section of Q.2931 are to the section as modified by Amendments 2 [22], Corrigendum 1 to Amendment 2 of Q.2931 [24], and Amendment 4 of Q.2931 [23]. e.g. a reference to 4.5.5/Q.2931 would be to the revised text in Amendment 2 of Q.2931.

When a VPCI/VCI value is assigned, the allocation is in both directions even when the connection is unidirectional (has zero backward bandwidth). The VPCI/VCI value cannot be used for another connection until the call is cleared.

1.0/Q.2931 Scope:

This Section and all its subsections are for informative purpose only.

1.3.11/Q.2931 Public UNI ATM Addressing:

Add the phrase "and/or private UNI" after "public UNI."

Replace the reference to "Recommendation E.191" with a reference to "the Addressing Reference Guide [32]".

2.2/Q.2931 Additional B-ISDN call/connection states relating to interworking requirements:

The states U2, U25, N2, N25 are not supported.

3.0/Q.2931 Message Functional Definitions and Contents:

Only information elements from codeset 0 are supported.

3.1.1/Q.2931 ALERTING:

Add the following to Table 3-2/Q.2931:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1	both	O	7-63

3.1.2/Q.2931 CALL PROCEEDING:

Clarification of Note 1 -
The Connection identifier information element is mandatory in the network-to-user direction regardless of whether Annex H is implemented or not. It is mandatory in the user-to-network direction, unless the user accepts the connection identifier indicated in the SETUP message.

3.1.3/Q.2931 CONNECT:

AAL parameters maximum length is modified from 21 to 30 (this is to allow growth for future applications).
Broadband low layer information maximum length is modified from 17 to 20 (this is to allow growth for future applications).

Note 4 is superseded by Note 1 of Section 9.1.1.1.

The Note in Table 1/Q.2961.1 of section 1.8.1.2/Q.2961.1 is replaced by the following:

Note- May be included in the user-to-network direction when the SETUP message contained an ATM traffic descriptor information element with the Tb parameter set to "1" or with the Backward Frame Discard indicator set to "1". May be included in the network-to-user direction when the SETUP message contained an ATM traffic descriptor information element with the Tf parameter set to "1", or with the Backward Frame Discard indicator set to "1". If included only for the above reasons, this information element contains only octets 1, 2, 3, 4, 17, and 17.1.

Add the following to Table 3-4/Q.2931:

Information Element Name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1	both	O	7-63

3.1.5/Q.2931 RELEASE:

Add the following to Table 3-6/Q.2931:

Information Element Name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1	both	O	7-63

3.1.6/Q.2931 RELEASE COMPLETE:

Add the following to Table 3-7/Q.2931:

Information Element Name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1	both	O	7-63

3.1.7/Q.2931 SETUP:

AAL parameters maximum length is modified from 21 to 30 (this is to allow growth for future applications).

Broadband low layer information maximum length is modified from 17 to 20 (this is to allow growth for future applications).

Called party number is mandatory in the network-to-user and user-to-network directions.

Called party number minimum length depends on addressing and the maximum length is specified at 25.

Calling party number maximum length is specified at 26.

Broadband sending complete is optionally included in the user-to-network and network-to-user directions.

Note 10 is superseded by Note 1 of Section 9.1.1.2.

Inclusion of the QoS parameter information element in this message is optional. See section 9.1.1.2 for additional information.

Transit network selection maximum length is specified at 9 octets. This information element is included only once in the message.

If the Calling party subaddress information element is used to convey an ATM endsystem address, then an additional Calling party subaddress information element may be present to convey an OSI NSAP or User specified subaddress. If the Called party subaddress information element is used to convey an ATM endsystem address, then an additional Called party subaddress information element may be present to convey an OSI NSAP or User specified subaddress.

Add the following to Table 3-8/Q.2931:

Information Element Name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1	both	O	7-63

3.1.11/Q.2931 Connection available(as added by Amendment 4)

Add the following to Table 3-24/Q.2931:

Information element	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1	both	O	7-63

3.2/Q.2931 Additional or modified messages related for the support of 64 kbit/s based ISDN circuit-mode services:

Exceptions noted for Section 3.1/Q.2931 above apply to this section as well (for the same messages).

3.2.4/Q.2931 INFORMATION:

This message type is not supported.

3.2.7/Q.2931 SETUP:

Exceptions noted for 3.1/Q.2931 above apply with the following exception:
- Broadband Sending Complete is mandatory in the user-to-network and network-to-user directions.

3.2.8/Q.2931 SETUP ACKNOWLEDGE:

This message type is not supported.

3.3.1/Q.2931 RESTART:

Replace the first paragraph with the following:

This message is sent by the user or the network to request the recipient to restart (i.e., return to an idle condition) the indicated virtual channel, the indicated virtual path, or all virtual channels in the indicated virtual path connection, or all virtual channels and virtual paths controlled by the signalling virtual channel. See Table 3-22/Q.2931.

Replace Note 2, Table 3-22/Q.2931 as follows:

Included when necessary to indicate the particular virtual channel(s) or virtual path to be restarted.

3.3.2/Q.2931 RESTART ACKNOWLEDGE:

Replace Note 2, Table 3-23/Q.2931 as follows:

Included when necessary to indicate the particular virtual channel(s) or virtual path which have been restarted.

4.4.1/Q.2931 Message Type:

The following message types are not supported:
- SETUP ACKNOWLEDGE
- INFORMATION

Escape to national specific message types is not supported.

4.5.1/Q.2931 Coding Rules:

Add the following two paragraphs after the existing third paragraph of 4.5.1/Q.2931 and replace Table 4-3/Q.2031 (part 1 of 2) with the following:

The procedures on reception of empty information elements is supported, however, the transmission of empty information elements is not.

The following informative table indicates the maximum length, minimum length, and maximum number of occurrences in a message are specified for each supported information element. For each information element, the "Defined in" column contains references to the section(s) and document(s) where the information element is defined and, when applicable, modified.

For information elements that are optional in a message, the minimum length shown in the table below differs from that in the message section of Q.2931. The message section of Q.2931 allows empty information elements to be sent. Sending of empty information elements is not allowed by this specification, so the following table shows the minimum length for optional information elements not as 4 but as the minimum length for the information element to have valid content, as defined in the sections referenced in the "Defined in" column.

For some information elements, the maximum length shown in the table differs from the maximum length that can be found in the message tables of this specification. When there is such a discrepancy, the maximum length shown in the table is the maximum length of the information element as modified by the ATM Forum specifications referenced in the "Defined in" column of the table.

TABLE 4-3/Q.2931 (part 1 of 2)

General information element format - Information element identifiers

Bits		Information Element	Max	Min.	Max no. of	Defined in
8 7 6 5	4 3 2 1		Length	Length	Occurrences	
0 0 0 0	0 1 0 0	Narrowband bearer capability [1, 2]	14	6	3	§2
0 0 0 0	1 0 0 0	Cause [1]	34	6	2	§2, A11.3.2.3
0 0 0 1	0 1 0 0	Call state [6]	3008	5	[6]	§2, A12.3.2.1
0 0 0 1	1 1 1 0	Progress indicator [1]	6	6	2	§2
0 0 1 0	0 1 1 1	Notification indicator	[3]	5	[3]	§2
0 1 0 0	0 0 1 0	End-to-end transit delay	11	7	1	§9.1.2.1
0 1 0 0	1 1 0 0	Connected number	25	6	1	§A4.1
0 1 0 0	1 1 0 1	Connected subaddress	25	6	1	§A4.1
0 1 0 1	0 1 0 0	Endpoint reference	7	7	1	§5
0 1 0 1	0 1 0 1	Endpoint state [7]	3008	5	[7]	§5, A12.3.2.2
0 1 0 1	1 0 0 0	ATM adaptation layer parameters	30	5	2	§2
0 1 0 1	1 0 0 1	ATM traffic descriptor	36	6[5]	1	§2, §10.1.2.3, §2.2.1.2/[41]
0 1 0 1	1 0 1 0	Connection identifier	9	9	1	§2
0 1 0 1	1 0 1 1	OAM traffic descriptor	6	6	1	§2
0 1 0 1	1 1 0 0	Quality of service parameter	6	6	1	§2
0 1 0 1	1 1 0 1	Broadband high layer information	13	5	1	§2
0 1 0 1	1 1 1 0	Broadband bearer capability	7	6	1	§2, §2.2.1.3/[41]
0 1 0 1	1 1 1 1	Broadband low-layer information [2]	20	5	3	§2
0 1 1 0	0 0 0 0	Broadband locking shift	5	5	[4]	§2
0 1 1 0	0 0 0 1	Broadband non-locking shift	5	5	[4]	§2
0 1 1 0	0 0 1 0	Broadband sending complete	5	5	1	§2
0 1 1 0	0 0 1 1	Broadband repeat indicator	5	5	2	§2
0 1 1 0	1 1 0 0	Calling party number	26	6	1	§2
0 1 1 0	1 1 0 1	Calling party subaddress [1]	25	6	2	§2
0 1 1 1	0 0 0 0	Called party number	25	6	1	§2
0 1 1 1	0 0 0 1	Called party subaddress [1]	25	6	2	§2
0 1 1 1	1 0 0 0	Transit network selection	9	6	1	§2
0 1 1 1	1 0 0 1	Restart indicator	5	5	1	§2
0 1 1 1	1 1 0 0	Narrowband low layer compatibility [2]	20	5	2	§2
0 1 1 1	1 1 0 1	Narrowband high layer compatibility [1]	7	5	2	§2
0 1 1 1	1 1 1 0	User-user	133	6	1	§Annex 4.8
0 1 1 1	1 1 1 1	Generic identifier transport [1]	63	7	3	§2.1.1
1 0 0 0	0 0 0 1	Minimum acceptable ATM traffic descriptor	34	7	1	§8.1.2.2, §2.2.1.4/[41]
1 0 0 0	0 0 1 0	Alternative ATM traffic descriptor	30	12	1	§8.1.2.1
1 0 0 0	0 1 0 0	ATC setup parameters	36	6	1	§10.1.2.2
1 0 0 0	1 0 0 1	Broadband report type	5	5	2	§2, §2.2.1.2/[39]
1 1 1 0	0 0 0 0	Called party soft PVPC or PVCC	11	8	1	A11.3.2.1
1 1 1 0	0 0 1 1	Calling party soft PVPC or PVCC	10	7	1	A11.3.2.2
1 1 1 0	1 0 1 1	Connection scope selection	6	6	1	§7.2.2.1

1 1 1 0	0 1 0 0	ATC additional parameters	14	14	1	§10.1.2.1
1 1 1 0	0 1 1 1	Security services	512	12	1	§4/[35]
1 1 1 0	1 1 0 0	Extended QoS parameters	25	7	1	§9.1.2.2
1 1 1 0	1 1 0 1	PHY/MAC-layer identifier	10	9	1	§3.1/[36]
1 1 1 0	1 1 1 1	Network call correlation identifier	38	15	1	§2/[37]
1 1 1 1	0 0 0 0	Minimum desired cell rate	13	13	1	§3.1/[38]
1 1 1 1	0 0 0 1	Optional traffic attributes	10	6	5	§2/[40]
1 1 1 1	0 0 1 0	Rerouting services	8	8	1	§5.1/[43]
1 1 1 1	0 1 0 0	Rerouting cause	5	5	1	§5.3/[43]
1 1 1 1	0 1 0 1	Reference list	3007	6	1	A12.3.2.3

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 maximum length and the number of repetitions of this information element are network dependent.

Note 4 -   See Section 2 (4.5.3/Q.2931, 4.5.4/Q.2931 and 5.6.6/Q.2931) for treatment of these information elements.

Note 5 -   The minimum length for the ATM traffic descriptor information element in the SETUP message is 12.

Note 6 -   When the optional procedures of Annex 12 are supported the Call state information element may be repeated once for each call state. When the optional procedures of Annex 12 are not supported, the maximum length for the Call state information element is 5 and the information element may not be repeated.

Note 7 -   When the optional procedures of Annex 12 are supported the Endpoint state information element may be repeated once for each party state. When the optional procedures of Annex 12 are not supported, the maximum length for the Endpoint state information element is 5 and the information element may not be repeated.

Coding standard for ISO/IEC standard and national standard are not supported.

The use of the information element identifier value "1111 1111" as a mechanism to extend the information element identifier code space is not supported and information elements with this identifier value will be treated as unrecognized information elements.

4.5.2/Q.2931 Extension of codesets:

Not supported.

4.5.3/Q.2931 Broadband locking shift procedures:

Recognition of Broadband locking shift information element is mandatory (all shifted information elements may be treated as unrecognized information elements; see Section 2, 5.6.6/Q.2931).

4.5.4/Q.2931 Broadband non-locking shift procedures:

Recognition of Broadband non-locking shift information element is mandatory (all shifted information elements may be treated as unrecognized information elements; see Section 2, 5.6.6/Q.2931).

4.5.5/Q.2931 ATM adaptation layer parameters:

(No changes)

4.5.6/Q.2931 ATM traffic descriptor:

Add the following traffic descriptor subfields (and related notes) to Figure 4-13/Q.2931, as modified by Figure 1/Q.2961.1:

8	7	6	5	4	3	2	1	
Traffic Management Options Identifier								17*
1	0	1	1	1	1	1	1	
For-ward Frame Dis-card	Back-ward Frame Dis-card	0	0	0	0	Tag-ging Back-ward	Tag-ging For-ward	17.1*
Best Effort Indicator								18* (Note B)
1	0	1	1	1	1	1	0	

Note B -   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 the ATM Forum Traffic Management Specification Version 4.1 [17]).

Best Effort Indication (octet 18)

The best effort indication is used in conjunction with the Broadband bearer capability to indicate the UBR service category (see Annex 9). This octet is included when best effort is requested (see the ATM Forum Traffic Management Specification, Version 4.1 [17]).

Table 2/Q.2961.1 is modified by the following addition:

```
- Forward Frame Discard (octet 17.1) (Note E)
  Bit

  8

  0       No Frame discard allowed in Forward direction
  1       Frame discard allowed in Forward direction

- Backward Frame Discard (octet 17.1) (Note E)
  Bit

  7

  0       No Frame discard allowed in Backward direction
  1       Frame discard allowed in Backward direction
```

Note E - The frame discard capability is described in the ATM Forum Traffic Management Specification 4.1 [17], where a frame is delimited by the ATM user-to-user indication in the PTI field of an ATM cell. Absence of octet 17.1 indicates no frame discard allowed in forward or backward direction.

The network specific coding standard 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.) See the ATM Forum Traffic Management Specification, Version 4.1 [17] for definitions of parameters used by this information element.

The valid combinations of the traffic descriptor subfields in the ATM traffic descriptor information element are shown in Annex 9.

4.5.7/Q.2931 Broadband bearer capability:

Modify Figure 4-14/Q.2931 and Table 4-8/Q.2931 by adding a new Bearer Class codepoint to indicate Transparent Virtual Path (VP) service and by restructuring Octet 5a to support a new field "ATM Transfer Capability".

Note: The change to Octet 5a is backward compatible with the use of Octet 5a in Q.2931 and is in alignment with use of this Octet in the ITU-T Recommendation Q.2961.2 [45].

Replace Octet 5a in Figure 4-14/Q.2931 with the following:

1 ext	ATM Transfer Capability (ATC)	5a

Delete the Note to Figure 4-14/Q.2931. In Table 4-8/Q.2931 delete all references and coding of the Traffic Type and Timing Requirements fields.

Add the following to Table 4-8/Q.2931:

```
        The following codepoint is added to the Bearer Class Field in Octet 5:

- Bearer Class (octet 5)
        Bits 5 - 1

  1 1 0 0 0    Transparent VP Service

Values used on transmission and reception (Note A, Note G)
```

ATM transfer capability (octet 5a)
Bits
7 6 5 4 3 2 1
0 0 0 0 1 0 1   CBR (Note B)
0 0 0 0 1 1 1   CBR with CLR commitment on CLP=0+1 (Note H)
0 0 0 1 0 0 1   Real time VBR (Note G)
0 0 1 0 0 1 1   Real time VBR with CLR commitment on CLP=0+1 (Note I)
0 0 0 1 0 1 0   Non-real time VBR (Note C, Note D)
0 0 0 1 0 1 1   Non-real time VBR with CLR commitment on CLP=0+1 (Note J)
0 0 1 0 1 0 0   VBR.2 (Note K)
0 0 1 0 1 0 1   VBR.3 (Note L)
0 0 0 1 1 0 0   ABR

Additional values recognized on reception (Note E)

ATM Transfer Capability (octet 5a)
Bits
7 6 5 4 3 2 1
0 0 0 0 0 0 0   Non-real time VBR
0 0 0 0 0 0 1   Real time VBR
0 0 0 0 0 1 0   Non-real time VBR
0 0 0 0 1 0 0   CBR
0 0 0 0 1 1 0   CBR
0 0 0 1 0 0 0   Non-real time VBR

Additional reserved values (Note F)

ATM Transfer Capability (octet 5a)
Bits
7 6 5 4 3 2 1
x x 0 0 0 0 0   reserved for backward compatibility
x x 0 0 0 0 1   reserved for backward compatibility
x x 0 0 0 1 0   reserved for backward compatibility
x x 0 0 1 0 0   reserved for backward compatibility
x x 0 0 1 0 1   reserved for backward compatibility
x x 0 0 1 1 0   reserved for backward compatibility
x x 0 1 0 0 0   reserved for backward compatibility
x x 0 1 0 0 1   reserved for backward compatibility
x x 0 1 0 1 0   reserved for backward compatibility

where:
x x = "0 1", "1 0", or "1 1"

All other values are reserved.

Note A: The allowed combinations of the ATC field and Bearer Class field are specified in Annex 9.

Note B: When the Bearer Class is coded BCOB-A, this octet shall only be present if the ATC is other than *CBR*.

Note C: When the Bearer Class is coded BCOB-C, this octet shall only be present if the ATC is other than *non-real time VBR*.

Note D: When the Bearer Class is coded BCOB-X or Transparent VP service, and this octet is absent the ATC is *non-real time VBR*.

Note E: In order to be backward compatible with UNI 3.0/UNI 3.1 Specification, these codepoints must be recognized in combination with the Bearer Class field coding of "BCOB-X". At the S_B reference point or the coincident S_B and T_B reference point (i.e., when the call is originated by the calling user), a SIG 4.1 compliant user will not include these values in a transmitted SETUP message. A SIG 4.1 compliant user at the T_B reference point or a SIG 4.1 compliant network may relay these values.

Note F: These values are reserved to promote backward compatibility with UNI 3.0/UNI 3.1 (i.e. the two bits marked x x are spare bits in UNI 3.0/UNI 3.1 and would accordingly be ignored by such equipment) and will not be used for the indication of an ATM transfer capability.

Note G: The ITU-T uses the term Statistical Bit Rate (SBR) which is equivalent to VBR and the ITU-T uses the term Deterministic Bit Rate (DBR) which is equivalent to CBR. When the ITU-T uses SBR without timing this is equivalent to Non-real time VBR and when the ITU-T uses SBR with timing this is equivalent to Real time VBR (see section 1.2 in the ATM Forum Traffic Management Specification, Version 4.1 [17]).

Note H: This ATC differs from the ATC for *CBR* in that for this ATC the CLR objective applies to the aggregate CLP=0+1 stream whereas for the *CBR* ATC the CLR objective may only apply to the CLP=0 stream (see the conformance definition in the ATM Forum Traffic Management Specification, Version 4.1 [17]). This ATC is not supported by UNI 3.1.

Note I: This ATC differs from the ATC for *Real time VBR* in that for this ATC the CLR objective applies to the aggregate CLP=0+1 stream whereas for the *Real time VBR* ATC the CLR objective may only apply to the CLP=0 stream (see the conformance definition in the ATM Forum Traffic Management Specification, Version 4.1 [17]). This ATC is not supported by UNI 3.1.

Note J: This ATC differs from the ATC for *Non-real time VBR* in that for this ATC the CLR objective applies to the aggregate CLP=0+1 stream whereas for the *Non-real time VBR* ATC the CLR objective may only apply to the CLP=0 stream (see the conformance definition in the ATM Forum Traffic Management Specification, Version 4.1 [17]). This ATC is not supported by UNI 3.1.

Note K: This ATC differs from the ATCs for Non-real time VBR and Real time VBR in that tagging is not applied, regardless of the setting of the Tf and Tb bits in the ATM traffic descriptor information element (see the conformance definition in the ATM Forum Traffic Management Specification, Version 4.1 [17]). This ATC is not supported by UNI 3.1 or UNI 4.0. Currently only Non-real time VBR.2 is supported.

Note L: This ATC differs from the ATCs for Non-real time VBR and Real time VBR in that tagging is requested and shall be applied at the UPC, regardless of the setting of the Tf and Tb bits in the ATM traffic descriptor information element (see the conformance definition in the ATM Forum Traffic Management Specification, Version 4.1 [17]). This ATC is not supported by UNI 3.1 or UNI 4.0. Currently only Non-real time VBR.3 is supported.

4.5.8/Q.2931 Broadband high layer information:
Add the following after the first paragraph:
See the ATM Forum Native ATM Services: Semantic Description, Version 1.0 Specification [15] for the use of this information element to specify the proper entity within the called user ATM device that receives the notification of the incoming call.

4.5.9/Q.2931 Broadband low layer information:
Add the following after the first paragraph:
See the ATM Forum Native ATM Services: Semantic Description, Version 1.0 Specification [15] for the use of this information element to specify the proper entity within the called user ATM device that receives the notification of the incoming call.

4.5.10/Q.2931 Call state:
Call states U2, N2, U25, and N25 are not supported.

4.5.11/Q.2931 Called party number:
The maximum length of this information element is 25 octets.

Only two combinations of Type of number and Addressing/numbering plan identification are supported:

> Unknown/ATM endsystem address
> International number/ISDN numbering plan (E.164)

In Note 2 of Figure 4-18/Q.2931, replace 'Recommendation E.191' with 'Recommendation X.213 | ISO/IEC 8348, using the "preferred binary encoding" '.

Replace Note 8 of Table 4-12/Q.2931 with the following text:

This codepoint is used to indicate an ATM end system address (see Section 3 of the Addressing Reference Guide [32]).
In Note 11 of Table 4-12/Q.2931, replace 'public B-ISDNs, Recommendation E.191' with 'ATM service provider networks, the Addressing Reference Guide [32]'.

In the definition of 'ATM end system address octets' in Table 4-12/Q.2931, replace 'Recommedation E.191' with 'Recommendation X.213 | ISO/IEC 8348, using the "preferred binary encoding".'

4.5.12/Q.2931 Called party subaddress:

In Table 4-13/Q.2931 replace the reference to "clause 9 of Recommendation E.191" with "Section 3 of the Addressing Reference Guide [32]":

Add the following Note at the end of the section:

3   Guidelines on the use of subaddresses are described in Annex 1.

4.5.13/Q.2931 Calling party number:
The maximum length of this information element is 26 octets.

Only two combinations of Type of number and Addressing/numbering plan identification are supported:

> Unknown/ATM endsystem address
> International number/ISDN number plan (E.164)

In Note 2 of Figure 4-20/Q.2931, replace 'Recommendation E.191' with 'Recommendation X.213 | ISO/IEC 8348, using the "preferred binary encoding".'

Replace Note 8 of Table 4-14/Q.2931 with the following text:

This codepoint is used to indicate an ATM end system address (see Section 3 of the Addressing Reference Guide [32]).

In Note 11 of Table 4-14/Q.2931, replace 'public B-ISDNs, Recommendation E.191' with 'ATM service provider networks, the Addressing Reference Guide [32]'.

In the definition of 'ATM end system address octets' in Table 4-14/Q.2931, replace 'Recommendation E.191, clause 9 (for details, see also the description of sub-address information in Table 4-15)' with 'Recommendation X.213 | ISO/IEC 8348, using the "preferred binary encoding".'

4.5.14/Q.2931 Calling party subaddress:

In Table 4-15/Q.2931 replace the reference to "clause 9 of Recommendation E.191" with "Section 3 of the Addressing Reference Guide [32]"

Add the following Note at the end of the section:

3   Guidelines on the use of subaddresses are described in Annex 1.

4.5.15/Q.2931 Cause:
Network-specific cause value 23 is added as follows:

0 0 1 0 1 1 1	23	User rejects all calls with calling line identification restriction (CLIR) (Note A)	-

Note A - This cause value is used with coding standard "1 1", Standard defined for the network (either public or private) present on the network side of the interface.

Note: some additions/modifications to the cause information element are included in the revised Q.2610 [6] and the revised Q.850 (which is referenced by Q.2610).

4.5.16/Q.2931 Connection identifier:
VP associated signalling codepoint is not supported.

At the end of first paragraph, add the following sentence:
      See the procedures in sections 5.1.2 and 5.2.3 for further details.

The following codepoint is added to the preferred/exclusive field of Octet 5 in table 4-16/Q.2931.

Bits
   3 2 1
   1 0 0 Exclusive VPCI; no VCI (used for switched VPCs)

Note 1 of Figure 4-22/Q.2931 is replaced with:

      Note 1 - If the "Pref./Ex"- Field indicates "any VCI" or "no VCI", the VCI field shall be ignored.

Note for clarification:

When a VPCI/VCI value is assigned, the allocation is in both directions. The VPCI/VCI value cannot be used for another connection until the call is cleared.

4.5.17/Q.2931 End-to-end transit delay parameter:
See section 9.1.2.1 for changes.

4.5.18/Q.2931 Quality of Service parameter:
QoS classes 0-4 are supported - replace the tables for octets 5 and 6 with the following:
QoS Class Forward (octet 5)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	QoS class 0 - Unspecified QoS class (Notes 1,4)
0 0 0 0 0 0 0 1	QoS class 1 (Note 2)
0 0 0 0 0 0 1 0	QoS class 2 (Note 2)
0 0 0 0 0 0 1 1	QoS class 3 (Note 2)
0 0 0 0 0 1 0 0	QoS class 4 (Note 2)
1 1 1 1 1 1 1 1	Reserved (Notes 1, 3)

QoS Class Backward (octet 6)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	QoS class 0 - Unspecified QoS class (Notes 1,4)
0 0 0 0 0 0 0 1	QoS class 1 (Note 2)
0 0 0 0 0 0 1 0	QoS class 2 (Note 2)
0 0 0 0 0 0 1 1	QoS class 3 (Note 2)
0 0 0 0 0 1 0 0	QoS class 4 (Note 2)
1 1 1 1 1 1 1 1	Reserved (Notes 1, 3)

Note 1 -   This codepoint is taken from the coding standard value 00. The meaning of this code point applies only for coding standard 00. For coding standard value 11, this code point is reserved by the ATM Forum. If this class is indicated, the network does not guarantee any specific Quality of Service.

Note 2 -   The meanings of these codepoints apply only for the coding standard value 11. For coding standard value 00 these code points are defined in Q.2965.1 [46] and are not supported in this specification. The ATM Forum reserves the right to assign all values for coding standard value 11. However, these values will be assigned in ascending sequence.

Note 3 -   This codepoint has been reserved by ITU-T.

Note 4 -   For some public networks, only the Coding Standard value 00 may be allowed at the public UNI.

For usage of the QoS Classes, see Annex B.3 of the ATM Forum Traffic Management Specification, Version 4.1 [17].

4.5.20/Q.2931 Restart indicator:
The description of the class codepoint 000 should be changed to:
        Indicated switched virtual channel (Note 1)

The description of the class codepoint 001 should be changed to:
        Indicated switched virtual path or all switched virtual channels in a virtual path which are
        controlled by the signalling virtual channel on which the RESTART message is sent (Note 2)

The description of the class codepoint "010" should be changed to:
> All switched virtual channels and switched virtual paths controlled by the layer 3 entity which sends the RESTART message.

Note 1 should be changed to:
> The Connection identifier information element shall be included and indicates the switched virtual channel to be restarted.

First sentence of note 2 should be changed to:
> The Connection identifier information element shall be included and indicates the switched virtual path to be restarted or the virtual path in which all switched virtual channels are to be restarted.

Second sentence of note 3 should be modified to
> All switched virtual channels and paths controlled by the layer 3 entity are to be restarted.

4.5.22/Q.2931 Transit network selection:
Only one combination of Type of Network Identification and Network Identification Plan is supported:
> National network identification/Carrier identification code

The maximum length of this information element is 9 octets.

4.5.23/Q.2931 Notification indicator:
When received in a message the user may either ignore this indication or pass it on to the application using the signalling layer.
In Figure 4-29/Q.2931 Replace the text "Further contents as defined in other ITU-T Recommendations, e.g. Q.932" by "Further contents as defined below and in other ITU-T Recommendations, e.g. Q.932".

Coding of Octet 5
Bit
7654321	Meaning
0011100	Adaptive timing recovery used for transmit (TX) clock (Note 1)

Note 1   Usage of this codepoint to indicate Adaptive timing recovery used for transmit (TX) clock is specified in the Voice and Telephony over ATM to the Desktop specification [47].
An alternative mechanism for indication of adaptive timing recovery uses the Broadband report type information element according to Annex M/Q.2931. This alternative mechanism may be used by other applications (e.g. ITU-T Recommendation H.321).

4.5.24/Q.2931 OAM traffic descriptor:
When this information element is used during the establishment of a switched Virtual Path, it applies to the end-to-end F4 flow (e.g. in this case octet 6 contains the Forward end-to-end OAM F4 traffic descriptor and the Backward end-to-end OAM F4 traffic descriptor parameters).

4.5.25/Q.2931 Broadband report type:

Add the following new paragraph:

Switching systems supporting the Broadband report type information element in the SETUP message shall also support the CONNECTION AVAILABLE message defined in section 3.1.11/Q.2931 and the procedures in Annex N/Q.2931.

Add the following to the end of Note 2 of Table 4-23/Q.2931:

An alternative mechanism for indication of adaptive timing recovery uses the Notification indicator information element according to the Voice and Telephony over ATM to the Desktop specification [47].

5.0/Q.2931 B-ISDN Call/connection control procedures:

The signalling virtual channel uses VPI=0, VCI=5 as a default. See Annexes 2 and 8 for examples of the use of other VPI/VCI values for the signalling channel.

The procedures in this Specification allow for optional support of Switched Virtual Path Connections (SVPCs). Except where noted, the references to Switched Virtual Channel Connections (SVCCs) apply equally to the SVPCs.

Note: The primitives to/from Q.2931 are described in Annex A/Q.2931.

5.1.1/Q.2931 Call/Connection request:
Broadband sending complete is optionally included by the user.
Retransmission of the SETUP message is optional.
Delete the second paragraph.
Add the following sentence:
        The user shall include the Called party number information element.

5.1.2/Q.2931 Connection identifier (VPCI/VCI) allocation/selection - Origination:
Associated signalling is not supported.

5.1.2.1/Q.2931 Associated signalling:
Associated signalling is not supported.

5.1.2.2/Q.2931 Non-associated signalling:
Add the following after the last paragraph:

The default shall be to always use case c). The user should consistently use just one of the cases a), b), or c). The use of option a) or b) by the user should be upon bilateral agreement with the network to avoid collision in assigning connection identifiers. (Note: see section A2.3 on how these options apply for proxy signalling).

When the establishment of a Switched VP Connection (SVPC) is requested (i.e. the Bearer Class field of the Bearer capability information element in the SETUP message indicates "Transparent VP Service"), the user shall indicate one of the following:

     c) No indication is included (i.e., the Connection identifier information element is not included in the
        SETUP message), or
     d) Exclusive VPCI; no VCI

In case (c), the network selects any available VPCI.
In case (d), if the indicated VPCI is available, the network selects it for the call. The selected VPCI is indicated in the Connection identifier information element in the first message returned by the network in response to the SETUP message (e.g., CALL PROCEEDING). The VP associated signalling field is coded as "explicit indication of VPCI". The preferred/exclusive field is coded as "exclusive VPCI; no VCI".

In case (c), if the network is not able to allocate a VPCI, a RELEASE COMPLETE message with Cause *#45 "No VPCI/VCI available"* is sent by the network.

In case (d), if the indicated VPCI is not available, a RELEASE COMPLETE message with Cause #35 "*Requested VPCI/VCI not available*" is sent by the network.

The default shall be to always use case c). The user should consistently use just one of the cases c) or d). The use of option d) by the user should be upon bilateral agreement with the network to avoid collision in assigning connection identifiers.

5.1.2.3/Q.2931 Use of VPCI:
Add the following after the second paragraph:
The default is that the VPCI values are numerically equal to the VPI value.
Note - Some of the VPCI values may not be available for use (e.g., some values of VPI may be used for permanent virtual path connections or the upper bound on the VPCI range may be restricted by the number of active VPI bits).

5.1.3/Q.2931 QoS and traffic parameters selection procedures:
Replace this section with the following text:

The user shall indicate the requested ATM traffic descriptor in the ATM traffic descriptor information element. The user may indicate a requested QoS class in the QoS parameter information element (see Section 9).

The network determines the ATM service category for the call from the Bearer Class and ATM Transfer Capability fields in the Broadband bearer capability information element and from the Best Effort Indicator in the ATM traffic descriptor information element, as specified in Annex 9. If the network is not able to provide the requested service category, the network shall reject the call, returning a RELEASE or RELEASE COMPLETE message with one of the following causes:

> #57   *Bearer capability not authorized;*
> #58   *Bearer capability not presently available;*
> #65   *Bearer service not implemented.*

If the network detects that the Broadband bearer capability and ATM traffic descriptor information elements contain a non-supported set of parameters, the network shall return a RELEASE or RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

If the network is not able to provide the requested ATM traffic descriptor, the network shall reject the call, returning a RELEASE or RELEASE COMPLETE message with Cause #37, "*User cell rate unavailable*".

If the network is not able to provide the requested QoS parameters (see Section 9.2), the network shall reject the call, returning a RELEASE or RELEASE COMPLETE message with Cause #49*, "Quality of service unavailable*".

If the network is able to provide the requested traffic and QoS parameters, the network shall progress the call to the called user.

5.1.5/Q.2931 Call/connection proceeding:
Sending a CALL PROCEEDING message is optional (consistent with Annex H/Q.2931).

5.2.1/Q.2931 Incoming call/connection request
Retransmission of SETUP is optional.

5.2.2/Q.2931 Address and Compatibility Check:
The Address and Compatibility Check procedures are not part of this Specification and are left as an implementation option.

5.2.2.2.1/Q.2931 General principles

Add the following note:

Note: The Broadband category 1 compatibility information is applicable for SVCCs and SVPCs. The Broadband category 2 compatibility information is applicable to SVCCs. Currently, no equivalent Broadband category 2 compatibility information is defined for SVPCs.

5.2.3/Q.2931 Connection identifier (VPCI/VCI) allocation/selection - Destination:
Associated signalling is not supported.

5.2.3.1/Q.2931 Associated Signalling:
Associated signalling is not supported.

5.2.3.2/Q.2931 Non-associated Signalling:
Add the following after the last paragraph:

The default shall be to use case b) for all calls. The network should consistently use just one of the cases a), b), or c) for all calls. The use of option a) or c) by the network should be upon bilateral agreement with the user to avoid collision in assigning connection identifiers. (Note: see section A2.3 on how these options apply for proxy signalling).

When the establishment of a Switched VP Connection (SVPC) is requested (i.e. the Bearer Class field of the Bearer capability information element in the SETUP message indicates "Transparent VP Service"), the network shall indicate one of the following:

　　c) No indication is included (i.e., the Connection identifier information element is not included in the
　　　　SETUP message), or
　　d) Exclusive VPCI; no VCI

In case (c), the user selects any available VPCI.

In case (d), if the indicated VPCI is available, the user selects it for the call. The selected VPCI is indicated in the Connection identifier information element in the first message returned by the user in response to the SETUP message (e.g., CALL PROCEEDING). The VP associated signalling field is coded as "explicit indication of VPCI". The preferred/exclusive field is coded as "exclusive VPCI; no VCI". If the Connection identifier information element is not present in the first response message, the Connection identifier in the SETUP message shall be assumed.

In case (c), if the user is not able to allocate a VPCI, a RELEASE COMPLETE message with Cause #45 *"No VPCI/VCI available"* is sent by the user.

In case (d), if the indicated VPCI is not available, a RELEASE COMPLETE message with Cause #35 *"Requested VPCI/VCI not available"* is sent by the user.

The default shall be to always use case d). The network should consistently use just one of the cases c) or d). The use of option c) by the network should be upon bilateral agreement with the user to avoid collision in assigning connection identifiers.

5.2.4/Q.2931 QoS and traffic parameter selection procedures:
Replace this section with the following text:

The user determines the ATM service category for the call from the Bearer Class and ATM Transfer Capability fields in the Broadband bearer capability information element and from the Best Effort Indicator in the ATM traffic descriptor information element, as specified in Annex 9. If the user is not able to provide the requested service category, the user shall reject the call, returning a RELEASE or RELEASE COMPLETE message with one of the following causes:

> #57   *Bearer capability not authorized;*
> #58   *Bearer capability not presently available;*
> #65   *Bearer service not implemented.*

If the user detects that the Broadband bearer capability and ATM traffic descriptor information elements contain a non-supported set of parameters, the user shall return a RELEASE or RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

If the user is not able to provide the requested ATM traffic descriptor, the user shall reject the call, returning a RELEASE or RELEASE COMPLETE message with Cause #37, "*User cell rate unavailable*".

If the user is not able to provide the requested QoS parameters (see Section 9.2), the user shall reject the call, returning a RELEASE or RELEASE COMPLETE message with Cause #49, "*Quality of service unavailable*".

5.2.5.1/Q.2931 Response to en-bloc SETUP or completion of overlap receiving:
Add the following text after Section 5.2.5.1/Q.2931:

> When the user receives a SETUP message without the calling party number and the user rejects all incoming calls that do not provide the calling party number, the user shall return a RELEASE COMPLETE message with network-specific Cause #23, "*User rejects all calls with calling line identification restriction (CLIR)*", and enter the Null state. The network processes this RELEASE COMPLETE message in accordance with Section 5.2.5.3/Q.2931.

> When the user is not an ATM endpoint and the user is able to provide the requested ATM traffic descriptor and the QoS, the user shall progress the call.

5.2.5.4/Q.2931 Call failure:
Retransmission of SETUP is optional.

5.2.7/Q.2931 Active Connection:
The CONNECT ACKNOWLEDGE message indicates completion of the ATM connection for that interface. There is no guarantee of an end-to-end connection until a CONNECT message is received at the calling user. Upon receipt of the CONNECT ACKNOWLEDGE message the called user shall: stop timer T313 and enter the Active state.

Note - In order to avoid the possibility of losing received data on the connection before the CONNECT ACKNOWLEDGE has been received and processed, the called user should be prepared to receive data on a new connection at any time after returning the CONNECT message to the network.

5.5/Q.2931 Restart procedure:
The first sentence of the second paragraph should be changed to:

The restart procedure is used to return a switched virtual channel, all switched virtual channel in a virtual path, a switched virtual path, or all switched virtual channels and switched virtual paths controlled by the signalling virtual channel to the idle condition.

The third sentence of the note should be changed to:

In the case where the same switched virtual channel(s) or switched virtual path(s) are specified, they shall not be considered free for reuse until all relevant restart procedures are completed.

5.5.1/Q.2931 Sending RESTART:
5.5.1.1/Q.2931 Normal Procedure
Paragraph 1 should be changed to:

A RESTART message is sent by the network or user equipment in order to return switched virtual channels or switched virtual paths to the idle condition. The Restart indicator information element shall be present in the RESTART message to indicate whether an "indicated switched virtual channel", "indicated switched virtual path or all switched virtual channels in a virtual path" or "all switched virtual channels and switched virtual paths controlled by the layer 3 entity" are to be restarted. If the Restart indicator information element is coded as "indicated switched virtual channel" or "indicated switched virtual path or all switched virtual channels in a virtual path" then the Connection identifier information element shall be present to indicate which switched virtual channel or switched virtual path is to be returned to the idle condition. If the Restart indicator information element is coded as "all switched virtual channels and switched virtual paths controlled by the later 3 entity", then the Connection identifier information element shall not be included.

The third and fourth sentences of the second paragraph should be changed to:

Receipt of a RESTART ACKNOWLEDGE message stops timer T316 and indicates that the switched virtual channel(s)/switched virtual path(s) and associated resources (e.g., call reference value(s)) can be freed for reuse. The Null state will be entered after the switched virtual channel/switched virtual path and call reference value are released.

Paragraph 4 should be changed to:

Calls associated with restarted switched virtual channel(s)/switched virtual path(s) shall be cleared towards the remote parties using Cause #41, "*Temporary failure*".

5.5.1.2/Q.2931 Exceptional Procedures
The second sentence of the first paragraph should be changed to:

While timer T316 is running, the switched virtual channel(s)/switched virtual path(s) being restarted shall not be used to support new calls requested using the call setup procedures.

The sixth sentence of the first paragraph should be changed to:

The switched virtual channel(s)/switched virtual path(s) is considered to be in an out-of-service condition until maintenance action has been taken.

Paragraph 2 should be changed to:

If a RESTART ACKNOWLEDGE message is received indicating a different set of switched virtual channel(s)/switched virtual path(s) from the set indicated in the RESTART message, the RESTART ACKNOWLEDGE message shall be discarded.

5.5.2/Q.2931 Receipt of RESTART:
5.5.2.1/Q.2931 Normal Procedures
The first sentence of the first paragraph should be changed to:

Upon receiving a RESTART message the recipient shall enter the Restart state associated to the global call reference and start timer T317; it shall then initiate the appropriate internal actions to return the specified switched virtual channel(s)/switched virtual path(s) to the idle condition and release all call references associated with it.

Paragraph 2 should be changed to:

Calls associated with restarted switched virtual channel(s)/switched virtual path(s) shall be cleared towards the remote parties using cause #41, "*Temporary failure*".

Paragraph 3 should be changed to:

Even if all the specified switched virtual channel(s)/switched virtual path(s) are in the idle condition, or already in the process of restart to the idle condition, receiving entity shall transmit a RESTART ACKNOWLEDGE message to the originator upon receiving a RESTART message.

Paragraph 4 should be changed to:

If the Restart indicator information element is coded as "all switched virtual channels and switched virtual paths controlled by the layer 3 entity which sends the RESTART message", then all calls on all interfaces associated with the signalling virtual channel shall be cleared.

In paragraph 5, replace all occurrences of "all user plane virtual channels in the indicated VPC controlled via the signalling virtual channel in which the RESTART message is sent" by "indicated switched virtual path or all switched virtual channels in a virtual path".

In paragraph 7, replace all occurrences of "switched virtual channels" by "switched virtual channels and switched virtual paths".

5.5.2.2/Q.2931 Exceptional procedures
Paragraph 2, 3 & 4 should be changed to:

If the Restart indicator information element is coded as "all switched virtual channels and switched virtual paths controlled by the layer 3 entity which sends the RESTART message" and a connection identifier information element is included, the Connection identifier information element is treated as described in subclause 5.6.8.3 of Q.2931.

If the Restart indicator information element is coded as "indicated switched virtual channel" or "indicated switched virtual path or all switched virtual channels in a virtual path" and the Connection identifier information element is not included, then the procedures in subclause 5.6.7.1 of Q.2931 shall be followed.
If the Restart indicator information element is coded as "indicated switched virtual channel" or "indicated switched virtual path or all switched virtual channels in a virtual path" and the Connection identifier information element contains an unrecognized VPCI, then the procedures in subclause 5.6.7.2 of Q.2931 shall be followed.

If the Restart indicator information element in the received RESTART message is coded "indicated Switched Virtual Channel" and the VPCI indicated in the Connection identifier information element is being used for an active switched virtual path, then the procedures in section 5.6.7.2/Q.2931 shall be followed.

5.6.6/Q.2931 General information element errors:
When a Broadband-locking shift information element occurs in a message, the Broadband-locking shift information element and all subsequent information elements may be treated as unrecognized information elements. However, when a Cause information element is generated to report errors of these shifted information elements the diagnostic field of the Cause information element (if present) should only include the information element identifier for the Broadband-locking shift information element and of any non-shifted information element in error.

When a Broadband-non-locking shift information element occurs in a message, the Broadband-non-locking shift information element and the subsequent information element may be treated as unrecognized information elements. However, when a Cause information element is generated to report errors of these shifted information elements the diagnostic field of the Cause information element (if present) should only include the information element identifier for the Broadband-non-locking shift information element and of any non-shifted information element in error.

6.4.5/Q.2931 Cause information:
The DSS2 network-specific Cause #23 "*User rejects all calls with calling line identification restriction (CLIR)*" shall be mapped to the DSS1 Cause #31 "*Normal, unspecified*".

6.5/Q.2931 Overlap sending and receiving:
Not supported.

6.7.1/Q.2931 Tones and announcements:
When the network offers voice/audio services, tones and announcements shall be provided as specified in this section.

7.1/Q.2931 Timers in the network side:
Retransmission of SETUP is optional.

7.2/Q.2931 Timers in the user side: Retransmission of SETUP is optional.

Annex B/Q.2931 Compatibility checking:
The Address and Compatibility Check procedures are not part of this Specification and are left as an implementation option.

Annex C.1/Q.2931 General:
The following text is added to the end of the section as follows:

The procedures of this Annex are required in support of some applications (e.g., multiprotocol interconnection). Endpoints should assume that the B-LLI negotiation procedures will be offered by most networks. Therefore it is strongly recommended that networks support all of the procedures of this Annex. At a minimum, all networks shall carry the B-LLI information element in the SETUP message.

Annex D/Q.2931 Transit network selection:
Only one transit network selection information element is supported.

Annex D.2/Q.2931 Selection supported:
Specification of more than one transit network is not supported.

Annex E.2/Q.2931 Mapping functions for the direction DSS 2 → DSS 1: and
Annex E.3/Q.2931 Mapping functions for the direction DSS 1 → DSS 2:
The DSS2 N-BC and DSS1 BC information elements shall also support n x 64kbit/s service.

Annex E.4/Q.2931 Codepoint values of information elements to support 64 Kbits/s based circuit-mode ISDN services in B-ISDN:
The QoS class forward and QoS class backward should both be coded to class 1 or 0. Class 1 should be used when all network or destination equipment is ATM Forum compatible. Class 0 should be used when ITU compatible equipment is used within the network or at the destination or when the type of equipment is unknown.

Annex F.3/Q.2931 ATM Adaptation Layer Indication in the CONNECT Message:
Add the following after the first paragraph

When the called user has received an ATM adaptation layer parameter information element in a SETUP message and the AAL type is User defined AAL, the ATM adaptation layer parameter information may be included in the CONNECT message.

Annex K/Q.2931Handling of the End-to-end transit delay information element:
This Annex is superseded by Section 9.2.

Annex M.1/Q.2931 Indication of using recovered clock for transmission

Add the following to the end of the section

Note -   An alternative mechanism for indication of adaptive timing recovery uses the Notification indicator information element according to the Voice and Telephony over ATM to the Desktop specification [47].

Appendix I/Q.2931 Guidelines for the use of instruction indicator:

Add following to Table I-2/Appendix I.

Information Element	Flag	Origin	Action Indicator
Generic identifier transport	used	N&U	Clear call
Connection scope selection	not used	N&U	Not significant
Alternative ATM traffic descriptor	used	N&U	Discard, proceed and report status
Minimum acceptable ATM traffic descriptor	used	N&U	Discard, proceed and report status
OAM traffic descriptor	used	N&U	Discard, proceed and report status
ATC setup parameters	not used	N&U	Not significant
ATC additional parameters	used	N&U	Discard information element and proceed
Extended QoS parameters	used	N&U	Discard information element and proceed
Reference list	used	N&U	Discard information element and proceed

Appendix III/Q.2931 Signalling for Semi-Permanent Connection Control:
Not supported.

2.1 Additional Information Elements

2.1.1 Generic Identifier Transport Information Element

The Generic identifier transport information element is used to carry an identifier between two users. The network may process and examine the contents of this information element. Depending on the identifier type, its purpose and structure are defined either in this Specification or in other specifications or standards. The number of instances of this information element in a message is limited to three.

			Bits					
8	7	6	5	4	3	2	1	Octets
Generic identifier transport information element								
0	1	1	1	1	1	1	1	1
Information element identifier								
1 Ext	Coding Standard		Information Element Instruction Field					2
		Flag	Reserved	Information Element Action Ind.				
Length of Generic identifier transport information element contents								3
Length of Generic identifier transport information contents (continued)								4
Identifier Related Standard/Applications								5
Identifier Type								6 (Note)
Identifier Length								6.1
Identifier Value								6.2 to 6.m
Identifier Type								N (Note)
Identifier Length								N.1 (Note)
Identifier Value								N.2 (Note) to N.n (Note)

Note - Octet group 6 can be repeated to form new octet groups numbered sequentially octet group 7, 8, ..., N.

Figure 2-1 Generic identifier transport information element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized coding

On reception, both the codepoints "ATM Forum specific" and "ITU-T standardized coding" may be accepted as valid values, and may be processed identically.

Identifier related standard/application (octet 5) (Note 1)
Bits
7 6 5 4 3 2 1
0 0 0 0 0 0 1   Digital Storage Media Command & Control (DSM-CC) resourceId (ISO/IEC
                       13818-6) (Note 2)
0 0 0 0 0 1 0   Recommendation H.245 / Recommendation H.310 (Note 3)
The codepoints in section 8.2 of Q.2941.2 [26] and in section 8.2 of Q.2941.3 [27] for the "Identifier related standard/application (octet 5)" apply.
All other values are reserved.

Note 1 - Each application requiring a different set/structure of identifiers (coded in octet group 6 and possibly in subsequent octet groups) should use a different value of octet 5.
Note 2 - When the Identifier related standard/application field is coded as DSM-CC (ISO/IEC 13818-6), octet group 6 specifies DSM-CC sessionId part of the resourceId and octet group 7 specifies the resourceNum. The encoding format is defined in ISO/IEC 13818-6.
Note 3 - When the Identifier related standard/application field is coded as Recommendation H.245 / Recommendation H.310, a H.245 resourceID / H.310 correlationID is coded in octet group 6. The encoding format is specified in ISO/IEC 13818-6.

Identifier type, length and content (octet group 6 and possibly subsequent octet groups):

Octet group 6 is used to define an identifier or one part of an identifier composed of multiple parts. Octet group 6 may be repeated. When an identifier is structured and consists of more than one part, an octet group starting with octet group 6 and successively numbered octet group 7, 8, etc. represents one of the identifier parts. When an identifier consists of only one part, this part is coded integrally in octet group 6.

Identifier type (Octet 6, 7, ..., N) (Note 1)
Bits
7 6 5 4 3 2 1
0 0 0 0 0 0 1   Session (Note 2)
0 0 0 0 0 1 0   Resource (Note 3)
The codepoints in section 8.2 of Q.2941.2 [26] and in section 8.2 of Q.2941.3 [27] for the " Identifier type (octet 6, 7, ..., N)" apply.
All other values are reserved.

Note 1 - The value coded in the Identifier type field is independent of the Identifier related standard/application field (octet 5). For example, when the Identifier type field is coded as Session '00000001', it refers to a Session identifier regardless of the coding of octet 5. However, the format of the Identifier value is dependent on the value specified in octet 5.
Note 2 - When the identifier type is coded as Session, a Session identifier shall be coded in the Identifier value field of the octet group. The maximum length is 20 octets.
Note 3 - When the identifier type is coded as Resource, a Resource identifier shall be coded in the Identifier value field of the octet group. The maximum length is 4 octets.

Identifier length:

A binary number indicating the length in octets of the identifier coded in the subsequent octets of the octet group.

Identifier value:

Value of an identifier coded according to the Recommendation or the Standard identified in octet 5.

Coding of DSM-CC resourceId:

1. When octet 5 is coded as DSM-CC (ISO/IEC 13818-6), octet groups 6 and 7 follow. They include the sessionId value of DSM-CC in octet group 6 and the resourceNum value in octet group 7.

Identifier Related Standard/Applications								5
0	0	0	0	0	0	0	1	
Session								6
0	0	0	0	0	0	0	1	
Identifier Length								6.1
Identifier Value								6.2 to 6.m
Resource								7
0	0	0	0	0	0	1	0	
Identifier Length								71
Identifier Value								7.2 to 7.n

Figure 2-1(a) Coding of the Generic identifier transport information element for DSM-CC resourceId

2. When octet 5 is coded as H.245 / H.310, octet group 6 follows. It includes the Resource ID / Correlation ID value in octet group 6.

Identifier Related Standard/Applications								5
0	0	0	0	0	0	1	0	
Resource								6
0	0	0	0	0	0	1	0	
Identifier Length								6.1
Identifier Value								6.2 to 6.m

Figure 2-1(b) Coding of the Generic identifier transport information element for H.245 correlation ID

2.2 Additional Procedures

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2.2.1 Frame Discard

The procedures in this section address how to handle a SETUP message with an indication of frame discard.

Additional optional procedures that take the AAL type into consideration are described in Annex 13.

2.2.1.1 Originating Procedures

Upon receipt of a SETUP message with the forward frame discard bit coded to *frame discard allowed*, the network shall, if possible, pass this indication towards the called party and the network may perform frame discard (see the ATM Forum Traffic Management Specification Version 4.1 [17]) for the forward direction of the connection. If the indication of *frame discard allowed* can not be transported towards the destination user (e.g., because of interworking with UNI 3.1 signalling protocol) the call shall progress without the indication. When the forward frame discard bit is absent or is coded to *no frame discard allowed*, the network shall pass this indication towards the called party and the network shall not perform frame discard for the forward direction of the connection.

Upon receipt of a SETUP message with the backward frame discard bit coded to *frame discard allowed*, the network shall, if possible, pass this indication towards the called party. If the indication of *frame discard allowed* can not be transported towards the destination user (e.g., because of interworking with UNI 3.1 signalling protocol) the call shall progress without the indication.

Upon receipt of an answer indication with an indication of backward *frame discard allowed*, the network shall pass this indication towards the calling party in a CONNECT message and the network may perform frame discard for the backward direction of the connection.

Upon receipt of an answer indication with either no backward frame discard indication or with an indication of *no backward frame discard allowed*, the network shall not perform frame discard for the backward direction of the connection and shall pass this indication towards the calling party in a CONNECT message by either not including the frame discard bit in the message or by coding the backward frame discard bit to *no frame discard allowed* in the message.

When the user (if not the endsystem) receives a CONNECT message with a backward frame discard indication coded to *frame discard allowed* the user shall (if possible) pass this indication towards the calling party and the user may perform frame discard for the backward direction of the connection. When the user (if not the endsystem) receives a CONNECT message with either no backward frame discard indication or with an indication of *no backward frame discard allowed* the user shall not perform frame discard for the backward direction of the connection and shall pass this indication towards the calling party.

2.2.1.2 Terminating Procedures

Upon receipt of a SETUP message with the forward frame discard bit coded to *frame discard allowed*, the user (if not the endsystem) shall, if possible, pass this indication towards the called party and the user may perform frame discard for the forward direction of the connection. When the forward frame discard bit is

absent or is coded to *no frame discard allowed*, the user (if not the endsystem) shall, if possible, pass this indication towards the called party and the user shall not perform frame discard for the forward direction of the connection.

Upon receipt of a SETUP message with the backward frame discard bit coded to *frame discard allowed*, the user (if not the endsystem) shall, if possible, pass this indication towards the called party. If the indication of *frame discard allowed* can not be transported towards the destination user (e.g., because of interworking with UNI 3.1 signalling protocol) the call shall progress without the indication.
The endsystem shall interpret the receipt of a SETUP message with the backward frame discard bit coded to *frame discard allowed*, as a request by the calling party that the called endsystem request backward frame discard in the CONNECT message.

When the called user wishes to request frame discard for the backward direction, the user shall include a backward frame discard indication coded to *frame discard allowed* in the CONNECT message.
When the network receives a CONNECT message with a backward frame discard indication coded to *frame discard allowed* the network shall (if possible) pass this indication towards the calling party and the network may perform frame discard for the backward direction of the connection. When the network receives a CONNECT message with either no backward frame discard indication or with an indication of *no backward frame discard allowed* the network shall not perform frame discard for the backward direction of the connection and shall pass this indication towards the calling party.

2.2.2 Procedures for Generic Identifier Transport

When the network receives a message with a Generic identifier transport information element, the Generic identifier transport information element shall be transported without modification by the network.

3.0 Addressing

An ATM address may be either a native E.164 number up to 15 digits in length, or a 20-octet ATM Endsystem Address based on the ISO NSAP encoding format. The ATM address formats and their usage are specified in the Addressing Reference Guide [32].

Applicability of these ATM address formats at the private and public UNI is specified in this section. Procedures to register addresses across a UNI and the related MIB definition are included in the ATM Forum ILMI Specification, Version 4.0.

3.1 Private UNI

The Private UNI shall support the ATM Endsystem Address structure defined in section 3.1 of the Addressing Reference Guide [32]

3.2 Public UNI

The Public UNI shall support one of the following:

1. Native E.164 address structure:
   - Type of Number field = international number
   - Numbering Plan Identification field = Recommendation E.164.
2. ATM Endsystem Address Structure (as defined in the Addressing Reference Guide [32] Section 3):
   - Type of Number = Unknown
   - Numbering Plan Indication = ATM Endsystem Address.
3. Both of 1 and 2 above.

4.0 Signalling Virtual Channel and Signalling ATM Adaptation Layer (SAAL)

4.1 Signalling ATM Adaptation Layer

This section specifies the Signalling ATM Adaptation Layer (SAAL) for use at the UNI. The SAAL resides between the ATM layer and Q.2931. The purpose of the SAAL is to provide reliable transport of

Q.2931 messages between peer Q.2931 entities (e.g., ATM Switch and host) over the ATM layer. The SAAL is composed of two sublayers, a common part and a service specific part. The service specific part is further subdivided into a Service Specific Coordination Function (SSCF), and a Service Specific Connection Oriented Protocol (SSCOP). Figure 4-1 illustrates the structure of the SAAL.

The SAAL for supporting signalling shall use the protocol structure as illustrated in Figure 4-1.

The Common Part AAL protocol provides unassured information transfer and a mechanism for detecting corruption of SDUs. AAL Type 5 Common Part protocol shall be used to support signalling. The AAL Type 5 Common Part Protocol is specified in Recommendation I.363.

The Service Specific Connection Oriented Protocol (SSCOP) resides in the Service Specific Convergence Sublayer (SSCS) of the SAAL. SSCOP is used to transfer variable length Service Data Units (SDUs) between users of SSCOP. SSCOP provides for the recovery of lost or corrupted SDUs. SSCOP is specified in Q.2110.

The SAAL for supporting SIG 4.1 shall utilize SSCOP as specified in Q.2110.

Note: to resolve a potential SSCOP problem, the alternative procedure and SDL specified in section 5.1/[31], "Increased robustness during power-up connection establishment", should apply.

An SSCF maps the service of SSCOP to the needs of the SSCF user. Different SSCFs may be defined to support the needs of different AAL users. The SSCF used to support Q.2931 at the UNI is specified in Q.2130.

The external behavior of the SAAL at the UNI shall appear as if the UNI SSCF as specified in Q.2130 were implemented.

4.2 Signalling Virtual Channel

Except when the optional proxy signalling capability (see Annex 2), or when the optional Virtual UNI capability (see Annex 8) is used, the signalling virtual channel shall be that identified by VPI = 0, VCI = 5.

A default ATM layer service category and default traffic contract are defined in this specification to be, respectively, the service category and values of traffic contract parameters for the signalling VCC that apply absent any configuration or subscription option. The specification of standard defaults means that degradation of signalling performance due to cell loss can be avoided without requiring configuration or use of optional ILMI procedures. If used, procedures specified in the ATM Forum ILMI Specification, Version 4.0 will override the default service category and traffic contract.

Primitives

```
┌─────────────────────┐
│  Service Specific   │
│ Coordination Function│
│       (SSCF)        │
└─────────────────────┘
```

Service Specific Convergence Sublayer AAL Functions

```
┌─────────────────────┐
│  Service Specific   │   Peer-to-Peer
│ Connection Oriented │   Messages
│ Peer-to-Peer Protocol│◄──────────►
│      (SSCOP)        │
└─────────────────────┘
```

Common Part AAL Functions

```
┌─────────────────────┐
│   Common Part AAL   │   Peer-to-Peer
│ Peer-to-Peer Protocol│   Messages
│      (CP-AAL)       │◄──────────►
└─────────────────────┘
```

Primitives
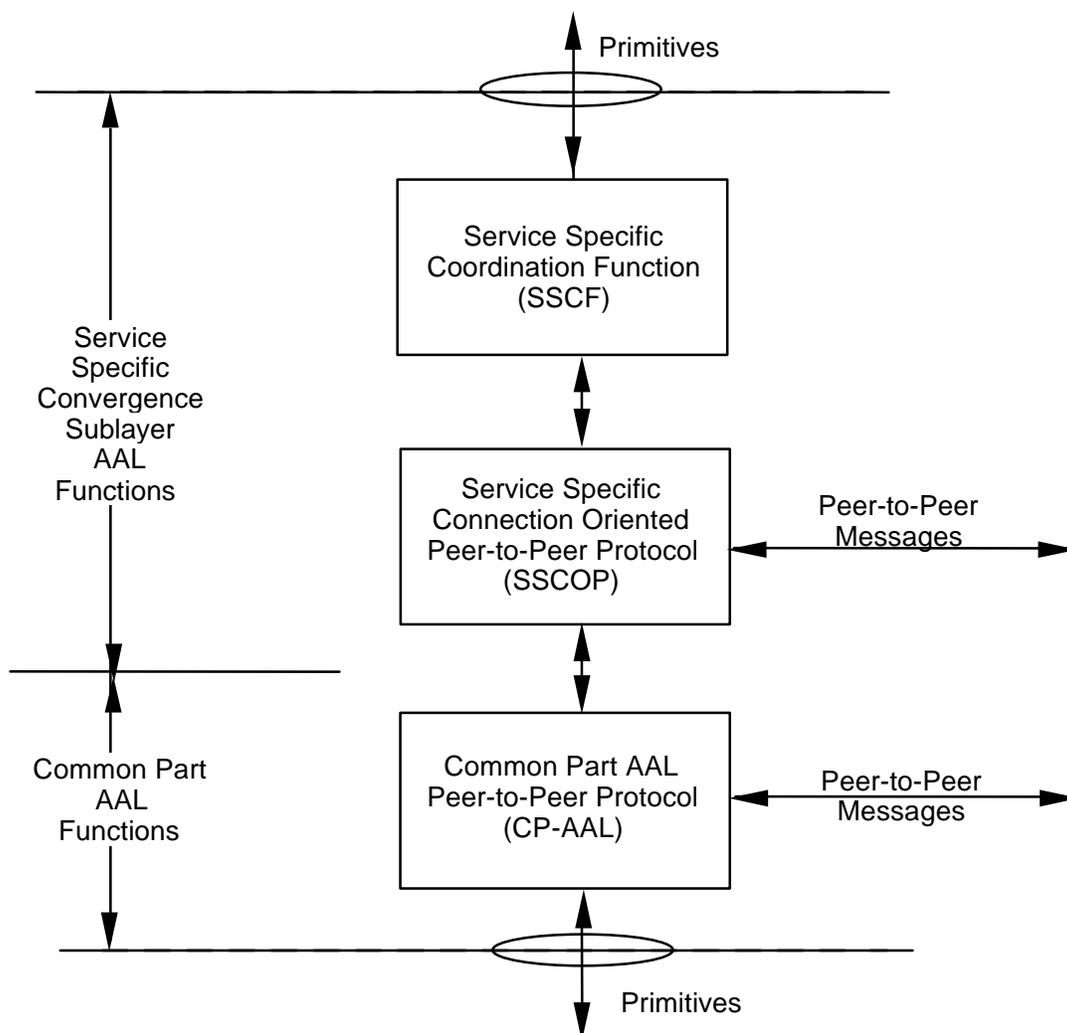
Figure 4-1 SAAL Structure

Note: The Figure represents the allocation of functions and is not intended
to illustrate sub-layers as defined by OSI modeling principles.

The default ATM layer service category for the signalling virtual channel shall be either real time or non-real time VBR, as defined in section 2 of the ATM Forum Traffic Management Specification, Version 4.1 [17]. Selection of one of these service categories is network specific. If real time VBR is used, no objective is specified for CDV. A service category other than the default may be selected by mutual agreement (e.g., at subscription time).

The signalling protocol defined in this Specification is sensitive to delay and message loss. The network should bound CLR to be 10^{-6} or better. The network should also be engineered such that the end-to-end transfer delay objective for the AA-DATA primitive (see ITU-T Recommendation Q.2110) is 500 ms or better when the default traffic contract parameters are met, for an AA-DATA PDU which is five cells long. Other assumptions in performing this engineering are implementation specific.

Note: Networks that do not bound CTD for nrt-VBR connections may need to use the rt-VBR service category in order to meet these objectives. If the 500 ms objective cannot be met, it will be necessary to increase the value of some SSCOP timers, and possibly some DSS2 timers.

In order to avoid window starvation (i.e. a condition wherein the transmission rate is limited by the SSCOP window size), it is recommended that the following relationship be maintained between the average signalling message size (avgMS, in cells), SCR, MBS, maximum SAAL window size (maxWS), and signalling round trip delay (SRTD) which includes SAAL delays:

$$maxWS \geq PT + (MBS + SCR*SRTD)/avgMS \quad \text{when } SRTD \geq MBS/(PCR-SCR); \text{ or,}$$
$$maxWS \geq PT + PCR * SRTD/avgMS \quad \text{otherwise}$$

Where:

PT is the poll time, which is either:

25, when SCR > 100 cells/s; or

.75 * SCR when SCR ≤ 100 cells/s

based on the default values for the Poll Timer (i.e., 750 msec) and MaxPD (i.e., 25) as defined in Recommendation Q.2130

Only CLP=0 cells shall be sent on the signalling VCC. The default traffic contract parameters for shaping the output of the signalling VCC are: SCR (0+1), MBS(0+1) and PCR(0+1). However, the UPC function in the network may use either the VBR.1 (i.e., UPC is on PCR(0+1) and SCR(0+1), no tagging allowed) or VBR.3 (i.e., UPC is on PCR(0+1) and SCR(0), and tagging is allowed) traffic contract definition.

Note: As long as only CLP=0 cells are sent, shaping to SCR(0+1) is equivalent to shaping to SCR(0)

The output of the signalling VCC should be shaped to conform with the traffic contract. Implementations that do not perform this shaping may, during periods of congestion, or when connected to networks that do not perform tagging for the VBR.3 traffic contract definition, experience degraded signalling performance due to cell loss. Degradation might take the form of excessive delay in establishment or clearing of connections, or a signalling VCC outage.

Note: The UNI 3.1 Specification made no statement about service category or traffic parameters for the signalling VCC. However, the specification of a default service category in this Specification does not affect backward compatibility with implementations according to the UNI 3.1 Specification. At worst, a non-default traffic contract might be needed to provide adequate signalling performance. If a SIG 4.1 device detects that it is connected to a UNI 3.0 or UNI 3.1 device, it should use the VBR.3 traffic contract definition.

Networks that use the VBR.3 traffic contract definition for the signalling VCC may implement tagging and preferential discard on the signalling VCC, so as to minimize the likelihood that implementations that do not shape will experience degraded signalling performance during incidental periods when the traffic contract on SCR(0) is exceeded. Networks may also implement frame discard, so that if the traffic contract is exceeded and it is necessary to discard, fewer signalling messages will be affected.

The default traffic contract for the signalling virtual channel at the S (or S/T) reference point shall be as follows:

- PCR = the payload rate of the UNI or Virtual UNI
- SCR shall be as shown in Table 4-1
- MBS = 16 cells

The payload rate is the ATM cell rate of the UNI (i.e., excluding any physical layer overhead) or Virtual UNI. All implementations of this Specification at the S or S/T reference point shall support this default traffic contract.

Devices should support traffic contracts in addition to the default at the S (or S/T) reference point (e.g., by configuration or subscription option).

Table 4-1 Default SCR at the S (or S/T) Reference Point

Nominal Interface rate	SCR (approx. thruput)	SCR (cells/s)
<1.5 Mbit/s	8 kbit/s	21
1.5 Mbit/s to < 4 Mbit/s	16 kbit/s	42
4 Mbit/s to < 8 Mbit/s	32 kbit/s	84
8 Mbit/s to < 20 Mbit/s	48 kbit/s	126
20 Mbit/s to < 30 Mbit/s	128 kbit/s	334
30 Mbit/s to < 50 Mbit/s	192 kbit/s	500
50 Mbit/s to < 100 Mbit/s	256 kbit/s	667
100 Mbit/s to < 300 Mbit/s	768 kbit/s	2000
>= 300 Mbit/s	3.072 Mbit/s	8000

Note: For ITU-T compliant public UNIs, the default traffic contract is PCR(0+1) = 168 cells/s (see Recommendation Q.2120)

5.0 Point-to-Multipoint Calls

When setting up point-to-multipoint calls, the ITU-T Recommendation Q.2971, as modified by ITU-T Recommendation Q.2971 Corrigendum 1 [25], shall apply with the exceptions stated in this section.

Note: All sections of Recommendation Q.2971 and its annexes and appendices shall apply. Only the subsections/annexes/appendices of Q.2971 that have been modified by this Specification are given below. In this Specification, subsections, annexes, appendices, etc. of referenced documents, such as Q.2971, are identified by the actual subsection/annex/appendix number from that document, the document number and the title of the subclause/annex/appendix.

Note for clarification: When a VPCI/VCI value is assigned, the allocation is in both directions. The VPCI/VCI value cannot be used for another connection until the call is cleared.

Add the following sections:

8.1.2.1/Q.2971 ADD PARTY:
AAL parameters maximum length is modified from 21 to 30 (this is to allow growth for future applications).
Broadband low layer information maximum length is modified from 17 to 20 (this is to allow growth for future applications).
Called party number minimum length depends on addressing and maximum length is specified at 25.
Calling party number maximum length is specified at 26.
Transit network selection maximum length is specified at 9 octets.
This information element is included only once in the message.

If the Calling party subaddress information element is used to convey an ATM endsystem address, then an additional Calling party subaddress information element may be present to convey an OSI NSAP or User specified subaddress. If the Called party subaddress information element is used to convey an ATM endsystem address, then an additional Called party subaddress information element may be present to convey an OSI NSAP or User specified subaddress.

Add the following to Table 8-10/Q.2971:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1 (Note A)	both	O	7-63

Note A - Also see the ATM Forum SAA/AMS IA 1.0 for more information.

8.1.2.2/Q.2971 ADD PARTY ACKNOWLEDGE:
AAL parameters maximum length modified from 21 to 30 (this is to allow growth for future applications).
Broadband low layer information maximum length is modified from 17 to 20 (this is to allow growth for future applications).
Add the following to Table 8-11/Q.2971:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1 (Note A)	both	O	7-63

Note A - Also see the ATM Forum SAA/AMS IA 1.0 for more information.

8.1.2.3/Q.2971 PARTY ALERTING:
Add the following to Table 8-12/Q.2971:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1 (Note A)	both	O	7-63

Note A - Also see the ATM Forum SAA/AMS IA 1.0 for more information.

8.1.2.4/Q.2971 ADD PARTY REJECT:
Add the following to Table 8-13/Q.2971:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1 (Note A)	both	O	7-63

Note A - Also see the ATM Forum SAA/AMS IA 1.0 for more information.

8.1.2.5/Q.2971 DROP PARTY:
Add the following to Table 8-14/Q.2971:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1 (Note A)	both	O	7-63

Note A - Also see the ATM Forum SAA/AMS IA 1.0 for more information.

8.1.2.6/Q.2971 DROP PARTY ACKNOWLEDGE:
Add the following to Table 8-15/Q.2971:

Information Element name	Reference	Direction	Type	Length
Generic identifier transport information element	2.1.1 (Note A)	both	O	7-63

Note A - Also see the ATM Forum SAA/AMS IA 1.0 for more information.

9/Q.2971 Signalling procedures at the coincident S_B and T_B reference point
and
10/Q.2971 Procedures at the T_B reference point for interworking with private B-ISDNs:
These two sections describe the procedures for point-to-multipoint calls.

Clause 9/Q.2971 specifies the procedures defined for DSS2 at the "coincident S_B and T_B reference point"; e.g. the procedures for a terminal. Clause 10/Q.2971 specifies the procedures defined for DSS2 at the "T_B reference point for interworking with private B-ISDNs"; e.g. the procedures for a B-ISDN PBX. The major difference between these two sets of procedures is the procedure for establishing additional leaves at the destination UNI. The Clause 9/Q.2971 procedures use a SETUP message for each add party request at a leaf UNI. The Clause 10/Q.2971 procedures use a SETUP message for the first add party request at a leaf UNI and an ADD PARTY message for each subsequent add party requests at a leaf UNI where the call is already present.

For this specification, both sets of procedures, those specified in Clause 9/Q.2971 and those specified in clause 10/Q.2971, shall apply. Which of these two procedures is used at a specific UNI shall be determined by bilateral agreement between the user and the network, regardless of whether the UNI resides at the coincident S_B and T_B reference point or at the T_B reference point.

Note: Although the procedures of Clause 10/Q.2971 may be in force at a particular UNI, there are cases where the network may forward a request to add a party as a SETUP message.

Add the following:
13.1/Q.2971   Timers at the user side:
The value of T399 shall be in the range 30-120 seconds (i.e. the sum of T303 and T310).

6.0

To preserve section numbering with the previous version of this document this section is intentionally blank (see section 1.6).

7.0 ATM Anycast Capability

The ATM Anycast capability allows a user to request a point-to-point connection to a single ATM end system that is part of an ATM group (see section 3.3 of the Addressing Reference Guide [32]).

The ATM Anycast capability can be requested by a calling user sending a SETUP message across its user-network interface. This SETUP message shall contain the desired ATM group address in the called party number information element. The user-plane-connection-configuration field shall be set to point-to-point. The network, upon receiving this SETUP message, shall establish a single point-to-point connection to a member of the group identified by the called party number. When the connection request reaches one member of the group, the called member may return its own individual ATM address or subaddress to the calling user through the Connected party number and the Connected party subaddress information elements in the CONNECT message as specified in Annex 4, Section A4.5.

This section extends the Q.2931 point-to-point signalling protocol as outlined in the previous paragraph to support the ATM Anycast capability.

7.1. Addressing

To support the ATM Anycast capability, ATM group addresses are used as specified in section 3.3 of the Addressing Reference Guide [32].

7.2. Coding Requirements

This section lists the messages and information elements whose contents have been modified to support the ATM Anycast capability.

7.2.1 Modified Messages

The SETUP message is modified to support the ATM Anycast capability.

3.1.7/Q.2931   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
Connection scope selection	7.2.2.1	both	O (A)	6

Note A -   May only be included when the calling user requests a point-to-point connection containing a group address in the Called party number information element. When included, the network shall progress the call and update the Connection scope selection information element as specified in Annex 6.

Figure 7-1/Q.2931 SETUP Message Content

7.2.2 Additional Information Elements

7.2.2.1 Connection Scope Selection

The purpose of the Connection Scope Selection information element is to allow the calling user to indicate to the network that the call/connection shall be processed and progressed within the selected routing range.

				Bits				
8	7	6	5	4	3	2	1	Octets
Connection Scope Selection								
1	1	1	0	1	0	1	1	1
Information element identifier								
1 Ext	Coding Standard		Information Element Instruction Field					2
			Flag	Reserved	Information Element Action Ind.			
Length of Connection scope selection information element contents								3
Length of Connection scope selection information element contents (continued)								4
1 ext	Spare			Type of connection scope				5
Connection scope selection								6

Figure 7-2 Connection Scope Selection Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
1 1	ATM Forum Specific

Type of connection scope (octet 5)

Bits 4 3 2 1	Meaning
0 0 0 1	Organizational
All others	Reserved

Connection scope selection (octet 6): when the Type of connection scope is coded as "Organizational" (Note 1):

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	Reserved
0 0 0 0 0 0 0 1	Local network
0 0 0 0 0 0 1 0	Local network plus one
0 0 0 0 0 0 1 1	Local network plus two
0 0 0 0 0 1 0 0	Site minus one
0 0 0 0 0 1 0 1	Intra-site
0 0 0 0 0 1 1 0	Site plus one
0 0 0 0 0 1 1 1	Organization minus one
0 0 0 0 1 0 0 0	Intra-organization
0 0 0 0 1 0 0 1	Organization plus one
0 0 0 0 1 0 1 0	Community minus one
0 0 0 0 1 0 1 1	Intra-community
0 0 0 0 1 1 0 0	Community plus one
0 0 0 0 1 1 0 1	Regional
0 0 0 0 1 1 1 0	Inter-regional
0 0 0 0 1 1 1 1	Global

Note 1 -   The calling user may use the guideline as described in Annex B of the Addressing Reference Guide [32] to select a proper value of this field.

7.3 Call/Connection Control Procedures for ATM Point-to-point Calls

This section describes the modified point-to-point call/connection control procedures to support the ATM Anycast capability.

5.1.5/Q.2931 Call/Connection proceeding
Add the following procedures:

When the SETUP message contains an ATM group address in the Called party number information element, the network shall progress the call to one of the members of the group with the Called party number remaining unchanged. Selection of a specific member of the group is outside the scope of this Specification. However, the Connected Line Presentation (see Annex 4, Section 4.5) capability allows the originating ATM endsystem to receive the address of the connected party.

If the received SETUP message contains an ATM group address and there are no registered members within the indicated connection scope, the network shall initiate the call clearing procedure in accordance with §5.4/Q.2931 with Cause #3 "*No route to destination*" toward the calling user.

7.4 Address Registration

In order to support the ATM Anycast capability, ILMI address registration must support the atmfAddressOrgScope MIB object and related procedures, as specified in Section 9 of the ILMI 4.0 Specification.

8.0   Connection Characteristics Negotiation During Establishment Phase

This section specifies the signalling protocol for negotiation of connection characteristics for point-to-point calls/connections and for the first party of point-to-multipoint calls/connections. The negotiation capabilities are only applicable during the call/connection establishment phase. In particular, the following capabilities are specified:

- negotiation of connection characteristics using an Alternative ATM traffic descriptor and
- negotiation of peak cell rate traffic parameters using a Minimum acceptable ATM traffic descriptor

In the case of the use of the Alternative ATM traffic descriptor information element the parameters of the information element are handled as a single entity whereas the Minimum acceptable ATM traffic descriptor information element allows the specification of a range of values for parameters which are handled independently.

This section applies to CBR, rt-VBR and nrt-VBR ATM service category calls, and to ABR calls using the procedures described in Section 10. It applies to UBR calls with the restriction that only the Minimum acceptable ATM traffic descriptor information element is supported

8.1 Coding requirements

This section lists the messages and information elements whose contents have been modified to support negotiation of connection characteristics during the call/connection establishment phase.

8.1.1 Messages

Table 8-1 lists the existing Q.2931 messages that need modification to support the connection characteristics negotiation function during the establishment phase of the call/connection.

Table 8-1 Modified Q.2931 Messages

Message	Reference
SETUP	8.1.1.1
CONNECT	8.1.1.2

8.1.1.1 SETUP

This message is sent by the calling user to the network and by the network to the called user to initiate call/connection establishment. See Table 8-2 for additions to the structure of this message shown in Table 3-8/Q.2931 and in 8.1/Q.2961.1.

Message type: SETUP
Significance: Global
Direction: Both

Table 8-2 SETUP Message Additional Content

Information element	Reference	Direction	Type	Length
Alternative ATM traffic descriptor	8.1.2.1	both	O (Note 1)	12-30
Minimum acceptable ATM traffic descriptor	8.1.2.2	both	O (Note 1)	8-28

Note 1 - Either the Alternative ATM traffic descriptor information element or Minimum acceptable ATM traffic descriptor information element, but not both, shall be included in the SETUP message when traffic parameters are negotiable.

8.1.1.2 CONNECT

This message is sent by the called user to the network and by the network to the calling user to indicate call/connection acceptance by the called user. See Table 8-3 for additions to the structure of this message shown in Table 3-2/Q.2931.

Message type: CONNECT
Significance: Global
Direction: Both

Table 8-3 CONNECT Message Additional Content

Information element	Reference	Direction	Type	Length
ATM traffic descriptor	4.5.6/Q.2931 4.1/Q.2961.1	both	O (Note 1)	6-30

Note 1 - Included to specify the traffic parameter values allocated for the call/connection if one or more traffic parameters were negotiable in the SETUP message.

8.1.2 Information elements

8.1.2.1 Alternative ATM traffic descriptor

The purpose of the Alternative ATM traffic descriptor information element is to specify an alternative ATM traffic descriptor for the negotiation of traffic parameters during call/connection setup. This information element is applicable to CBR and VBR calls.

The Alternative ATM traffic descriptor information element is coded as shown in Figure 8-1. The maximum length of this information element is 30 octets.

Bits								Octets
8	7	6	5	4	3	2	1	
Alternative ATM traffic descriptor								1
1	0	0	0	0	0	1	0	
Information element identifier								
1 Ext	Coding standard		Information Element Instruction Field					2
			Flag	Reserved	Information Element Action Ind.			
Length of Alternative ATM traffic descriptor contents								3 4
Further octets as contents of ATM traffic descriptor (Figure 4-13/Q.2931 and Figure 1/ Q.2961.1 as modified by section 2 § 4.5.6/Q.2931)								5* / 18*

Figure 8-1   Alternative ATM Traffic Descriptor Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized coding

The Alternative ATM traffic descriptor information element can have any combination of traffic parameters that is allowed for the ATM traffic descriptor information element. Within a single SETUP message the combination of traffic parameters may be different for these two information elements. However, the Alternative ATM traffic descriptor information element contains the Best Effort indicator if and only if it is also contained in the ATM traffic descriptor information element. If it is determined that the alternative bandwidth requirements are "greater" than those in the ATM traffic descriptor information element, the Alternative ATM traffic descriptor information element may be treated as an information element with content error.

8.1.2.2 Minimum Acceptable ATM Traffic Descriptor

The purpose of the Minimum acceptable ATM traffic descriptor information element is to specify the minimum acceptable ATM traffic parameters in the negotiation of traffic parameters during call/connection setup. The minimum acceptable ATM traffic parameters are the lowest values that the user is willing to accept for the call/connection. This information element is applicable to CBR, VBR, ABR and UBR calls. For UBR, the negotiation procedures are described in the ATM Forum Traffic Management Specification, Version 4.1 [17].

The Minimum acceptable ATM traffic descriptor information element is coded as shown in Figure 8-2 and in section 2 Table 4-3/Q.2931 (part 1 of 2). The maximum length of this information element is 28 octets.

Bits								Octets
8	7	6	5	4	3	2	1	
Minimum acceptable ATM traffic descriptor								1
1	0	0	0	0	0	0	1	
Information element identifier								
1 Ext	Coding standard		Information element instruction field					2
			Flag	Reserved	Spare	Action indicator		
Length of Minimum acceptable ATM traffic descriptor contents								3 4
The octet groups 5 through 8 are encoded as octet groups 5 through 8 specified in Figure 4-13/Q.2931 and Table 4-7/Q.2931 The octet groups 9 through 16 are encoded as octet groups 9 through 16 specified in Figure 1/Q.2961.1 and Table 2/Q.2961.1 The octet groups 17 and 18 are encoded as octet groups 19 and 20 respectively, specified in section 10.1.2.3.								5* /22*

Figure 8-2   Minimum acceptable traffic descriptor information element

In a SETUP message, a traffic parameter is allowed in the Minimum acceptable ATM traffic descriptor information element only if the corresponding traffic parameter is in the ATM traffic descriptor information element of the SETUP message (e.g. if there is no Forward Peak Cell Rate (CLP=0) parameter in the ATM traffic descriptor information element of a SETUP message then the Forward Peak Cell Rate (CLP=0) is not allowed in the Minimum acceptable ATM traffic descriptor information element of the SETUP message).

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized coding

On reception, both the codepoints "ATM Forum specific" and "ITU-T standardized coding" may be accepted as valid values, and may be processed identically.

8.2 Signalling procedures

8.2.1 Negotiating the connection characteristics at the originating interface

8.2.1.1 Negotiation request (Originating interface)

The user initiates the negotiation of the connection characteristics by including in addition to the ATM traffic descriptor information element, either the Minimum acceptable ATM traffic descriptor information element or the Alternative ATM traffic descriptor information element, but not both, in the SETUP message. In the case of the use of the Alternative ATM traffic descriptor information element the parameters of the information element are handled as a single entity whereas the Minimum acceptable ATM traffic descriptor information element allows the specification of a range of values for parameters which are handled independently. If a Minimum acceptable ATM traffic descriptor information element is used the traffic parameter values indicated shall be less than the corresponding traffic parameter values specified in the ATM traffic descriptor information element.

If point-to-multipoint procedures are supported, the user may initiate negotiation for the first party of a point-to-multipoint call. If the user initiates negotiation, the user shall send ADD PARTY messages only if the link

is in the Active state. If an ADD PARTY message is received for a call for which the SETUP message contained either a Minimum acceptable ATM traffic descriptor information element or an Alternative ATM traffic descriptor information element while in the Call Delivered state, an ADD PARTY REJECT message with a Cause information element indicating Cause #111, "*Protocol error, unspecified*" shall be sent in response.

8.2.1.2 Traffic parameter negotiation procedures (Originating interface)

When both the Minimum acceptable ATM traffic descriptor and the Alternative ATM traffic descriptor information elements are present in a SETUP message, the call shall be rejected as specified in 5.4.2/Q.2931 with Cause #73, "*Unsupported combination of traffic parameters*".

If the parameters of either the Alternative ATM traffic descriptor information element or the Minimum acceptable ATM traffic descriptor information element are not according to the allowed combinations as specified in 8.1.2.1 and 8.1.2.2 respectively, the network shall handle these information elements as if they were non-mandatory information elements with content error as specified in 5.6.8/Q.2931.

When the Minimum acceptable ATM traffic descriptor information element is included in the SETUP message and the network is able to provide the traffic parameter values specified in the ATM traffic descriptor information element, the network shall progress the connection establishment request with both the ATM traffic descriptor information element and the Minimum acceptable ATM traffic descriptor information element.

When the Alternative ATM traffic descriptor information element is included in the SETUP message and the network is able to provide the traffic parameter values specified in the ATM traffic descriptor information element and the network is able to provide the traffic parameter values specified in the Alternative ATM traffic descriptor information element, the network shall progress the connection establishment request with both the ATM traffic descriptor information element and the Alternative ATM traffic descriptor information element.

When the Alternative ATM traffic descriptor information element is included in the SETUP message and the network is able to provide the traffic parameter values specified in the ATM traffic descriptor information element and the network is not able to provide the traffic parameter values specified in the Alternative ATM traffic descriptor information element, the network shall progress the connection establishment request with the ATM traffic descriptor information element and without Alternative ATM traffic descriptor information element.

If the network is not able to provide some of the traffic parameter values indicated in the ATM traffic descriptor information element and the Minimum acceptable ATM traffic descriptor information element is included, the procedures of 8.2.1.2.1 shall apply.

If the network is not able to provide some of the connection characteristics indicated in the ATM traffic descriptor information element and Alternative ATM traffic descriptor information element is included, the procedures of 8.2.1.2.2 shall apply.

8.2.1.2.1 Minimum acceptable ATM traffic parameter negotiation

If the network is not able to provide some of the traffic parameter values indicated in the ATM traffic descriptor information element but is able to provide at least their corresponding traffic parameter values in the Minimum acceptable ATM traffic descriptor information element, the network shall progress the connection establishment request after adjusting the traffic parameter values indication in the ATM traffic descriptor information element. The adjusted parameter values will support at least the corresponding

minimum acceptable values. If some of the parameters in the Minimum acceptable ATM traffic descriptor information element are still less than the corresponding parameters in the modified ATM traffic descriptor information element then the call/connection shall be progressed with the Minimum acceptable ATM traffic descriptor information element containing all such parameters in addition to the modified ATM traffic descriptor information element. Otherwise, the call/connection shall progress with the modified ATM traffic descriptor information element and without the Minimum acceptable ATM traffic descriptor information element. For UBR, if the Minimum acceptable ATM traffic descriptor information element is present, the network should negotiate the Forward and/or Backward Peak Cell Rate parameters downwards to reflect the smallest bandwidth limitation along the path of the connection.

If the network is not able to provide at least the traffic parameter values indicated in the Minimum acceptable ATM traffic descriptor, the network shall reject the connection establishment request as specified in 5.4.2/Q.2931 with Cause #37 "*User cell rate unavailable*".

8.2.1.2.2 Alternative traffic parameter negotiation

If the network is not able to provide the ATM traffic descriptor indicated in the ATM traffic descriptor information element but is able to provide the ATM traffic descriptor indicated in the Alternative ATM traffic descriptor information element, the network shall progress the connection establishment request by using the contents of the Alternative ATM traffic descriptor information element as the ATM traffic descriptor.

If the network can provide neither the ATM traffic descriptor indicated in the ATM traffic descriptor information element nor the ATM traffic descriptor indicated in the Alternative ATM traffic descriptor information element, the network shall reject the connection establishment request as specified in 5.4.2/Q.2931 with Cause #37 "*User cell rate unavailable*".

8.2.2 Negotiation Acceptance (Originating interface)

Upon receiving an indication that the request has been accepted the network shall send a CONNECT message across the UNI and enter the Active state. The message returned to the user shall contain the ATM traffic descriptor information element indicating the traffic parameter values finally allocated to the connection.

If no ATM traffic descriptor information element is included in the CONNECT message, the connection characteristics specified in the ATM traffic descriptor information element sent in the SETUP message shall apply.

8.3 Negotiating the connection characteristics at the destination interface

8.3.1 Negotiation request (Destination interface)

The network shall send a SETUP message containing, in addition to the ATM traffic descriptor information element, either the Minimum acceptable ATM traffic descriptor information element or the Alternative ATM traffic descriptor information element when traffic parameters are negotiable.

8.3.2 Traffic parameter negotiation procedures (Destination interface)

If the user is able to provide the connection characteristics specified in the ATM traffic descriptor information element, the user shall progress the connection establishment request.

If the user is not able to provide some of the traffic parameter values indicated in the ATM traffic descriptor information element and the Minimum acceptable ATM traffic descriptor information element is included, the procedures of 8.3.2.1 shall apply.

If the user is not able to provide the ATM traffic descriptor indicated by the ATM traffic descriptor information element and Alternative ATM traffic descriptor information element is included, the procedures of 8.3.2.2 shall apply.

8.3.2.1 Minimum acceptable ATM traffic parameter negotiation

If the user is not able to provide some of the traffic parameter values indicated in the ATM traffic descriptor information element, but is able to provide at least their corresponding traffic parameter values in the Minimum acceptable ATM traffic descriptor information element, the user shall progress the connection establishment request.

If the user is not able to provide at least the traffic parameter values indicated in the Minimum acceptable ATM traffic descriptor, the user shall reject the connection establishment request as specified in 5.4.2/Q.2931 with Cause #47, "*Resources not available, unspecified*".

8.3.2.2 Alternative ATM traffic parameter negotiation

If the user is not able to provide the ATM traffic descriptor indicated by the ATM traffic descriptor information element, but is able to provide the ATM traffic descriptor indicated by the Alternative ATM traffic descriptor information element, the user shall progress the connection establishment request on the basis of the Alternative ATM traffic descriptor information element.

If the user can provide neither the ATM traffic descriptor indicated by the ATM traffic descriptor information element nor the ATM traffic descriptor indicated by the Alternative ATM traffic descriptor information   element, the user shall reject   the   connection establishment request as specified in 5.4.2/Q.2931 with Cause #47 "*Resource not available, unspecified*"

8.3.3 Negotiation confirmation (Destination interface)

When the user receives a SETUP message and wishes to accept the request, the user responds with a CONNECT message and enters the appropriate connection state.

If the user has progressed the call based on either the Minimum acceptable ATM traffic descriptor information element or the Alternative traffic descriptor information element, the message returned by the user shall contain the ATM traffic descriptor information element with the accepted connection characteristics. If negotiation has proceeded on the basis of the Minimum acceptable ATM traffic descriptor information element, the ATM traffic descriptor information element shall contain appropriately modified values for the same set of parameters as received in the ATM traffic descriptor information element. If negotiation has proceeded on the basis of the Alternative ATM traffic descriptor information element, the ATM traffic descriptor information element shall contain the parameters and values as contained in the

Alternative ATM traffic descriptor information element with the exception of the traffic management option parameters (see section 2.2.1 and Q.2961).

If the user has progressed the call based on the ATM traffic descriptor, inclusion of the ATM traffic descriptor information element in the CONNECT message is optional. If no ATM traffic descriptor information element is included in the CONNECT message, the connection characteristics specified in the ATM traffic descriptor information element sent in the SETUP message shall apply. If the ATM traffic descriptor information element is included in the CONNECT message, the connection characteristics specified in this information element shall apply.

If the user rejects the request it will send the appropriate message (RELEASE COMPLETE) and enter the Null state.

9.0 Signalling of Individual QoS Parameters

The purpose of this section is to describe the messages, information elements, and procedure modifications needed to support the signalling of individual QoS parameters. The signalling of these parameters is predicated upon the ATM Service Category in Annex 9. The messages, information elements, and procedures specified in this section support the worst-case (i.e., additive) method for accumulation of delay parameters described in the ATM Forum Traffic Management Specification, Version 4.1 [17].

9.1 Coding Requirements

This section specifies additions and modifications to the messages and information elements used to support signalling of individual QoS parameters.

9.1.1 Modified Message Contents

9.1.1.1 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. See Table 9-1 below for modifications to the structure of this message from that shown in Tables 3-4/Q.2931 and 8-4/Q.2971 as modified in sections 2 and 8 of this Specification.

Table 9-1 CONNECT Message Additional Contents

Message Type: CONNECT
Significance: Global
Direction: Both

Information Element	Reference	Direction	Type	Length
End-to-end transit delay	9.1.2.1	both	O(1)	7
Extended QoS parameters	9.1.2.2	both	O(1)	7-13

Note 1 - Included when the called user received this information element in the SETUP or ADD PARTY message and the origin of the information element was the calling user.

9.1.1.2 SETUP

This message is sent by the calling user to the network and by the network to the called user to initiate B-ISDN call and connection establishment. See Table 9-2 below for modifications to the structure of this message from that shown in Tables 3-8/Q.2931and 8-5/Q.2971as modified in sections 2, 6, 7, and 8 of this Specification.

Table 9-2 SETUP Message Additional Contents

Message Type: SETUP
Significance: Global
Direction: Both

Information Element	Reference	Direction	Type	Length
End-to-End transit delay	9.1.2.1	both	O(1)	7-11
Extended QoS parameters	9.1.2.2	both	O(2)	7-25
QoS parameter	4.5.18/Q.2931	both	O(3)	6

Note 1 -   Included to specify an end-to-end transit delay requirement.

Note 2 -   Included to specify individual QoS parameter requirements for the call. This information element is mandatory when the QoS parameter information element is absent.

Note 3 -   This information element is mandatory when the Extended QoS parameter information element is absent. When the Extended QoS parameter information element is present, the QoS parameter information element may be included to facilitate interworking with networks that do not support the Extended QoS parameter information element. See section 9.2 for further details.

9.1.1.3 ADD PARTY ACKNOWLEDGE

See Table 9-3 below for modifications to the structure of this message from that shown in Table 8-11/Q.2971.

Table 9-3 ADD PARTY ACKNOWLEDGE Message Additional Contents

Message Type: ADD PARTY ACKNOWLEDGE
Significance: Global
Direction: Both

Information Element	Reference	Direction	Type	Length
End-to-End transit delay	9.1.2.1	both	O(1)	7

Note 1 -   Included when the called user received this information element in the SETUP or ADD PARTY message and the origin of the information element was the calling user.

9.1.2 Information Elements

9.1.2.1 End-to-End Transit Delay

There is no change to the format of the End-to-end transit delay as specified in section 8.2.1/Q.2965.2.

8.2.1/Q.2965.2 End-to-End Transit Delay:
Replace all references to I.356 with a reference to "the ATM Forum Traffic Management Specification, Version 4.1 [17]".
Replace Note 1 to Figure 1/Q.2965.2 with:

> "Note 1 -   Included if and only if the origin of this information element is other than the originating user."

9.1.2.2 Extended QoS Parameters

The purpose of the Extended QoS parameters information element is to indicate the individual QoS parameter values acceptable on a per call basis and to indicate the cumulative QoS parameter values. The QoS parameter values included in the Extended QoS parameters information element together with those included in the End-to-end transit delay information element (if present) specify a QoS capability at a SIG 4.1 interface.

The relevant QoS parameters applicable to user data transferred during the data transfer phase on the user plane are defined in the ATM Forum Traffic Management Specification, Version 4.1 [17].

The Extended QoS parameter information element is coded as shown in Figure 9-1.
The maximum length of this information element is 25 octets.

				Bits				
8	7	6	5	4	3	2	1	Octets
	Extended QoS parameters							1
1	1	1	0	1	1	0	0	
Information element identifier							
1 Ext	Coding Standard	Flag	Reserved	Information Element Instruction Field — Information Element Action Ind.			2
	Length of Extended QoS parameters contents							3
	Length of Extended QoS parameters contents (continued)							4
	Origin							5
1	0	0	1	0	1	0	0	6*
Acceptable Forward Peak-to-Peak Cell Delay Variation Identifier							
	Acceptable Forward Peak-to-Peak Cell Delay Variation							6.1*
	Acceptable Forward Peak-to-Peak Cell Delay Variation (cont'd)							6.2*
	Acceptable Forward Peak-to-Peak Cell Delay Variation (cont'd)							6.3*
1	0	0	1	0	1	0	1	7*
Acceptable Backward Peak-to-Peak Cell Delay Variation Identifier							
	Acceptable Backward Peak-to-Peak Cell Delay Variation							7.1*
	Acceptable Backward Peak-to-Peak Cell Delay Variation (cont'd)							7.2*
	Acceptable Backward Peak-to-Peak Cell Delay Variation (cont'd)							7.3*
1	0	0	1	0	1	1	0	8*
	Cumulative Forward Peak-to-Peak Cell Delay Variation Identifier							(Note 1)
	Cumulative Forward Peak-to-Peak Cell Delay Variation							8.1*
	Cumulative Forward Peak-to-Peak Cell Delay Variation (cont'd)							8.2*
	Cumulative Forward Peak-to-Peak Cell Delay Variation (cont'd)							8.3*
1	0	0	1	0	1	1	1	9*
	Cumulative Backward Peak-to-Peak Cell Delay Variation Identifier							(Note 1)
	Cumulative Backward Peak-to-Peak Cell Delay Variation							9.1*
	Cumulative Backward Peak-to-Peak Cell Delay Variation (cont'd)							9.2*
	Cumulative Backward Peak-to-Peak Cell Delay Variation (cont'd)							9.3*
1	0	1	0	0	0	1	0	10*
	Acceptable Forward Cell Loss Ratio Identifier							(Note 2)
	Acceptable Forward Cell Loss Ratio							10.1*
1	0	1	0	0	0	1	1	11*
	Acceptable Backward Cell Loss Ratio Identifier							(Note 2)
	Acceptable Backward Cell Loss Ratio							11.1*

Note 1 -   If an acceptable forward and/or backward Peak-to-Peak CDV is included, then the corresponding cumulative forward and/or backward Peak-to-Peak CDV shall be included, respectively.

Note 2 -   The acceptable forward and/or backward cell loss ratio specified is either for the CLP=0 traffic stream or for the CLP=0+1 traffic stream, depending on the conformance definition (see Annex 9).

Figure 9-1 Extended QoS Parameters Information Element

Coding Standard (octet 2)

Bits 7 6	Meaning
1 1	ATM Forum Specific

Origin (octet 5)

Indicates the origin of this information element. If the origin is the calling party, then the called party can assume that the received cumulative values are end-to-end values. Otherwise, the received cumulative values do not represent end-to-end values.

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	Originating user
0 0 0 0 0 0 0 1	Intermediate network

Acceptable Forward/Backward Peak-to-Peak Cell Delay Variation (octets 6.1-6.3/7.1-7.3)

The acceptable forward and backward peak-to-peak cell delay variation parameters indicate the calling user's highest acceptable (least desired) peak-to-peak cell delay variation values, expressed in units of microseconds. They are coded as 24-bit binary integers, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit. The value "1111 1111 1111 1111 1111 1111", however, is not to be interpreted as an acceptable peak-to-peak cell delay variation value. This codepoint or the lack of this identifier in this information element indicates: 'any forward/backward peak-to-peak cell delay variation value acceptable'.

Cumulative Forward/Backward Peak-to-Peak Cell Delay Variation (octets 8.1-8.3/9.1-9.3)

The cumulative forward/backward peak-to-peak cell delay variation values are expressed in units of microseconds. They are coded as 24-bit binary integers, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit.

Acceptable Forward/Backward Cell Loss Ratio (octets 10.1/11.1)

The acceptable forward and backward cell loss ratio parameters indicate the calling user's highest acceptable (least desired) cell loss ratio values. A cell loss ratio is expressed as an order of magnitude n, where the cell loss ratio takes the value 10^{-n}. The value n is coded as a binary integer, having a range of $1 <= n <= 15$. In addition, the value "1111 1111" or the lack of this identifier in this information element indicates: 'any forward/backward cell loss ratio value acceptable'. All other values are reserved.

9.2 Signalling Procedures in Support of Individual QoS Parameters

This section describes the call/connection control procedures to support signalling of individual QoS parameters.

9.2.1 Changes to procedures of Q.2931

These procedures are in addition to the procedures in Q.2931 for specifying QoS classes.

5.1.3/Q.2931 QoS and Traffic parameters selection procedures (originating interface)
Add the following paragraphs to the end of this section:

The possible inclusion of individual QoS parameters in the SETUP message by the user is determined by the ATM service category of the call. The allowed individual QoS parameters for each ATM service category are specified in Annex 9.

If the user wants to request or indicate individual quality of service parameter values for this call, the user may include acceptable and/or cumulative values of allowed individual QoS parameters in the Extended QoS parameters information element and/or the End-to-end transit delay information element. If an acceptable value of a parameter is included, and the end-to-end value of that parameter is determined by accumulation, then the corresponding cumulative value of the parameter shall also be included. The cumulative forward and backward values of individual QoS parameters indicated by the user in the SETUP message (if present) include the cumulative values from the original user to the network boundary, and from the network boundary to the user, respectively. These values are updated sequentially along the route of the call to determine the values to be expected for this call.

The Extended QoS parameters information element takes precedence over the QoS parameter information element. The use of QoS Classes in SIG 4.1 is retained for backward compatibility with UNI 3.0/3.1 and with ITU standards (e.g. Q.2931/Q.2971). When an Extended QoS parameters information element is present, the network shall not derive values for any absent QoS parameters. When an Extended QoS parameters information element is present, if no acceptable forward value of an allowed individual QoS parameter for the corresponding ATM service category is specified (in the Extended QoS parameters or End-to-end transit delay information elements), then any value of the individual QoS parameter is deemed acceptable for this call. If the End-to-end transit delay information element is included in the SETUP message and the Extended QoS parameters information element is not included, then the QoS classes included in the QoS parameter information element shall not be used to determine any objectives for maximum end-to-end transit delays for this call/connection but may be used to determine the remaining parameters.

If the SETUP message includes an Extended QoS parameters information element and the calling user wants the call to complete even when the Extended QoS parameters information element is not supported (e.g., when interworking with UNI 3.0/3.1 or ITU standards occur), the calling user should also include the QoS parameter information element.

If the calling user does not want the call to complete when the Extended QoS parameters information element is not supported (e.g., when interworking with UNI 3.0/3.1 or ITU standards occur), the calling user should not include the QoS parameter information element.

If a user at the originating side of a T_B reference point (i.e., private network) receives a setup indication with no Extended QoS parameters information element, the user may optionally generate an Extended QoS parameter information element and/or an End-to-end transit delay information element (the latter only if none is contained in the setup indication) using a local mapping from the Forward and Backward QoS Class subfields in the QoS parameter information element. When such a mapping is used, the individual QoS parameters for which values are implied (from the QoS classes included in the QoS parameter information element and the ATM service category of the call) must be specified, and the origin of each information element including one or more of the newly generated individual QoS parameters must be marked as an 'intermediate network' (i.e., in the Extended QoS parameters information element the Origin field is set to

'intermediate network', and in the End-to-end transit delay information element a 'network-generated indicator' is included). The QoS parameter information element shall remain in the SETUP message progressed to the network.

If the network receives a SETUP message that does not contain any Extended QoS parameters information element and the network is able to provide the requested QoS class (including any implied values of maximum end-to-end transit delays if and only if no End-to-end transit delay information element is included), the remaining procedures in this section shall be followed. If the network is not able to provide the requested QoS class, the network shall reject the call, returning a RELEASE COMPLETE message with Cause #49, "*Quality of service unavailable*."

If the network receives a SETUP message that contains both the QoS parameter information element and the Extended QoS parameters information element, the network shall simply pass on the QoS parameter information element if the call is progressed and follow the remaining procedures in this section.

For each parameter contained in the Extended QoS parameters information element and/or the End-to-end transit delay information element, the network shall:

1) Additively increment the accumulated value of that parameter, if the parameter is cumulative, to account for the expected increases due to user data transfer within the network over the related connection during the data transfer phase of the call.
2) Determine if acceptable values of that parameter can be supported. If any parameter can not be supported, then the network shall reject the call, returning a RELEASE COMPLETE message with Cause #49, "*Quality of service unavailable*".

If the network detects that the Extended QoS parameters information element and/or End-to-end transit delay information element contain a non-supported set of individual QoS parameters for the ATM service category of the call (see Annex 9), the network shall return a RELEASE COMPLETE message with Cause #73, *"Unsupported combination of traffic parameters"*.

If the network is able to provide the acceptable values of all specified individual QoS parameters, the network shall progress the call to the called user.

5.1.7/Q.2931 Call/Connection acceptance (originating interface)

Add the following paragraph:

If the received connect indication includes an Extended QoS parameters information element and/or an End-to-end transit delay information element, then the CONNECT message sent to the calling user shall include the Extended QoS parameters information element and/or End-to-end transit delay information element, respectively.

5.2.4/Q.2931 QoS and Traffic parameter selection procedures (destination interface)
Add the following paragraphs to the end of this section:

In the case where the network received an Extended QoS parameters information element in the setup indication, the network shall indicate the acceptable and cumulative values of each included individual QoS parameter in the Extended QoS parameters information element in the SETUP message sent to the called party.

If the network received an End-to-end transit delay information element in the setup indication, the network shall indicate the acceptable and cumulative values of the end-to-end transit delay in the End-to-end transit delay information element in the SETUP message sent to the called party.

If no Extended QoS parameters information element was contained in the received setup indication, the network may optionally generate an Extended QoS parameters information element and/or an End-to-end transit delay information element (the latter only if none is contained in the setup indication) using a local mapping from the Forward and Backward QoS Class subfields in the QoS parameter information element. When such a mapping is used, the individual QoS parameters for which values are implied (from the QoS classes included in the QoS parameter information element and the ATM service category of the call) must be specified, and the origin of each information element including one or more of the newly generated individual QoS parameters must be marked as an 'intermediate network' (i.e., in the Extended QoS parameters information element the Origin field is set to 'intermediate network', and in the End-to-end transit delay information element a 'network-generated indicator' is included). The cumulative values of parameters generated from this mapping, as included in the SETUP message sent to the called party, must account for the known amounts due to user data transfer within the network over the related connection during the data transfer phase of the call. The QoS parameter information element shall remain in the SETUP message progressed to the user.

If the called user receives a SETUP message that does not contain an Extended QoS parameters information element, the called user shall decide whether the requested quality of service can be supported based on the QoS class and on the acceptable forward maximum end-to-end transit delay (if an End-to-end transit delay information element is included). If the called user is not able to provide the requested QoS class, the user shall reject the call, returning a RELEASE COMPLETE message with Cause #49, "*Quality of service unavailable*."

For each parameter contained in the Extended QoS parameters information element and/or the End-to-end transit delay information element, the called user shall:

1) Additively increment the forward and backward accumulated values of that parameter, if the parameter is cumulative, to account for the expected increases due to user data transfer from the network boundary to the user or from the user to the network boundary, respectively.
2) Determine if the acceptable values of that parameter can be supported. If any parameter can not be supported, then the user shall reject the call, returning a RELEASE COMPLETE message with Cause #49, "*Quality of service unavailable*".

When an Extended QoS parameters information element is included, if no acceptable value of an allowed individual QoS parameter is specified (in the Extended QoS Parameters or End-to-end transit delay information elements), the default is that any value of the individual QoS parameter is acceptable and the user shall continue to process the call.

If the user detects that the Extended QoS parameters information element and/or End-to-end transit delay information element contains a non-supported set of individual QoS parameters for the ATM service category of the call, the called user shall return a RELEASE COMPLETE message with Cause #73, "*Unsupported combination of traffic parameters*".

5.2.6/Q.2931 Call/Connection acceptance (destination interface)
Add the following two paragraphs:

At the S_B reference point and at the coincident S_B and T_B reference point, if the received SETUP message contained an Extended QoS parameters information element or an End-to-end transit delay information element, and the origin of the information element is the originating user, then the CONNECT message sent to the network shall include the cumulative values of QoS metrics in the Extended QoS parameters information element or End-to-end transit delay information element, respectively. These values are only returned to the calling user when end-to-end cumulative values have been obtained, accounting for the entire path from the originating user to the destination user. The acceptable values of QoS parameters fields shall not be included.

If the network receives an Extended QoS parameters information element and/or an End-to-end transit delay information element in the CONNECT message containing an acceptable QoS parameter field, the field shall be discarded. The network need not check the correctness of the cumulative values of QoS metrics received in the CONNECT message.

Annex K/Q.2931 Handling of the End-to-end transit delay information element:
This annex does not apply (this annex is superseded by the procedures of this section).

9.2.2 Changes to procedures in Q.2971

The End-to-end transit delay may be specified on a leaf-by-leaf basis by the Root. If the End-to-end transit delay information element is included in the original SETUP message and this information element is not included in a subsequent ADD PARTY message, then the end-to-end transit delay is unspecified for that party.

When an add party indication is mapped into a SETUP message, the QoS parameter, Extended QoS parameters, ATM traffic descriptor, and Broadband bearer capability information elements received in the original SETUP message for this point-to-multipoint call shall be mapped into the corresponding information elements in the SETUP message progressed towards the leaf. When an add party indication that does not contain an End-to-end transit delay information element is mapped into a SETUP message:

- if the original SETUP message contained a user-generated End-to-end transit delay information element, no End-to-end transit delay information element shall be included in the SETUP message progressed toward the leaf (i.e. any value of maximum end-to-end transit delay is acceptable);
- if the original SETUP message contained a network-generated End-to-end transit delay information element, the End-to-end transit delay information element shall be mapped into the corresponding information element in the SETUP message progressed towards the leaf;
- otherwise, the procedures of Section 9.2 for the destination interface shall be followed.

If the root needs to specify the end-to-end transit delay for any party in a point-to-multipoint connection, it is recommended that the End-to-end transit delay information element be included by the root in the SETUP message and all subsequent ADD PARTY messages.

9.1.1/Q.2971 Set up of the first party
If the SETUP message contains a Broadband bearer capability information element indicating "point-to-multipoint" in the user plane connection configuration field and contains any backward value of an allowed individual QoS parameter, the network shall clear the call with Cause #73 "*Unsupported combination of traffic parameters* ".

When a user or network maps QoS classes into individual QoS parameters, the backward QoS class shall be ignored (i.e., no backward individual QoS parameters shall be created).

9.3 End-to-end transit delay relationship with ATM service categories

It is recommended that the End-to-end transit delay information element be included only if the ATM service category of the call is CBR or real-time VBR. Specification of the end-to-end transit delay for the non-real-time VBR service category is allowed, in order to retain compatibility with ITU-T Recommendations (e.g., Q.2931). Note that this inclusion is not specified by the ATM Forum Traffic Management Specification, Version 4.1 [17]. Non-real-time VBR calls with End-to-end transit delay information elements shall only be accepted when commitments can be made to achieve the specified acceptable maximum end-to-end transit delays.

10.0 Available Bit Rate (ABR) Capability

The ATM Forum Traffic Management Specification, Version 4.1 [17] specifies the ABR capability. This section describes the signalling support required to set up a point-to-point call with ABR capability.

When establishing a point-to-point call with ABR capability, messages, information elements and procedures described in this Specification (except sections 5, 6 and 9) apply. This section describes the additional information elements and procedures applicable only for the ABR capability. The description is in an incremental form with differences from the basic point-to-point call with respect to messages, information elements and procedures for ABR being identified herein.

10.1 Coding Requirements

This sub-section describes the additional coding requirements for messages and information elements to support the point-to-point call with ABR capability.

10.1.1 Modification of Point-to-point Messages

10.1.1.1 CONNECT Message

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. See Table 10-1 for additions to the structure of this message shown in Table 3-2/Q.2931.

Table 10-1 CONNECT Message Additional Content

Message type: CONNECT
Significance: global
Direction: both

Information Element name	Reference	Direction	Type	Length
ATM traffic descriptor	4.5/Q.2931	both	O (Note 1)	12-30
ATC Setup Parameters	10.1.2.2	both	O (Note 1)	6-36
ATC Additional Parameters	10.1.2.1	both	O (Note 2)	14

Note 1 - Mandatory for an ABR connection.

Note 2 - Included in the user-to-network direction when the SETUP message contains the ATC additional parameters information element. Included in the network to user direction when the called user included ATC additional parameters information element in the CONNECT message.

10.1.1.2 SETUP Message

This message is sent by the calling user to the network and by the network to the called user to initiate call establishment. See Table 10-2 for additions to the structure of this message shown in Table 3-8/Q.2931.

Table 10-2 SETUP Message Additional Content

Message type: SETUP
Significance: global
Direction: both

The Alternative ATM traffic descriptor information element is not permitted for ABR connections.

Information Element name	Reference	Direction	Type	Length
ATC Setup Parameters	10.1.2.2	both	O (Note 1)	6-36
ATC Additional Parameters	10.1.2.1	both	O (Note 2)	14

Note 1 -   Mandatory if the calling user requested an ABR connection.

Note 2 -   Included in the user-to-network direction when the calling user wants to specify explicitly a set of ATC additional parameters. Permitted only if the calling user requested an ABR connection. Included in the network-to-user direction when the calling user included it.

10.1.2 Information Elements

The modified and new information elements for ABR capability are described in this section. The new information elements are:

- ATC setup parameters, contains mandatory parameters
- ATC additional parameters, contains optional parameters

The structure of these information elements is described below.

10.1.2.1 ATC additional parameters

The purpose of the ATC Additional Parameters information element is to specify the set of additional ABR parameters during the call/connection establishment. The length of this information element is 14 octets.

Bits								Octets
8	7	6	5	4	3	2	1	
1	1	1	0	0	1	0	0	1
ATC additional parameters information element identifier								
1	Coding		Information Element Instruction Field					2
Ext	Standard		Flag	Reserved	Information Element Action Ind.			
Length of ATC additional parameters information element contents								3
Length of ATC additional parameters information element contents (continued)								4
Forward Additional Parameters Record identifier								5
1	1	0	0	0	0	1	0	
Forward Additional Parameters Record								5.1
Forward Additional Parameters Record (continued)								5.2
Forward Additional Parameters Record (continued)								5.3
Forward Additional Parameters Record (continued)								5.4
Backward Additional Parameters Record identifier								6
1	1	0	0	0	0	1	1	
Backward Additional Parameters Record								6.1
Backward Additional Parameters Record (continued)								6.2
Backward Additional Parameters Record (continued)								6.3
Backward Additional Parameters Record (continued)								6.4

Coding standard (octet 2)

Bits 7 6	Meaning
1 1	ATM Forum specific

Additional Parameters Record (Octet 5.1 - 5.4 and 6.1 - 6.4)

> The Additional Parameters Record is a 32-bit binary value. Bit 8 of the first octet is the most significant bit (bit position 32) and Bit 1 of the fourth octet is the least significant bit (bit position 1). The Additional Parameters value is a compressed encoding of a set of ABR parameters. See the ATM Forum Traffic Management Specification, Version 4.1 [17], for definitions of the parameters mentioned in the table below.

> To keep the encoding compact, most parameters are encoded as the $\log_2$ of the parameter value, scaled by a suitable scaling factor. In addition, some are scaled by other parameters, as described below. For each parameter there is a corresponding "present" bit, which is set to 1 to indicate that the parameter is present and 0 to indicate it is absent. If a parameter is absent, the parameter data bits shall be treated as "spare" bits.

Name	Size (bits)	Bit Position	Multiplier	Range	Encoding
Nrm present	1	32			Boolean
Trm present	1	31			Boolean
CDF present	1	30			Boolean
ADTF present	1	29			Boolean
Nrm	3	28-26	2	2-256	note 1
Trm	3	25-23	0.7813 ms	0.78-100 ms	note 1
CDF	3	22-20	1/128	0, 1/64-1	note 2
ADTF	10	19-10	10 ms	0.01-10.23 s	note 3
Spare	9	9-1			0

Note 1 - Encoded logarithmically. The encoded value is:
$$\log_2 (\text{parameter} / \text{multiplier})$$
Conversely, the parameter value represented by a given encoding is:
$$\text{multiplier} * 2^{\text{encoding}}$$

Note 2 - If the parameter value is zero, the encoding is zero. Otherwise the parameter is encoded according to Note 1.

Note 3 - Coded as a binary integer. The coding value 0 is treated as 1 (i.e., 0.01 seconds).

10.1.2.2 ATC Setup Parameters

The purpose of the ATC Setup Parameters information element is to specify the set of ABR parameters during the call/connection establishment. The maximum length of this information element is 36 octets.

			Bits					Octets
8	7	6	5	4	3	2	1	
1	0	0	0	0	1	0	0	1
ATC setup parameters information element identifier								
1 Ext	Coding Standard		Information Element Instruction Field					2
			Flag	Reserved	Information Element Action Ind.			
Length of ATC setup parameters information element contents								3
Length of ATC setup parameters information element contents (continued)								4
Forward ABR Initial Cell Rate Identifier (CLP = 0+1)								5* (Note 1)
1	1	0	0	0	0	1	0	
Forward ABR Initial Cell Rate								5.1* (Note 1)
Forward ABR Initial Cell Rate (continued)								5.2* (Note 1)
Forward ABR Initial Cell Rate (continued)								5.3* (Note 1)
Backward ABR Initial Cell Rate Identifier (CLP = 0+1)								6* (Note 1)
1	1	0	0	0	0	1	1	
Backward ABR Initial Cell Rate								6.1* (Note 1)
Backward ABR Initial Cell Rate (continued)								6.2* (Note 1
Backward ABR Initial Cell Rate (continued)								6.3* (Note 1)

Forward ABR Transient Buffer Exposure Identifier								7* (Note 1)
1	1	0	0	0	1	0	0	
Forward ABR Transient Buffer Exposure								7.1* (Note 1)
Forward ABR Transient Buffer Exposure (continued)								7.2* (Note 1)
Forward ABR Transient Buffer Exposure (continued)								7.3* (Note 1)
Backward ABR Transient Buffer Exposure Identifier								8* (Note 1)
1	1	0	0	0	1	0	1	
Backward ABR Transient Buffer Exposure								8.1* (Note 1)
Backward ABR Transient Buffer Exposure (continued)								8.2* (Note 1)
Backward ABR Transient Buffer Exposure (continued)								8.3* (Note 1)
Cumulative RM Fixed Round Trip Time Identifier								9
1	1	0	0	0	1	1	0	
Cumulative RM Fixed Round Trip Time								9.1
Cumulative RM Fixed Round Trip Time (continued)								9.2
Cumulative RM Fixed Round Trip Time (continued)								9.3
Forward Rate Increase Factor Identifier								10* (Note 1)
1	1	0	0	1	0	0	0	
Forward Rate Increase Factor								10.1* (Note 1)
Backward Rate Increase Factor Identifier								11* (Note 1)
1	1	0	0	1	0	0	1	
Backward Rate Increase Factor								11.1* (Note 1)
Forward Rate Decrease Factor Identifier								12* (Note 1)
1	1	0	0	1	0	1	0	
Forward Rate Decrease Factor								12.1* (Note 1)
Backward Rate Decrease Factor Identifier								13* (Note 1)
1	1	0	0	1	0	1	1	
Backward Rate Decrease Factor								13.1* (Note 1)

Note 1 -   This parameter is optional in the user-to-network direction in a SETUP message, mandatory in the network-to-user direction in a SETUP message, and mandatory in both directions in a CONNECT message.

Coding Standard (octet 2)

Bits 7 6	Meaning
0 0	ITU-T standardized coding

On reception, both the codepoints "ATM Forum specific" and "ITU-T standardized coding" may be accepted as valid values, and may be processed identically.

Forward and Backward ABR Initial Cell Rate (ICR)

> (octets i.1 - i.3, where i may have values 5 or 6)
> These values are coded in cells per second. They are the rates at which each source may initially commence transmitting. 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. For further details see the ATM Forum Traffic Management Specification, V4.1 [17].

Forward and Backward Transient Buffer Exposure (TBE)

> (octets i.1 - i.3, where i may have values 7 or 8)
> These values are coded in cells. It is the number of cells which can be supported for a VC starting up before the control loop is established. The range of this parameter is 1 through 2^{24}-1. 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. For further details see the ATM Forum Traffic Management Specification, V4.1 [17].

Cumulative RM Fixed Round Trip Time

> (octets 9 .1 - 9.3) This parameter is used to accumulate the sum of all the fixed propagation delays and queuing delays in the round trip call path from the source to the destination and back for ABR RM cells. It is coded as a 24-bit binary integer number of microseconds, with Bit 8 of the first octet being the most significant bit and Bit 1 of the third octet being the least significant bit. For further details see the ATM Forum Traffic Management Specification, V4.1 [17].

Forward and Backward Rate Increase Factor (RIF)

> (octet i.1, where i may have values 10 or 11)
> This parameter controls the rate at which the cell transmission rate increases. It is signalled as $\log_2$ (RIF * 32768). The range of this parameter is 0-15. It is coded as an 8-bit binary integer, with Bit 8 being the most significant bit and Bit 1 being the least significant bit. For further details see the ATM Forum Traffic Management Specification, V4.1 [17].

Forward and Backward Rate Decrease Factor (RDF)

> (octet i..1, where i may have values 12 or 13)
> This parameter controls the rate at which the cell transmission rate decreases. It is signalled as $\log_2$ (RDF * 32768). The range of this parameter is 0-15. It is coded as an 8-bit binary integer, with Bit 8 being the most significant bit and Bit 1 being the least significant bit. For further details see the ATM Forum Traffic Management Specification, V4.1 [17].

10.1.2.3 ATM Traffic Descriptor

Add the following traffic descriptor subfields (and related notes) to Figure 4-13/Q.2931, as modified by Figure I/Q.2961.1:

8	7	6	5	4	3	2	1	Bit Positions
Forward Minimum Cell Rate Identifier (CLP = 0+1)								19* (Note 1)
1	0	0	1	0	0	1	0	
Forward Minimum Cell Rate								19.1* (Note 1)
Forward Minimum Cell Rate (continued)								19.2* (Note 1)
Forward Minimum Cell Rate (continued)								19.3* (Note 1)
Backward Minimum Cell Rate Identifier (CLP = 0+1)								20* (Note 1)
1	0	0	1	0	0	1	1	
Backward Minimum Cell Rate								20.1* (Note 1)
Backward Minimum Cell Rate (continued)								20.2* (Note 1)
Backward Minimum Cell Rate (continued)								20.3* (Note 1)

Note 1 - If an ABR connection is being requested, this parameter is optional in the user-to-network direction in a SETUP message, mandatory in the network-to-user direction in a SETUP message, and mandatory in both directions in a CONNECT message. It is not permitted for other traffic categories.

Forward/Backward Minimum Cell Rate (MCR)
(octets i.1 - i.3, where i may have values 19 or 20)
The forward and backward minimum cell rate (MCR) parameters indicate the minimum cell rate between the users and the network. 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. Allowable combinations of Traffic Parameter subfields are described in Annex 9.

10.2 Signalling Procedures

The procedures for basic call/connection control as described in clause 5 of Recommendation Q.2931 as modified in section 2 of this Specification shall apply. Only additional procedures to handle the point-to-point ABR call/connections are described in this section. These procedures shall apply only when the SETUP message contains a Broadband bearer capability information element indicating "ABR" in the ATM transfer capability field.

10.2.1 Call/Connection Establishment at the Originating Interface

The procedures of section 2 item 5.1.1/Q.2931 shall apply with the following changes:

If the caller is requesting an ABR connection, the calling party sends a SETUP message across its user-network interface. The message shall contain a Broadband bearer capability information element indicating "ABR" in the ATM transfer capability field and "point-to-point" in the User plane connection configuration field. The ATC Setup Parameters information element is mandatory in the SETUP message.

ABR parameters for a given (forward or backward) direction may be included in the ATC setup parameters information element only if the ATM traffic descriptor information element contains a non-zero PCR (CLP=0+1) parameter for that direction. Both the forward and backward Additional Parameters Records are always included in the ATC additional parameters information element (if the information element is present), but if the PCR (CLP=0+1) parameter for a given direction in the ATM traffic descriptor information element has a value of zero, then the Additional Parameters Record for that direction shall be coded with all bits zero.

Additionally, the following rules apply:

- The Cumulative RM fixed round trip time parameter in the ATC setup parameters information element shall be set to the fixed portion of the calling user's RM cell delay contribution for the forward and backward path.
- Tagging shall not be requested.
- In the ATM traffic descriptor information element, the calling user may include value(s) for MCR in one (forward or backward) or both (forward and backward) directions.
- In the ATC setup parameters information element, the calling user may include value(s) for ICR, TBE, RIF, and RDF in one or both directions.
- If the calling user wants to allow negotiation of MCR parameter, it includes a corresponding MCR parameter in the Minimum acceptable ATM traffic descriptor parameters information element.
- In the ATC additional parameters information element, the calling user may include values for any of the parameters in the information element. For each parameter that is included, the corresponding

"present" bit shall be set in the information element. For each parameter that is not supplied, the parameter bits and the corresponding "present" bit shall be set to 0.

10.2.1.1 QoS and Traffic Parameters Selection Procedures

The procedures of section 2 item 5.1.3/Q.2931 shall apply with the following changes:

In the case of an ABR connection, the following additional rules apply:

Procedures for parameter defaulting:

- Defaulting of parameters in the ATM traffic descriptor and ATC setup parameters information elements: The parameters that can be defaulted in the SETUP message are: MCR, ICR, TBE, RIF and RDF. If the SETUP message does not specify a value for a particular parameter in a given direction, the network shall supply a default value. In the case of MCR, the default value is zero; in the case of ICR, the default value is the corresponding PCR value; for TBE, the default value is the largest allowed value; and for RIF, the default value is 1 which is encoded as 15 (decimal), and for RDF, the default value is 1/32,768 which is encoded as 0. The default values supplied by the network (as possibly modified by the negotiation process described below) are included by the network into the SETUP message, and delivered to the called user.

The parameter negotiation by the network for the ABR service is described below.

- Negotiation of parameters in the ATM traffic descriptor and ATC setup parameters information elements:
  Parameter values for a given direction for PCR, ICR, TBE, RIF, and RDF can be negotiated by the network. MCR can be negotiated using the procedures described in section 8 if the corresponding MCR parameter is included in the Minimum acceptable ATM traffic descriptor information element in the SETUP message.

  If able to provide the indicated PCR, ICR, TBE, RIF, and RDF parameters, the network shall progress the call towards the called user, with the original values of these parameters.

  If unable to provide the indicated PCR, but able to provide at least the MCR value as negotiated, the network shall progress the call towards the called user, after adjusting the PCR value. The adjusted PCR value will be greater than or equal to the MCR value.

  When progressing the call, the network may, if necessary, also adjust the following ATC setup parameters: ICR, TBE, RIF and RDF. The network may adjust either or both of the forward or backward values for these parameters.

The following table summarizes the modifications that may be made by the network:

Parameter for a given direction	Modification by the network
PCR	Decrease only
ICR	Decrease only
TBE	Decrease only
RIF	Decrease only (Note 2)
RDF	(Notes 1, 2)

Note 1: The value of RDF may be increased or decreased, subject to the constraint that the ratio RDF/RIF shall not be decreased. (Hence, if RIF is decreased by a factor k, RDF may be decreased by at most a factor k, or it may be increased.)

Note 2: The values chosen by a node must obey the above rules, and they need to be chosen in such a way that any combination of the values of these parameters that subsequent nodes are allowed to select according to the negotiation rules will be acceptable to the node.

Parameter negotiation maintains the following invariant:
    $MCR <= ICR <= PCR$.

If the network is not able to provide the peak cell rates which are equal to MCR, then the call shall be cleared with Cause #37, "*User cell rate not available*".

Note that the negotiation specified above occurs after parameter defaulting, if applicable. Thus the defaults specified for these parameters are not necessarily visible, with the exception of the defaults for MCR, since the default values and negotiation rules allow negotiation away from the default values. The net effect is that the value chosen by the network for default values is network specific and may take on any value in the permissible range for each of these parameters.

- Negotiation of parameters in the ATM additional parameters information element:
Individual parameter values for the ATM additional parameters can be negotiated by the network only when the parameter is present (i.e., was supplied by the calling user). If the parameter is absent, the default value applies, and no negotiation is possible for the parameter in this case. If the ATM additional parameters information element is not included in the SETUP message, then the default values apply to all the (additional) parameters and none is negotiable. The default values for these parameters are specified in the ATM Forum Traffic Management Specification, Version 4.1 [17].

The ATM Forum Traffic Management Specification, Version 4.1 [17], provides further detail on considerations relating to negotiation. The following table summarizes the modifications that may be made:

Parameter for a given direction	Modification by the network
Trm	(Note)
CDF	Increase only
ADTF	Decrease only

Note - If the indicated Trm value is not supported, it can be changed to the default value by clearing the indicated present bit.

A parameter is negotiable up to its fixed bound specified for its encoding.

- Processing of the Cumulative RM fixed round trip time parameter in the SETUP message:

The network shall adjust the Cumulative RM fixed round trip time parameter in the ATC setup parameters information element when forwarding a SETUP message for an ABR connection. The amount of the adjustment is the fixed portion of the RM cell delay through the network (see Annex 10).

10.2.1.2 Call/Connection acceptance

In addition to the procedures of 5.1.7/Q.2931, the CONNECT message shall contain an ATC setup parameters information element, and, if included in the received connect indication, an ATC additional parameters information element.

10.2.2 Call/connection establishment at the destination interface

10.2.2.1 QoS and traffic parameter selection procedure

The procedures of 5.2.2.2.1/Q.2931 shall apply with the following changes:

Upon receipt of a SETUP message, the called user examines the ATM traffic descriptor and the ATC setup parameter information elements. MCR can be negotiated using the procedures described in section 8, if the corresponding minimum acceptable ATM traffic descriptor value for MCR is included in the SETUP message. To accept the call, the user shall take one of the following actions:

1. If able to support the indicated PCR and ABR parameter values, the user shall return a CONNECT message with the PCR and ABR parameters.

2. Otherwise, the user shall negotiate the PCR and/or the ABR parameters as described below and return a CONNECT message with the negotiated values:

   - If unable to provide the indicated PCR, but able to provide at least the MCR value as negotiated, the user shall adjust the PCR value down to a value not less than the MCR value.
   - The user may adjust the following ATC setup parameters: ICR, TBE, RIF and RDF. The called user may adjust these parameters in the forward and/or backward direction(s).
   - The user may adjust the ATC additional setup parameters that are present in the SETUP message.

     The parameter modifications are summarized in section 10.2.1.1, above.

10.2.2.2 Call/Connection Acceptance

The procedures of section 2 item 5.2.6/Q.2931 shall apply with the following changes:

The called user shall include an ATC setup parameters information element in the CONNECT message with the same set of parameters as in the received SETUP message.

If the user wishes to accept or modify any of the parameters in the received ATC additional parameters information element, the user shall include the ATC additional parameters information element in the CONNECT message with the accepted/modified parameters.

The adjustment of the RM cell delay for the forward and backward path is described in Annex 10.

10.2.2.3 Call/Connection Rejection

In addition to the normal call rejection procedures described in section 2, the following procedure also applies:

If the called user is not able to support a PCR that is greater than or equal to the MCR (and less than the PCR value received in the SETUP message), the user shall reject the call, returning a RELEASE COMPLETE message with Cause #47, *"Resources unavailable, unspecified"*.

Annex 1: Guidelines for Use of ATM Address Formats

A1.1 Introduction

[INFORMATIVE]

These guidelines incorporate the changes introduced in af-cs-0107.000. This Annex used to impose the restriction that the Called party subaddress information element can only contain an AESA if the Called party number information element contains a Native E.164 address. The use of this combination of addresses was intended to allow a private network to tunnel an AESA through a public network that supports only Native E.164 addresses. However, this combination does not support the situation where a private network wishes to tunnel an AESA through a public network that supports AESA.

This restriction has been removed and this Annex now allows the Called party subaddress information element to contain an AESA when the Called party number information element also contains an AESA. This applies to both the Public and Private UNI.

A1.2 Procedures

[NORMATIVE]

The Addressing Reference Guide [32] contains general guidelines on the use and allocation of addresses.

Listed below are the rules for the use of various address types in the address information elements supported at the Public and Private UNI.

1. At the Private UNI, only the AESA address format shall be carried in the Called party number information element.

2. The AESA format uses:

    - Type of Number and Addressing/Numbering Plan Identification of "Unknown/ATM Endsystem Address" when conveyed via Called party number and Calling party number information elements, and

    - Type of Address as "ATM endsystem address" when conveyed via Called party subaddress or Calling party subaddress information elements.

3. The maximum number of instances of the Called party subaddress information element containing an address other than an AESA (e.g. NSAP) is one.

4. The maximum number of instances of the Called party subaddress information element containing an AESA is one.

5. Other than the number of instances, there is no restriction on when a Called party subaddress information element can contain an AESA.

Annex 2: Proxy Signalling Capability

[Normative]

A2.1 Definition

Proxy Signalling is an optional capability for both the network and the user. When supported, it requires prior agreement (e.g. subscription) between the user and the network. Proxy Signalling allows a user, called the Proxy Signalling Agent (PSA), to perform signalling for one or more users that do not support signalling. The PSA may have one or more signalling Virtual Channels. Associated with each signalling VC is a set of VPCs that it controls, these VPCs may be across different UNIs. In addition, there may be an ILMI VC associated with each signalling VC.

The proxy signalling capability can be used to allow high end ATM equipment to support multiple physical interfaces that share the same ATM address. This gives the high-end equipment the ability to support connections with an aggregate bandwidth in excess of the line rate of any given physical interface. Of course, individual connections must be at a rate that is less than or equal to the line rate.

For example, consider a file server that is attached to a switch with four 155Mb/s physical interfaces that all use the same ATM address. The same server ATM address is used by all end users independent of which physical interface is used to connect to the file server. Individual connections must be less than or equal to 155 Mb/s but the total bandwidth to the server can be up to 622 Mb/s.

A2.2 Provisioning

The following subscription information is required for this capability for each signalling VC:

- The list of directory numbers that are routed to the PSA over the signalling VC.
- A mapping of VPCI values to a specific UNI and VPI combination for each VP controlled by the PSA over the signalling VC
- The VPI and VCI for the signalling VC and of the associated ILMI VC (if present).
- The virtual channel call offering procedures supported.
- As an option, the association of directory numbers with VPCIs may be provided to the network to allow the network to select the VPCI on incoming calls and to route point-to-multipoint calls properly (e.g., to know when to send a SETUP vs. an ADD PARTY message to the PSA).

> Note - The assigned VCI for the signalling channel may be other than 5 and the assigned VCI for ILMI may be other than 16. Multiple signalling and multiple ILMI virtual channels may be assigned within a VP.

A2.3 Procedures

The PSA and network can utilize the messages, procedures and information elements as described in this Specification, with amendments as described in this annex. When in conflict the annex procedure applies.

The PSA may originate or terminate a point-to-point or a point to multipoint call.

When providing a signalling VC to a PSA, the switch (and PSA) shall support Non-associated signalling over that VC. The switch shall be able to support case b) during call origination. In addition, the switch must support the following subscription options on a signalling VC basis, which are user selectable, to be applied to the destination interface (5.2.3.2/Q.2931):

- If the association of ATM addresses to VPCIs is supported and has been provisioned, only cases a) and c) of 5.2.3.2/Q.2931 shall be used
- If the association of ATM addresses to VPCIs is not supported, or is supported but has not been provisioned, only case c) of 5.2.3.2/Q.2931 shall be used

A2.4 Remote Proxy Signalling Agent

As a further option, a network may allow the PSA to be remotely located on another switch than the UNIs that it controls. When supported, this will require the provisioning of the signalling VC and if needed an ILMI VC from the PSA to the switch on which the controlled UNIs reside. The switch to which the PSA is directly connected will treat these VCs as PVCs and need not be aware of the intended use. The PSA shall use the same signalling procedures in this case.

Example Proxy Signalling Configuration
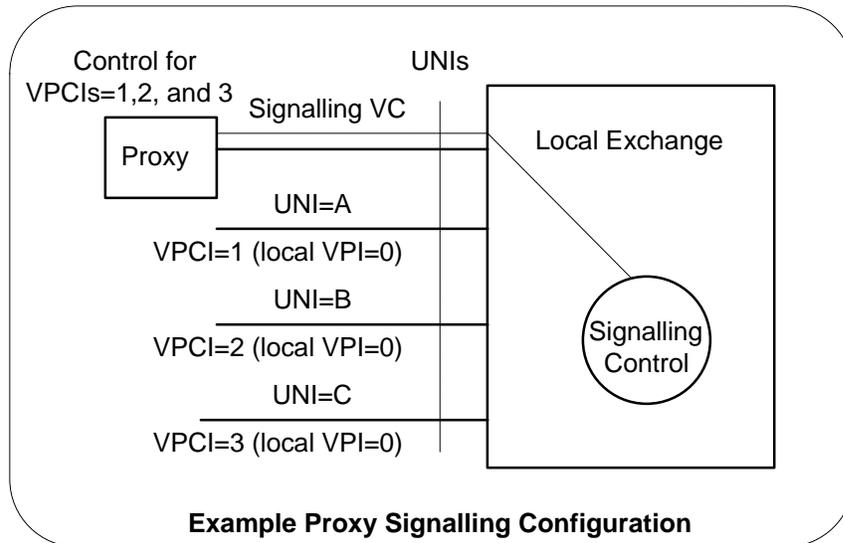
Provisioned VPCI Mapping

VPCI	Physical Interface	VPI
1	A	0
2	B	0
3	C	0

Proxy Signalling Example

A2.5 Example Message Flow

This is an example message flow for the PSA originating a call from user A to user B, where the PSA is a proxy for both user A and user B.

PSA   Network   PSA

SETUP (to User B, from A,
VPCI at UNI A)
                                        SETUP (to User B, from A,
                                        VPCI at UNI B)

                                        CONNECT
CONNECT (to User A)

Network has established ATM connection
between users A and B
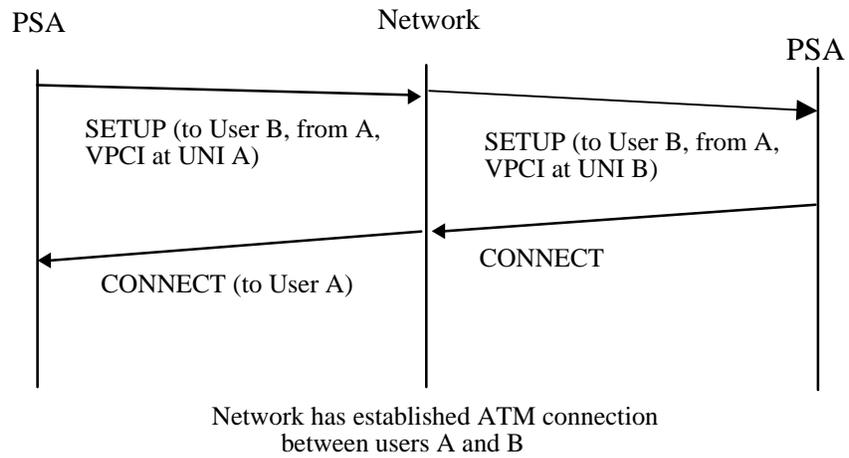
Annex 3:

To preserve section numbering with the previous version of this document this Annex is intentionally blank (see section 1.6).

Annex 4: Supplementary Services

[Normative]

A4.1 Direct Dialling In (DDI)

ITU-T Recommendation Q.2951 Clause 1 as modified by Q.2951 Corrigendum 1, shall apply with the extensions of Annex C/Q.2971 and ITU-T Recommendation Q.2951.9 [28].

Only two combinations of Type of Number and Addressing/Numbering Plan are supported:

- Unknown/ATM Endsystem Address

- International number/ISDN numbering plan (E.164).

Only the full number may be provided, i.e., partial numbers are not allowed.

Overlap receiving is not supported.

Delivery of the Called Party Number information element is mandatory.

A4.2 Multiple Subscriber Number (MSN)

ITU-T Recommendation Q.2951 Clause 2 as modified by Q.2951 Corrigendum 1, shall apply with the extensions of Annex C/Q.2971 and ITU-T Recommendation Q.2951.9 [28].

Only two combinations of Type of Number and Addressing/Numbering Plan are supported:

- Unknown/ ATM Endsystem Address

- International number/ISDN numbering plan (E.164).

Only the full number may be provided, i.e., partial numbers are not allowed.

Delivery of the Called Party Number information element is mandatory.

A4.3 Calling Line Identification Presentation (CLIP)

ITU-T Recommendation Q.2951 Clause 3 as modified by Q.2951 Corrigendum 1, shall apply with the extensions of Annex C/Q.2971 and ITU-T Recommendation Q.2951.9 [28].

Only two combinations of Type of Number and Addressing/Numbering Plan are supported:

- Unknown/ ATM Endsystem Address

- International number/ISDN numbering plan (E.164).

Annex A describing the two-number delivery option is not supported.

A4.4 Calling Line Identification Restriction (CLIR)

ITU-T Recommendation Q.2951 Clause 4 as modified by Q.2951 Corrigendum 1, shall apply with the extensions of Annex C/Q.2971.

A4.5 Connected Line Identification Presentation (COLP)

ITU-T Recommendation Q.2951 Clause 5 as modified by Q.2951 Corrigendum 1, shall apply with the extensions of Annex C/Q.2971 and ITU-T Recommendation Q.2951.9 [28].

Only two combinations of Type of Number and Addressing/Numbering Plan are supported:

   - Unknown/ATM Endsystem Address

   - International number/ISDN numbering plan (E.164).

6.11.1/Q.2951: When interworking from N-ISDN to B-ISDN, if the connected party number is coded as a National or Subscriber number in an ISDN numbering plan, it shall be converted to an International Number in an ISDN numbering plan.

A4.6 Connected Line Identification Restriction (COLR)

ITU-T Recommendation Q.2951 Clause 6 as modified by Q.2951 Corrigendum 1, shall apply with the extensions of Annex C/Q.2971.

A4.7 Subaddressing (SUB)

ITU-T Recommendation Q.2951 Clause 8 shall apply with the extensions of Annex C/Q.2971.

Annex 1 provides additional information on the use of subaddresses.

A4.8 User to User Signalling (UUS)

ITU-T Recommendation Q.2957 Clause 1 shall apply with the extensions of Annex D/Q.2971 and ITU-T Recommendation Q.2957 Amendment 1 [29].

Annex 5:

To preserve section numbering with the previous version of this document this Annex is intentionally blank (see section 1.6).

Annex 6: Connection Scope Selection

[Normative]

This Annex describes the processing of the Connection scope selection information element.
The ATM Anycast capability allows a calling user to indicate to the network a connection scope such that the connection request containing a group address may reach a group member within this connection scope, but not any group member outside this connection scope. The connection scope is indicated to the network by including a Connection scope selection information element in the SETUP message of a point-to-point connection, as defined in section 7.2.2.1. Connection scope is represented as an organizational scope value, as described in Annex B of the Addressing Reference Guide [32].

The user may identify the selected connection scope in the SETUP message. One instance of the Connection scope selection information element may be specified by the user in the SETUP message. If the user does not specify a Connection scope selection information element in the SETUP message and the SETUP message contains an ATM group address in the called party number information element, the network shall assume the default value of "localNetwork(1)".

The procedures for selection of an ATM group member within the connection scope are not specified in this document. When a Connection scope selection information element is present in a received SETUP message, the call shall be progressed with the Connection scope selection information element.

Annex 7: Procedures when Optional Capabilities are not supported

[Normative]

In Table 1-2, a number of capabilities are identified as optional. This annex specifies/clarifies the procedures that apply when the capabilities are not supported.

A7.1 Point-to-multipoint

When a terminal does not implement the point-to-multipoint procedures of section 5, the terminal will treat all the new messages and information elements defined in that section as unrecognized and follow the point-to-point procedures specified in section 2.

A7.2

To preserve section numbering with the previous version of this document this section is intentionally blank.

A7.3 ATM Anycast

When a terminal or network, which does not support the ATM Anycast capability specified in section 7, receives a SETUP message with an Anycast address the call will be rejected with Cause #28, "*Invalid number format (incomplete number)*".

A7.4 Virtual UNIs

When a network does not support the Virtual UNIs capability specified in Annex 8, no new procedures are needed since no new messages or information elements are defined and when only the default signalling virtual channel is supported any signalling channel on a VPI other than 0 will not be recognized as such.

A7.5 Switched Virtual Path

When a terminal or a network, which does not support the Switched Virtual Path capability, receives a SETUP message for a Switched VP, it shall reject the call with Cause #65, *"bearer service not implemented"*.

A7.6 Proxy Signalling

When a terminal or a network does not support the Proxy Signalling capability specified in Annex 2, no new procedures are needed since no new messages or information elements are defined.

A7.7 Frame Discard

When a terminal does not support the Frame Discard capability specified in Section 2.2.1, no new procedures are needed since no new messages or information elements are defined. However, the terminal must ignore the Frame Discard indicator bits in the ATM traffic descriptor information element (i.e. the terminal shall not take error action on the bits).

When a network does not support the Frame Discard capability, it shall transport the Frame Discard indicators in the setup and connect indications if the protocol on the egress interface supports the indicators.

A7.8 ABR

When a terminal or a network, which does not support the ABR capability, receives a SETUP message for an ABR call, it shall reject the call with Cause #65, *"bearer service not implemented"*.

A7.9 Generic Identifier Transport

When a terminal or a network, which does not support the Generic Identifier Transport capability specified in section 2.2.2, receives a message containing a Generic identifier transport information element, it shall treat the information element as an unrecognized information element according to the procedures specified in 5.6/Q.2931.

A7.10 Traffic Parameter Negotiation

When a terminal or a network, which does not support the Traffic Parameter Negotiation capability specified in section 8, receives a SETUP message containing either the Alternative ATM traffic descriptor or the Minimum ATM traffic descriptor information elements, it shall treat the information element as an unrecognized information element according to the procedures specified in 5.6/Q.2931.

A7.11 Supplementary Services

No new procedures are needed when the supplementary services defined in Annex 4 are not supported.

A7.12 Soft PVCs

When a terminal or a network, which does not support the Soft PVCs capability specified in Annex 11, receives a message containing either a Called party soft PVPC or PVCC information element or a Calling party soft PVPC or PVCC information element, it shall treat the information element as an unrecognized information element according to the procedures specified in 5.6/Q.2931. Due to the setting of the instruction indicator (specified in sections A11.4.1.1 and A11.5) the call will be cleared.

A7.13 Status Enquiry for multiple calls/parties in one message

See section A12.6.

A7.14 End-to-End Connection Completion Indication

When a terminal that does not support the End-to-end connection completion indication capability receives a message containing a Broadband report type information element with one of the Type of report indications specified for this capability, it will treat the information element as an unrecognized information element, an unexpected information element or as a recognized information element with invalid contents. If the information element action indicator is set as recommended in Appendix I/Q.2931, the information element will be discarded.

Section 2 clause 4.5.25/Q.2931 requires that networks that support the Broadband report type information element in the SETUP message shall also support the End-to-end connection completion indication capability. Due to this requirement, when a network that does not support the End-to-end connection completion indication capability receives a SETUP message containing a Broadband report type information element, it will treat the information element as an unrecognized or an unexpected information element. If the Information element Action Indicator is set as recommended in Appendix I/Q.2931, the information element will be discarded. This ensures that the called user will not receive the "End-to-end connection completion capability available" indication when a terminal or network along the path does not support the End-to-end connection completion indication capability.

When a terminal or network that does not support the End-to-end connection completion indication capability receives a CONNECTION AVAILABLE message, it will treat the message as an unrecognized message. If the Message action indicator is set as recommended in Appendix I/Q.2931, the only action taken will be to discard the message.

Annex 8: Virtual UNIs

[Normative]

In this Specification, virtual UNIs are supported across a physical UNI by assigning each end user one or more VPCs and then using a VPC cross-connect to combine the user VPCs onto a single facility going to a switch. On the user side, signalling messages shall use VPI=0, VCI=5 and ILMI messages shall use VPI=0, VCI=16. On the switch side, a unique VPI would be used to distinguish between individual users.

Supporting multiple signalling channels implies supporting multiple users on a UNI which also then requires support for multiple ILMI channels (one for each signalling channel). See the ATM Forum ILMI Specification, Version 4.0.

A8.1 Signalling

As shown in this example configuration, end users use VPI=VPCI=0, VCI=5 for all signalling. In order to be backwards compatible with UNI 3.1 compliant end-systems, the network shall be able to associate VPIs with a unique combination of (VPCI, Signalling Channel VPI). This would allow end systems to set the VPCI equal to the VPI even when VP cross-connects are used in the access. The switch maintains a translation table between VPCI and VPI. For the user, the VPCI is equal to the VPI. The VPCI remains constant in the signalling message as it travels between the user and switch. The VPI associated with the VPCI is used at each end for the actual user traffic. The use of VPCIs is described in section 5.1.2.2/Q.2931.

As an example assume that a switch is connected to the VP mux with an OC3 and that three users are connected to the mux with 51 Mb/s twisted pair interfaces. On the user side, each user is assigned VPI 0 and 1. These are translated to the unique values shown in the table on the switch side. Signalling and ILMI would use the default VCI on VPI zero on the user side and would be translated to VPI values 1, 3 and 5 for users 1, 2 and 3, respectively. This is shown in the Figure below. Although this example figure shows a physically separate VP multiplexer, this functionality could be included in the end-user equipment.

	END SYSTEM		NETWORK
USER	VPCI	VPI	VPI
1	0	0	1
1	1	1	2
2	0	0	3
2	1	1	4
3	0	0	5
3	1	1	6
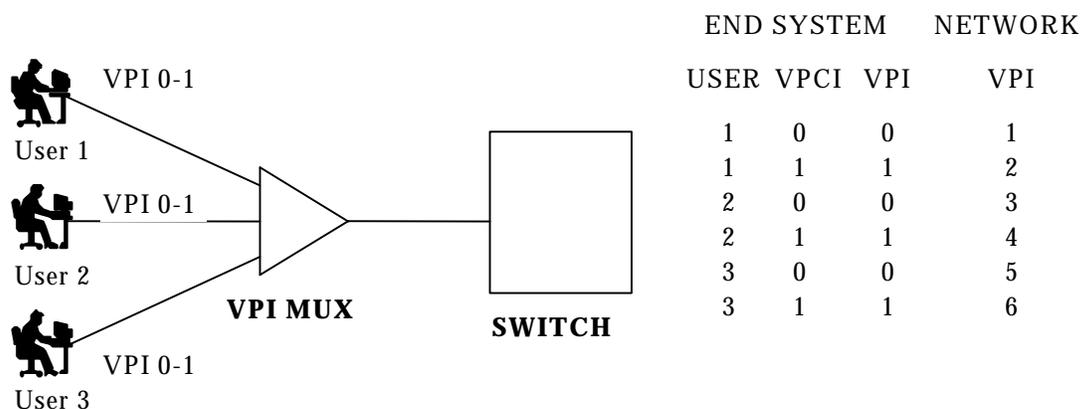
A8.2 OAM cells

VC based OAM cells (both end-to-end and segment) shall not be processed at the VP cross-connect since this device does not have VC visibility. For VC services (i.e. the switch does VC processing), segment

OAM cells shall be processed at the switch. End-to-end VP OAM cells shall not be processed at the VP cross connect or the switch (unless the switch is the endpoint for the VP). In order to allow the user to verify connectivity to the switch, the VP cross connect shall not process segment VP OAM cells, but rather let the switch do the processing. Loopbacks would then test the whole path from the user to the switch instead of only a portion of the path. This also helps hide the VP cross connect from the user. The VP cross connect shall generate fault management cells in the event of a failure.

A8.3 Management of the VPI Mux

Management of the VPI Mux is beyond the scope of this Specification.

Annex 9: Guidelines on the use of Bearer Class, Traffic Parameters, and QoS

[Normative]

A9.1 Bearer Class

The following provides a brief description of what is meant by the various BCOB classes in the Bearer capability information element.

A9.1.1 BCOB-A

This class is only used for requesting a virtual channel service. When the user specifies BCOB-A, the user is requesting more than an ATM only service. The network may look at the AAL information element to provide interworking based upon its contents. One example of such interworking would be between an ATM user calling a non-ATM user who has switched DS1 capability. In this case, the network interworking function would need to know the AAL used to be able to perform this interworking function. Another example is for interworking with N-ISDN circuit switching service.

A9.1.2 BCOB-C

This class is only used for requesting a virtual channel service. As for BCOB-A, when the user specifies BCOB-C, the user is requesting more than an ATM only service. The network may look at the AAL information element to provide interworking based upon its contents.

A9.1.3 BCOB-X

This class is only used for requesting a virtual channel service. When the user specifies BCOB-X, the user is requesting an ATM only service from the network. In this case, the network shall not process any higher layer protocols (e.g. AAL protocols).

The difference between BCOB-X and the other classes is what service is being requested from the network. For the VBR user that wants only a ATM cell relay service, the user should specify BCOB-X and Traffic Type VBR.

A user, that is placing a DS1 circuit emulation call but does not want to allow interworking, should specify BCOB-X and Traffic Type CBR. If the user wishes to allow interworking then the user should specify BCOB-A.

A9.1.4 Transparent VP Service

When the user specifies Transparent VP Service, the user is requesting an ATM only service from the network. This service differs from BCOB-X in that with the Transparent VP Service, both the VCI field (except for VCI values 0, 3, 4, and 6 through 15) and Payload Type field will be transported transparently by the network.

A9.2 Determination of ATM Service Category

The ATM service categories assigned to connections at the UNI are defined in the ATM Forum Traffic Management Specification, Version 4.1 [17]. An explicit way of requesting a particular ATM service category is not provided in SIG 4.1. Instead, the requested ATM service category must be derived from three pieces of information in a signalling message. The ATM service category is derived from -

1. the Broadband bearer class in octet 5 of the Broadband bearer capability (BBC) information element,

2. the absence or presence of the ATM transfer capability (ATC) octet (octet 5a) in the Broadband bearer capability information element,

3. and the value of the ATC if present, and the absence or presence of the Best effort indicator in octet 18 of the ATM Traffic Descriptor information element.

The octet representing ATC has been changed from containing two relevant fields in UNI 3.x to a single field in UNI 4.0. The two fields in UNI 3.x were "Traffic Type" which indicated whether the traffic was CBR or VBR, and "Timing Requirements" which indicated whether end-to-end timing was required or not. In UNI 4.0 the entire octet 5a was changed to a single field and named the ATM Transfer Capability. For reasons of backward compatibility valid pairs of codepoints from the previous two fields were maintained and incorporated into single-field codepoints for ATC. In addition, new codepoints for the ATC have been defined.

Table A9-1 summarizes the different combinations of Broadband bearer class, ATC, and Best effort indicator which define the ATM service categories. In addition the table provides a correlation between the single-field ATC codepoints and meaning of these codepoints in terms of the old two fields in octet 5a of the BBC information element in UNI 3.0/3.1.

Table A9-1: Derivation of ATM Service Categories from Signalling Information

ASC (a)	BC (b)	ATC (c)	BEI (d)	Equivalent UNI 3.0/3.1 Octet 5a Definitions	Comment
CBR	A	abs		absent	
		7	no	CBR traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
	X	4		CBR traffic type, timing not indicated	
		5		CBR traffic type, end-to-end timing required	
		6	no	CBR traffic type, end-to-end timing not required	
		7		CBR traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
	VP	5		CBR traffic type, end-to-end timing required	new in UNI 4.0
		7	no	CBR traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
rt-VBR	C	9		VBR traffic type, end-to-end timing required	
		19	no	undefined traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
	X	1		traffic type not indicated, end-to-end timing required	

		9	no	VBR traffic type, end-to-end timing required	
		19		undefined traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
	VP	9		VBR traffic type, end-to-end timing required	new in UNI 4.0
		19	no	undefined traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
nrt-VBR	C	abs		absent	
		11	no	VBR traffic type, reserved timing requirement	new in UNI 4.0 invalid UNI 3.1 BBC octet 5a coding
		20	no	undefined traffic type	new in SIG 4.1, invalid UNI 3.1 and UNI 4.0 BBC octet 5a coding
		21	no	undefined traffic type	new in SIG 4.1, invalid UNI 3.1 and UNI 4.0 BBC octet 5a coding
	X	abs	no	absent	
		0	no	traffic type not indicated, timing not indicated	
		2	no	traffic type not indicated, end-to-end timing not required	
		8	no	VBR traffic type, timing not indicated	
		10	no	VBR traffic type, end-to-end timing not required	
		11	no	VBR traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
		20	no	undefined traffic type	new in SIG 4.1, invalid UNI 3.1 and UNI 4.0 BBC octet 5a coding
		21	no	undefined traffic type	new in SIG 4.1, invalid UNI 3.1 and UNI 4.0 BBC octet 5a coding
	VP	abs	no	absent	new in UNI 4.0
		10	no	VBR traffic type, end-to-end timing not required	new in UNI 4.0
		11	no	VBR traffic type, reserved timing requirement	new in UNI 4.0, invalid UNI 3.1 BBC octet 5a coding
		20	no	undefined traffic type	new in SIG 4.1, invalid UNI 3.1 and UNI 4.0 BBC octet 5a coding
		21	no	undefined traffic type	new in SIG 4.1, invalid UNI 3.1 and UNI 4.0 BBC octet 5a coding
UBR	C	abs	yes	absent	
	X	abs	yes	absent	
		0	yes	traffic type not indicated, timing not indicated	
		2	yes	traffic type not indicated,	
		8	yes	VBR traffic type, timing not indicated	
		10	yes	VBR traffic type, end-to-end timing not required	
	VP	abs	yes	absent	new in UNI 4.0
		10	yes	VBR traffic type, end-to-end timing not required	new in UNI 4.0
ABR	C				
	X	12	no	undefined traffic type, timing not indicated	new in UNI 4.0 invalid UNI 3.1 BBC octet 5a coding

	VP					
GFR (See [41])	C					
	X	14	no	undefined traffic type	new in [41] invalid UNI 3.1 BBC octet 5a coding	
	C					
	X	15	no	undefined traffic type	new in [41] invalid UNI 3.1 BBC octet 5a coding	

(a) ATM Service Category as defined by ATM Forum Traffic Management Specification, Version 4.1 [17] Specification

(b) Broadband Bearer Class in octet 5 of Broadband bearer capability information element

(c) ATM Transfer Capability as defined in this Specification (octet 5a of the Broadband Bearer Capability information element)

(d) Best Effort Indicator - octet 18 of ATM Traffic descriptor information element (yes - present, no - not present)

A9.3 Allowed Combination of Bearer Capabilities, Traffic Parameters, and QoS

The parameters specified in the Broadband Bearer Capability information element, the ATM traffic descriptor information element, the Extended QoS parameters information element, the End-to-end transit delay information element, and the QoS parameter information element of the SETUP message should be consistent. Table A9-2 shows the allowable combinations of the Broadband Bearer Class, the ATM traffic descriptor parameters, the Extended QoS parameters, the End-to-end transit delay, and the QoS classes.

If a SETUP message is received containing a combination of Broadband Bearer Class, ATC and Best Effort Indicator that does not match an entry in Table A9-2, the call shall be cleared with Cause #65, "*Bearer capability not implemented*". If the combination of Traffic parameters, QoS parameters and QoS class in a SETUP message is not a combination allowed for the ATM Service Category, the call shall be cleared with Cause #73, "*Unsupported combination of traffic parameters*".

**Table A9-2 Allowable Combinations of Traffic and QoS
Related Parameters in the SETUP message**

ATM service Category (Note 16)	CBR								
Conformance	CBR.1 (note 10)			(Note 4)			(Note 4)		
Bearer Capability									
Broadband Bearer Class	A	X	VP	A	X	VP (note 5)	A	X	VP (note 5)
ATM Transfer Capability (Note 1)	7			absent	4,5, or 6	5	absent	4,5, or 6	5
Traffic Descriptor for a given direction									
PCR (CLP=0)								S	
PCR (CLP=0+1)		S			S			S	
SCR , MBS (CLP=0)									
SCR , MBS (CLP=0+1)									
Best Effort									
Tagging		N			N			Y/N	
Frame Discard		Y/N			Y/N			Y/N	
QoS Classes		*			*			*	
transit delay (note 2)		O			O			O	
peak-to-peak CDV		O			O			O	
CLR (CLP=0) (Note 11)					O			O	
CLR (CLP=0+1) (Note 11)		O							

ATM service Category (Note 16)	Real Time VBR								
Conformance	VBR.1 (note 10)			VBR.2			VBR.3		
Bearer Capability									
Broadband Bearer Class	C	X	VP	C	X	VP	C	X	VP
ATM Transfer Capability	19			9	1 or 9	9	9	1 or 9	9
Traffic Descriptor for a given direction									
PCR (CLP=0)									
PCR (CLP=0+1)		S			S			S	
SCR , MBS (CLP=0)					S			S	
SCR , MBS (CLP=0+1)		S							
Best Effort									
Tagging		N			N			Y	
Frame Discard		Y/N			Y/N			Y/N	
QoS Classes		*			*			*	
transit delay (note 2)		O			O			O	
peak-to-peak CDV		O			O			O	
CLR (CLP=0) (Note 11)					O			O	
CLR (CLP=0+1) (Note 11)		O							

ATM service Category (Note 16)	Real Time VBR			
Conformance	(notes 4, 7)	(notes 4, 8)	(note 4)	
Bearer Capability				
Broadband Bearer Class	X	X	X	C or VP (note 5)
ATM Transfer Capability	1 or 9	1 or 9	1 or 9	9
Traffic Descriptor for a given direction				
PCR (CLP=0)	S			
PCR (CLP=0+1)	S	S	S	
SCR , MBS (CLP=0)				
SCR , MBS (CLP=0+1)			S	
Best Effort				
Tagging	Y/N	N	N	
Frame Discard	Y/N	Y/N	Y/N	
QoS Classes	*	*	*	
transit delay (note 2)	O	O	O	
peak-to-peak CDV	O	O	O	
CLR (CLP=0) (Note 11)	O	O	O	
CLR (CLP=0+1) (Note 11)				

ATM service Category (Note 16)	Non-real Time VBR								
Conformance	VBR.1 (note 10)			VBR.2			VBR.3		
Bearer Capability									
Broadband Bearer Class	C	X	VP	C	X	VP	C	X	VP
ATM Transfer Capability (note 1)	11			absent	absent, 0, 2, 8 or 10	absent, 10	absent	absent, 0, 2, 8 or 10	absent, 10
Traffic Descriptor for a given direction									
PCR (CLP=0)									
PCR (CLP=0+1)	S			S			S		
SCR , MBS (CLP=0)				S			S		
SCR , MBS (CLP=0+1)	S								
Best Effort									
Tagging	N			N			Y		
Frame Discard	Y/N			Y/N			Y/N		
QoS Classes	*			*			*		
transit delay (note 2)	(note 3)			(note 3)			(note 3)		
peak-to-peak CDV									
CLR (CLP=0) (Note 11)				O			O		
CLR (CLP=0+1) (Note 11)	O								

ATM service Category (Note 16)	Non-real Time VBR					
Conformance	VBR.2 (note 14)			VBR.3 (note 14)		
Bearer Capability						
Broadband Bearer Class	C	X	VP	C	X	VP
ATM Transfer Capability (note 1)	20			21		
Traffic Descriptor for a given direction						
PCR (CLP=0)						
PCR (CLP=0+1)		S			S	
SCR , MBS (CLP=0)		S			S	
SCR , MBS (CLP=0+1)						
Best Effort						
Tagging	N/A (note 15)			N/A (note 15)		
Frame Discard	Y/N			Y/N		
QoS Classes	*			*		
transit delay (note 2)	(note 3)			(note 3)		
peak-to-peak CDV						
CLR (CLP=0) (Note 11)	O			O		
CLR (CLP=0+1) (Note 11)						

ATM service Category (Note 16)	Non-real Time VBR						
Conformance	(notes 4, 7)		(notes 4, 8)		(note 4)		
Bearer Capability							
Broadband Bearer Class	C	X	C	X	C	X	VP (note 5)
ATM Transfer Capability (note 1)	absent	absent, 0, 2, 8 or 10	absent	absent, 0, 2, 8 or 10	absent	absent, 0, 2, 8 or 10	absent, 10
Traffic Descriptor for a given direction							
PCR (CLP=0)		S					
PCR (CLP=0+1)		S		S		S	
SCR , MBS (CLP=0)							
SCR , MBS (CLP=0+1)							S
Best Effort							
Tagging	Y/N		N		N		
Frame Discard	Y/N		Y/N		Y/N		
QoS Classes	*		*		*		
transit delay (note 2)	(note 3)		(note 3)		(note 3)		
peak-to-peak CDV							
CLR (CLP=0) (Note 11)	O		O		O		
CLR (CLP=0+1) (Note 11)							

ATM service Category (Note 16)	ABR			UBR					
Conformance	ABR			UBR.1			UBR.2		
Bearer Capability									
Broadband Bearer Class	C	X	VP	C	X	VP	C	X	VP
ATM Transfer Capability (note 1)		12		absent	absent, 0, 2, 8 or 10	absent, 10	absent	absent, 0, 2, 8 or 10	absent, 10
Traffic Descriptor for a given direction									
PCR (CLP=0)									
PCR (CLP=0+1)		S			S			S	
SCR , MBS (CLP=0)									
SCR , MBS (CLP=0+1)									
MCR		(note 6)							
Best Effort					S (note 9)			S (note 9)	
Tagging		N			N			Y	
Frame Discard		Y/N			Y/N			Y/N	
MDCR [38]					OO			OO	
BCS [40]					OO			OO	
QoS Classes		0			0			0	
transit delay (note 2)									
peak-to-peak CDV									
CLR (CLP=0) (Note 11)									
CLR (CLP=0+1) (Note 11)									

ATM service Category (Note 16)	GFR (see [41])	
Conformance	GFR.1	GFR.2
Bearer Capability		
Broadband Bearer Class	C, X	C, X
ATM Transfer Capability (note 1)	14	15
Traffic Descriptor for a given direction		
PCR (CLP=0)		
PCR (CLP=0+1)	S	S
SCR , MBS (CLP=0)		
SCR , MBS (CLP=0+1)		
MCR	S	S
MFS	S	S
BCT	S	S
Best Effort		
Tagging	N/A (note 12)	N/A (note 12)
Frame Discard	N/A (note 13)	N/A (note 13)
QoS Classes	0	0
transit delay (note 2)		
peak-to-peak CDV		
CLR (CLP=0) (Note 11)		
CLR (CLP=0+1) (Note 11)		

Note 1-   Values 0, 1, 2, 4, 6, and 8 are not used on transmission by SIG 4.1 compliant users at the S_B reference point or the coincident S_B and T_B reference point. These values may be relayed by SIG 4.1 compliant users at the T_B reference point and by SIG 4.1 compliant networks. These values shall be understood on reception by all SIG 4.1 compliant systems.

Note 2-   Maximum End-to-end transit delay objectives may only be specified for the forward direction.

Note 3-   Maximum End-to-end transit delay objectives may be specified (though not recommended) for the ATM Service Category of   Non-real Time VBR for reasons of backward compatibility with ITU-T Recommendations.

Note 4-   Included for reasons of backward compatibility with UNI 3.1 and ITU-T Recommendations. With these conformance definitions, the CLR commitment is only for the CLP=0 traffic stream.

Note 5-   Included to allow switched virtual paths to use the UNI 3.1 conformance definitions.

Note 6 -   Optional in the user-to-network direction. Specified in the network-to-user direction.

Note 7 -   This combination should be treated as if the received PCR (CLP=0) parameter were a SCR (CLP=0) parameter and a MBS (CLP=0) parameter with a value of 1.

Note 8 -   This combination should be treated as if an additional SCR (CLP=0) were received with the same value as the received PCR (CLP=0+1) parameter with a MBS (CLP=0) parameter with a value of 1.

Note 9 -   The Best Effort indication applies to both the forward and backward directions.

Note 10 -   This combination should only be used when the CLR commitment on CLP=0+1 traffic is required versus CLR commitment on CLP=0 traffic, since these combinations are not supported by UNI 3.0/3.1 nor ITU-T Q.2931.

Note 11 -   In this table, the CLR parameter is shown as two entries to indicate explicitly whether the CLR commitment is for the CLP=0 or for the CLP=0+1 cells.

Note 12 -   Tagging for the GFR service is done on a frame basis, and whether it should be applied or not is implicitly indicated by the indication of GFR.2 or GFR.1. Thus Tagging shall not be signalled for GFR using the ATM traffic descriptor.

Note 13 -   Frame Discard is inherent to the GFR ATM service categories, and shall therefore not be signalled for GFR using the ATM Traffic Descriptor.

Note 14 -   These combinations are not supported by UNI 3.0, UNI 3.1, or UNI 4.0.

Note 15 -   Whether tagging should be applied or not is implicitly indicated by the ATM Transfer Capability codepoints 20 and 21. Thus Tagging shall not be signalled using the ATM traffic descriptor when ATM Transfer Capability codepoint 20 or 21 is specified.

Note 16 -   For each ATM Service Category and Conformance definition, an implementation shall be capable of recognizing all allowed combinations of traffic, QoS and related parameters This does not imply that all ATM Service Categories and Conformance Definitions need to be implemented.

Abbreviations:

PCR	Peak Cell Rate		SCR	Sustainable Cell Rate
MBS	Maximum Burst Size		OO	May or may not be present
Y	Yes		N	No
S	Specified		(Blank)	Unspecified

O = Optional. May be specified using:

- an individual QoS parameter encoded in the Extended QoS parameters information element or the End-to-end transit delay information element; or,
- objectives implied from the QoS class

If an Extended QoS parameters information element is present and this parameter is not present in the message, then any value of this parameter is acceptable. If neither the parameter nor the Extended QoS parameters information element is present in the message, then the objective for this parameter is determined from the QoS class in the QoS parameter information element.

Y/N = either "Yes" or "No" is allowed.

* = allowed QoS class values are a network option. Class 0 is always supported for alignment with ITU-T.

Annex 10: Handling of the Cumulative RM fixed round trip time field

[Normative]

A10.1 General

This annex describes the use of the Cumulative RM fixed round trip time field in the ATC setup parameters information element. The support of the RM fixed round trip time field and the procedures described in this Annex are mandatory both for the network and the user when providing the ABR service.

The purpose of the Cumulative RM fixed round trip time field is to indicate the time taken by an RM cell to travel from the source to the destination and back under conditions of no congestion.

A10.2 Handling of the Cumulative RM fixed round trip time parameter

The calling user includes the Cumulative RM fixed round trip time field in the ATC setup parameters information element in the SETUP message.

The Cumulative RM fixed round trip time field in the ATC setup parameters information element shall be set to the calling user's RM cell delay contribution for the forward and the backward path. User's RM cell delay shall include the calling terminal equipment to network boundary link propagation delay.

If the network receives ATC setup parameters information element without Cumulative RM fixed round trip time field, the network shall handle the ATC setup parameters information element as a mandatory information element with content error.

The network shall adjust the Cumulative RM fixed round trip time field in the ATC setup parameters information element when forwarding a SETUP message for an ABR connection. The amount of the adjustment is the fixed portion of the RM cell delay through the network, including the link propagation delay. The adjustment value, expressed in microseconds encoded as an integer, is added to the Cumulative round trip time field.

The called user shall adjust the Cumulative RM fixed round trip time field in the ATC setup parameters information element. The amount of the adjustment is the called user's RM cell delay contribution for the forward and the backward path. User's cell delay may include the called user's user-to-network boundary link propagation delay.

Annex 11: Soft PVCs

A11.1 Introduction

[Informative]

This Annex is an optional annex to SIG 4.1. It extends the Soft Permanent Virtual Connection (Soft PVC) capability defined in PNNI 1.1 (see Annex C/[16]) to the UNI. This capability allows a SETUP/ADD PARTY message for a Soft PVC to be sent by a user to the network across the UNI and allows a SETUP/ADD PARTY message for a Soft PVC to be sent by the network to a user across a UNI.

The Soft PVC capability at the UNI has interactions with the PNNI Soft PVC capability. Since there is no explicit indication that distinguishes between Soft PVCs that originate and terminate within this network, and Soft PVCs originated or terminated across UNIs, a network may restrict this capability.

For example:
- if network resources are reserved for Soft PVCs, the network may restrict user-originated Soft PVCs that could compete with network originated Soft PVCs for these reserved resources. In this case, a network may restrict the Soft PVC capability to "trusted" UNIs, e.g. intranetwork UNIs where the user side equipment is network equipment, or the network may restrict the amount of resources that would be used by the user-originated Soft PVCs.

- Some networks use the same addresses for Soft PVCs destined for the network side of the UNI and for SVCs destined for the user side of the UNI. If the Soft PVC capability at the UNI is allowed in such a network, the network may not be able to determine if a SETUP for a Soft PVC is destined for the network side of a UNI or for the user side of the UNI. Accordingly, a network may not allow the Soft PVC capability at the UNI.

A11.2 Scope

[Normative]

A soft PVPC/PVCC is established and released between the two endpoints serving the permanent virtual connection. Each interface where a soft PVPC/PVCC endpoint is located is identified by a unique ATM address.

One of the two endpoints of a soft PVPC/PVCC "owns" the soft PVPC/PVCC and is responsible for establishing and releasing the connection. This endpoint will be referred to as the calling endpoint. If the switched portion of the PVPC/PVCC gets disconnected because of switching system or link failure, it is also the responsibility of the calling endpoint to try to re-establish the connection. Frequency of re-establishment is an implementation option.

Before a soft PVPC/PVCC can be established, there must be a means to uniquely identify the endpoints of the PVPC/PVCC. The identity of the interface at the calling endpoint is encoded in the Calling Party number information element, if present. The Called party number identifies the interface at the destination endpoint of the soft PVPC/PVCC. The endpoints of a soft PVPC/PVCC are identified by these ATM addresses as well as endpoint identifiers such as VPCI/VCI or frame relay DLCI values.

The Soft PVC capability at the UNI allows:
- Both soft permanent virtual channel connection (PVCC) and soft permanent virtual path connections (PVPC) are supported.
- Upon bilateral agreement between the user and network, the user can be the initiating end of a soft PVPC/PVCC.
- Upon bilateral agreement between the user and network, the user can be the terminating end of a soft PVPC/PVCC.
- A soft PVPC/PVCC initiated by a user may terminate at a network interface or may be progressed to the user side of another UNI.
- A soft PVPC/PVCC initiated by a network at a network interface may be progressed to the user side of a UNI.
- A Soft PVPC/PVCC can be established between end-points of the same type. However, depending on the type of endpoint, either only PVPCs, only PVCCs or both PVPCs and PVCCs may be supported. For example both Soft PVPCs and Soft PVCCs can be established between cell relay endpoints while only Soft PVCCs can be established between frame relay endpoints.
- A Soft PVPC/PVCC can also be established between endpoints of different types including cell relay, frame relay and others. For example, a Soft PVCC can be established between a cell relay end point and a frame relay endpoint. The Soft PVCC can be originated from or terminated at either the cell relay or frame relay endpoint.

A11.3 Coding

[Normative]

A11.3.1 Messages

A11.3.1.1 SETUP

The following information elements are added to Table 3-8/Q.2931:

Message type: SETUP
Significance: Global
Direction: Both

Table A11-1 SETUP Message Additional Content

Information Element	Reference	Direction	Type	Length
Called party soft PVPC or PVCC	A11.3.2.1	both	O(1)	8-11
Calling party soft PVPC or PVCC	A11.3.2.2	both	O(2)	7-10

Note 1 -   Included in case of soft PVPC or PVCC setup.

Note2 -   May be included in case of soft PVPC or PVCC setup, when the calling endpoint wants to inform the destination interface of the values used for the PVPC or PVCC segment at the calling end.

A11.3.1.2 CONNECT

The following information elements are added to Table 3-2/Q.2931.

Message type: CONNECT
Significance: Global
Direction: Both

Table A11-2   CONNECT Message Additional Content

Information Element	Reference	Direction	Type	Length
Called party soft PVPC or PVCC	A11.3.2.1	both	O(1)	8-11

Note 1-   Included in case of soft PVPC or PVCC setup.

A11.3.1.3 ADD PARTY

The following information elements are added to Table 8-8/Q.2971:

Table A11-3   ADD PARTY Message Additional Content

Information Element	Reference	Direction	Type	Length
Called party soft PVPC or PVCC	A11.3.2.1	both	O(1)	8-11
Calling party soft PVPC or PVCC	A11.3.2.2	both	O(2)	7-10

Note 1 -   Included in case of soft PVPC or PVCC setup.

Note2 -   May be included in case of soft PVPC or PVCC setup, when the calling endpoint wants to inform the destination interface of the values used for the PVPC or PVCC segment at the calling end.

A11.3.1.4 ADD PARTY ACKNOWLEDGE

The following information elements are added to Table 8-11/Q.2971:

Table A11-4   ADD PARTY ACKNOWLEDGE Message Additional Content

Information Element	Reference	Direction	Type	Length
Called party soft PVPC or PVCC	A11.3.2.1	both	O(1)	8-11

Note 1-   Included in case of soft PVPC or PVCC setup.

A11.3.2 Information elements

A11.3.2.1 Called party soft PVPC or PVCC

Coded as specified in 6.4.6.2/[16].

A11.3.2.2 Calling party soft PVPC or PVCC

Coded as specified in 6.4.6.1/[16].

A11.3.2.3 Cause

In addition to the Cause values defined in section 2 §4.5.15/Q.2931, the following ATM Forum specific cause value, using coding standard 1 1, is applicable:

Bits 7 6 5 4 3 2 1	Number	Meaning	Diagnostics
0 1 0 0 0 1 0	34	Requested called party soft PVPC or PVCC not available	

A11.4 Procedure for Point-to-point calls

[Normative]

The signalling procedures for the establishment of point-to-point soft PVPC/PVCCs are the same as for point-to-point switched virtual connections with the following exceptions:

The connection characteristic negotiation procedures in Section 8 do not apply when there is a Called party soft PVPC or PVCC information element present in the SETUP message.

A11.4.1 Procedures at the originating interface

A11.4.1.1 User side

When a user is the "owner" of the PVPC/PVCC, the user shall initiate PVPC/PVCC establishment. A SETUP message shall be sent when the PVPC/PVCC is initially configured, or when the owner of the PVPC/PVCC becomes operational (e.g., power up), or during recovery from an outage.

A Bearer Class of VP or X is included in the Broadband bearer capability, which identifies establishment of a VPC or a VCC, respectively, between the connecting points. The Called party number information element shall contain the address of the destination interface, and the calling party number information element, if present, shall contain the address of the originating interface. The Called party soft PVPC/PVCC information element identifying the PVPC/PVCC endpoint at the destination network interface (i.e. the VPCI or VPCI/VCI or DLCI fields) shall also be included in the SETUP message.

When sending the Called or Calling party soft PVPC or PVCC information element, the instruction flag field (bit 5 of octet 2) shall be set to "follow explicit instruction", and the action indicator (bits 1-3 of octet 2) shall be set to "clear call.

When the "owner" receives a CONNECT message, it puts the PVPC/PVCC in an operational state. If the CONNECT message contains the Called party soft PVPC or PVCC information element, the connection identifier in the information element will be passed to the management entity.

A11.4.1.2 Network side

When the network receives a SETUP message, which contains a Called party soft PVPC or PVCC information element, the network shall:

− If the soft PVPC/PVCC request is authorized/allowed
    − Include the Called party soft PVPC or PVCC information element and the Calling party soft PVPC or PVCC information element, if present, unchanged in the setup indication.
    − Content validation, other than maximum length, shall not be performed on the content of either the Called party soft PVPC or PVCC or the Calling party soft PVPC or PVCC information elements.

− If the soft PVPC/PVCC request is not authorized/allowed,
    − Release the call with cause No. 63 "service or option not available, unspecified".

A11.4.2 Procedures at the destination interface

A11.4.2.1 User side

When a SETUP message is received at the called Soft PVPC/PVCC endpoint, the procedures of Sections 2, shall apply. The called party number identifies the destination interface serving as the called endpoint of the soft PVPC/PVCC.

If the called party number identifies a non-frame relay network interface and the Called party soft PVPC or PVCC information element specifies a DLCI, or the called party number identifies a frame relay interface and the Called party soft PVPC or PVCC information element specifies a VPCI/VCI, the call shall be cleared by sending a RELEASE or RELEASE COMPLETE message with cause #88 "incompatible destination".

A11.4.2.2 Network side

When the network receives a setup request with a Called party soft PVPC or PVCC information element,

− If the soft PVPC/PVCC is authorized/allowed, the network shall in addition to normal procedures:
    − Include the Called party soft PVPC or PVCC information element and Calling party soft PVPC or PVCC information element, if present, unchanged in the SETUP message sent to the user.
    − When the Called party soft PVPC or PVCC information element is received in the CONNECT message, the Called party soft PVPC or PVCC information element shall be forwarded unchanged in the connect indication.
    − Content validation, other than maximum length, shall not be performed on the content of the Called party soft PVPC or PVCC information element.
− If the soft PVPC/PVCC is not authorized/allowed, the network shall
    − Reject the setup with cause #63 "service or option not available, unspecified".

A11.4.2.3 Last PVPC segment allocation/selection

Refer to section 9.2.3.1/[16].

A11.4.2.4 Last PVCC segment allocation/selection at non-Frame Relay interfaces

Refer to section 9.2.3.2/[16].

A11.4.2.5 Last PVCC segment allocation/selection at Frame Relay interfaces

Refer to section 9.2.3.3/[16].

A11.5 Procedures for point-to-multipoint soft PVPC/PVCCs

The procedures of this Annex utilize the Point-to-Multipoint call/connection control procedures of Section 5.

When sending the Called or Calling party soft PVPC or PVCC information element, the instruction flag field (bit 5 of octet 2) shall be set to "follow explicit instruction" and the action indicator (bits 1-3 of octet 2) shall be set to "clear call".

A11.5.1 Adding a party at the originating interface

Connection establishment for point-to-multipoint soft PVPC/PVCCs shall be initiated by the root. When the soft PVPC/PVCC is initially configured, or a new party is added by network management, or when the root endpoint becomes operational (e.g., power up), or during recovery from an outage, a SETUP/ADD PARTY message shall be sent to one of the leaf endpoints.

A11.5.2 Set up of the first party

The procedures in section 5 for the first party of the point-to-multipoint soft PVPC/PVCC shall apply with the modifications in section A11.4 except section A11.4.2.5.

A11.5.3 Adding a party

After the connection is established to the first leaf, connections may be established to additional leaves. This shall be done by sending an ADD PARTY message for each leaf. The Called party number information element shall contain the address of the destination interface, and the calling party number information element, if present, shall contain the address of the root interface. The Called party soft PVPC/PVCC information element identifying the PVPC/PVCC endpoint at the destination network interface (i.e. the VPCI or VPCI/VCI or DLCI fields) shall also be included in the ADD PARTY message.

A11.5.3.1 Receiving an ADD PARTY ACKNOWLEDGE message at the originating interface

If the ADD PARTY ACKNOWLEDGE message contains the Called party soft PVPC or PVCC information element, the connection identifier in the information element will be passed to the management entity.

A11.5.3.2 Receiving an ADD PARTY message at the called interface

A11.5.3.2.1 User side

When an ADD PARTY message is received, the procedures of Section 5 §10.2/Q.2971 shall apply. The called party number identifies the destination interface of the soft PVPC/PVCC.

A11.5.3.2.2 Network side

When the network receives an add party request with a Called party soft PVPC or PVCC information element,

–   If the soft PVPC/PVCC is authorized/allowed, the network shall in addition to normal procedures:
     –   Include the Called party soft PVPC or PVCC information element and Calling party soft PVPC or PVCC information element, if present, unchanged in the ADD PARTY message sent to the user.
     –   When the Called party soft PVPC or PVCC information element is received in the ADD PARTY ACKNOWLEDGE message, the Called party soft PVPC or PVCC information element shall be forwarded unchanged in the add party acknowledge indication.
     –   Content validation, other than maximum length, shall not be performed on the content of the Called party soft PVPC or PVCC information element.

–   If the soft PVPC/PVCC is not authorized/allowed, the network shall
     –   Reject the party with cause #63 "service or option not available, unspecified".

A11.5.3.2.3 Last PVCC segment allocation/selection

Refer to section 9.3.3.2.1/[16].

A11.5.3.2.3 Last PVPC segment allocation/selection

Refer to section 9.3.3.2.2/[16].

Annex 12: Enhanced Status Enquiry

A12.1 Introduction
[Informative]

This Annex is an optional annex to SIG 4.1. It extends the Status Enquiry mechanism such that a single STATUS ENQUIRY message can be used to query for the status of up to 1000 calls or to query for the status of up to 1000 parties of a call. A single STATUS message will be returned to report the call or party state for all or a subset of the calls/parties identified in the STATUS ENQUIRY message.

This capability is useful when the network or user wants to query the state of multiple calls or parties (e.g. as a result of a signalling AAL error – see 5.6.9/Q.2931 and 5.6.10/Q.2931).

A12.2 Scope
[Normative]

This capability allows the user and the network to send a single STATUS ENQUIRY message to:
- Query the call state of up to 1000 calls, and to
- Query the party state of up to 1000 parties of a point-to-multipoint call.

This capability does not remove the restriction of only one outstanding STATUS ENQUIRY message for a call reference.

The user or network that receives such a query shall be able to respond with a single STATUS message conveying the requested state information for all or only a subset of the calls/parties identified in the STATUS ENQUIRY message.

The user or network shall be able to process a STATUS response for all or a subset of the calls/parties identified in the STATUS ENQUIRY message that was sent.

In order to operate correctly, this capability must be supported by both the user and network sides of an interface. When the peer signalling entity does not support this capability, the signalling entity initiating the procedures shall be able to detect it and the status enquiry procedures of section 2 §5.6.11/Q.2931 or section 5 §9.5.11/Q.2971 without the extensions of this Annex shall be used.

A12.3 Coding
[Normative]

A12.3.1 Messages

A12.3.1.1 STATUS

Table 3-9/Q.2931 applies with the following changes:
- *Modify length of the Call state information element to 5-3008.*
- *Add the following Note to the type column of the Call state information element*
  Note -   The Call state information element may be repeated – one occurrence of this information element may be present for each call state.

Table 8-6/Q.2971 applies with the following changes:

- *Modify length of the Endpoint state information element to 5-3008.*
- *Modify Note 1 as follows:*
  Note 1   Included when responding to a status enquiry about a single party state or at any time to report certain error conditions in the point-to-multipoint procedures.

- *Modify Note 2 as follows:*
  Note 2   Included when responding to a status enquiry about a single party state, when responding to a status enquiry about multiple party states, or at any time to report certain error conditions in the point-to-multipoint procedures.

- *Add the following Note to the type column of the Endpoint state information element*
  Note -   The Endpoint state information element may be repeated – one occurrence of this information element may be present for each party state.

A12.3.1.2 STATUS ENQUIRY

Table 3-10/Q.2931 applies with the following changes:

- *Add the following information element and corresponding note*

Information Element	Reference	Direction	Type	Length
Reference list	A12.3.2.1	both	O(1)	6-3007

  Note 1 -   This information element is included when querying for the state of multiple calls or multiple parties of a call.

- *Add the following note 2 to the type column of the call reference information element*

  Note 2   This message may be sent with the Global call reference defined in 4.3/Q.2931.

Table 8-7/Q.2971 applies with the following changes:

- *Modify the note by adding the word "single" before "party state" so it now reads:*

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

A12.3.2 Information elements

A12.3.2.1 Call State

Section 4.5.10/Q.2931 applies with the following changes:

- *The maximum length is modified from 5 to 3008 octets.*

- *Modify coding of call state information element by adding the following new octets:*

Bits								Octets
8	7	6	5	4	3	2	1	Octets
Call Reference List identifier								
0	0	0	0	0	0	0	1	6*
Call Reference List Length								6.1*
Call Reference List Length (continued)								6.2*
0/1 Call Reference Flag								6.3.1* (Note)
Call Reference Value								6.3.2* (Note)
								6.3.3* (Note)

> Note -   Octet group 6.3 may be repeated up to 1000 times. Each occurrence indicates a call reference for which the call is in the state indicated in the call state value in octet 5.

Call Reference List Length (octets 6.1 and 6.2)
> Length of the call reference list contents in octets, i.e. excluding the octets used for the call reference list length and the identifier.

Call Reference Flag (octet 6.3.1)

Bit 8	Meaning
0	The message is sent from the side that originated the call reference
1	The message is sent to the side that originated the call reference

Call Reference Value (octets 6.3.1, 6.3.2, and 6.3.3)
> The Call reference value is a 23-bit integer (coded in binary) to uniquely identify a call.

A12.3.2.2 Endpoint State

Section 8.2.2/Q.2971 applies with the following changes:

- *Modify coding of Endpoint state information element by adding the following new octets:*

Bits								Octets
8	7	6	5	4	3	2	1	Octets
Endpoint Reference List identifier								6*
0	0	0	0	0	0	1	0	
Endpoint Reference List Length								6.1*
Endpoint Reference List Length (continued)								6.2*
Endpoint Reference Type								6.3.1* (Note)
0/1 Endpoint Reference Flag								6.3.2* (Note)
Endpoint Reference Identifier Value								
								6.3.3* (Note)

> Note -   Octet group 6.3 may be repeated up to 1000 times. Each occurrence indicates an endpoint reference for which the call is in the state indicated in the endpoint state value in octet 5.

Endpoint Reference List Length (octets 6.1 and 6.2)

         Length of the endpoint reference list contents in octets, i.e. excluding the octets used for the endpoint reference list length and the identifier.

Endpoint Reference Type (octet 6.3.1)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	Locally defined integer

All other values are reserved

Endpoint Reference Flag (octet 6.3.2)

Bit 8	Meaning
0	The message is sent from the side that originated the endpoint reference
1	The message is sent to the side that originated the endpoint reference

Endpoint Reference Identifier Value (octets 6.3.2 and 6.3.3)

         The Endpoint reference identifier is a 15-bit integer (coded in binary) to uniquely identify an endpoint.

A12.3.2.3 Reference list

The purpose of the Reference list information element is to identify a list of call references or a list of endpoint references. The maximum length of this information element is 3007 octets.

			Bits					
8	7	6	5	4	3	2	1	Octets
Reference List								
1	1	1	1	0	1	0	1	1
Information element identifier								
1 ext	Coding Standard		Flag	Res.	Action Indicator			2
Length of Reference List contents								3
Length of Reference List contents (continued)								4
Call Reference List Identifier								5* (Note 1)
0	0	0	0	0	0	0	1	
Call Reference List length								5.1*
Call Reference List length (continued)								5.2*
0/1 Call Reference flag	Call Reference Value							5.3.1* (Note 2)
								5.3.2* (Note 2)
								5.3.3* (Note 2)
Endpoint Reference List Identifier								6* (Note 1)
0	0	0	0	0	0	1	0	
Endpoint Reference List Length								6.1*
Endpoint Reference List Length (continued)								6.2*
Endpoint Reference Type								6.3.1* (Note 2)
0/1 Endpoint Reference Flag	Endpoint Reference Identifier Value							6.3.2* (Note 2)
								6.3.3* (Note 2)

Note 1   Only one instance of either octet group 5 or octet group 6 may be present. If octet group 5 is present, octet group 6 must not be included and vice versa.

Note 2   Octet groups 5.3 and 6.3 may be repeated. The maximum number of times the octet group 5.3 or 6.3 may be present is 1000.

Figure A12-1 Reference list information element

Table A12-1   Contents of Reference list information element

Coding Standard (octet 2)

Bits 7 6	Meaning
1 1	ATM Forum specific

Call Reference List Length (octets 5.1 and 5.2)
> Length of the call reference list contents in octets, i.e. excluding the octets used for the call reference list length and the identifier.

Call Reference Flag (octet 5.3.1)

Bit 8	Meaning
0	The message is sent from the side that originated the call reference
1	The message is sent to the side that originated the call reference

Call Reference Value (octets 5.3.1, 5.3.2, and 5.3.3)
> The Call reference value is a 23-bit integer (coded in binary) to uniquely identify a call.

Endpoint Reference List Length (octets 6.1 and 6.2)
> Length of the Endpoint reference list contents in octets, i.e. excluding the octets used for the endpoint reference list length and the identifier.

Endpoint Reference Type (octet 6.3.1)

Bits 8 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0 0	Locally defined integer

All other values are reserved

Endpoint Reference Flag (octet 6.3.2)

Bit 8	Meaning
0	The message is sent from the side that originated the endpoint reference
1	The message is sent to the side that originated the endpoint reference

Endpoint Reference Identifier Value (octets 6.3.2 and 6.3.3)
> The Endpoint reference identifier is a 15-bit integer (coded in binary) to uniquely identify an endpoint.

A12.4 Procedure for Point-to-point calls
[Normative]

The procedures of section 2 §5.6.11/Q.2931 shall apply with the following additions:

When it is necessary to query the status of multiple calls (e.g. when a Signalling AAL connection reset or release occurs - see section 2 §5.6.9/Q.2931 and section 2 §5.6.10/Q.2931), the following extensions may be used to query the status of up to 1000 calls:
- The STATUS ENQUIRY message shall use the Global call reference in the Call reference information element.
- The STATUS ENQUIRY message shall contain a Reference list information element containing a list of up to 1000 call reference values.
- Timer T322 shall be started for each call reference on the list.

The above extensions may also apply when the status enquiry procedures are invoked as a result of expiry of timer T322. Specifically, when timer T322 expires, a STATUS ENQUIRY message may be sent using the call reference of the call, or the status of the call (and possibly the status of other calls) may be queried using the above extensions.

When a STATUS ENQUIRY message is received on the Global call reference and the message contains a Reference list information element that contains a list of call references, the receiver shall respond with a single STATUS message, which:
- Shall use the Global call reference in the Call reference information element.
- Shall contain call state information for all or a subset of the call references specified in the received Reference list information element.
- Shall contain one or more Call state information elements, at most one per state.
- Each Call state information element shall contain all or a subset of the call references that are specified in the received Reference list information element, and that are in the state specified in this Call state information element.
  For example, if all the call references are in either the Active state or in the Null state, then two Call state information elements would be included – one with the call state indicating Active state followed by a list of the call references from the Reference list information element that are in the Active state and – a second one with the call state indicating Null state followed by a list of the call references from the Reference list information element that are in the Null state.
- Shall contain a Cause information element with cause No. 30, "response to STATUS ENQUIRY".

The procedures of section 2 §5.6.12/Q.2931 shall apply with the following additions:

When a STATUS message is received on the Global call reference and the message contains one or more Call state information elements that contain one or more call reference values, the following shall apply:
- For each Call state information element the receiver shall follow the same procedure as if it had received one STATUS message for each of the call references listed in the Call state information element with a Call state information element indicating the same state as in this received Call state information element and with the same Cause information element as in the received STATUS message.
- For each call reference not present in any Call state information element of the STATUS message, but included in the Reference list information element in the corresponding STATUS ENQUIRY message, the receiver shall:
  - Stop timer T322 and may re-initiate the Status enquiry procedures, if the received STATUS message contains at least one call reference value present in the corresponding STATUS ENQUIRY. In this case, the re-initiation of the Status enquiry procedure shall not be counted as a retransmission.

- Keep timer T322 running, if the received STATUS message does not contain at least one call reference value present in the corresponding STATUS ENQUIRY

A12.5 Point-to-multipoint Procedures
[Normative]

A12.5.1 Call state enquiry

The procedures of section A12.4 shall apply

A12.5.2 Party state enquiry

The procedures of section 5 §9.5.11/Q.2971 shall apply with the following additions:

When it is necessary to query the status of multiple parties (e.g. when a Signalling AAL connection reset or release occurs - see section 5 §9.5.9/Q.2971 and section 5 §9.5.10/Q.2971), the following extensions may be used to query the status of up to 1000 parties of the same call:
- The STATUS ENQUIRY message shall contain a Reference list information element containing a list of up to 1000 endpoint reference values
- Timer T322 shall be started for each endpoint reference on the list.

The above extensions may also apply when the status enquiry procedures are invoked as a result of expiry of timer T322. Specifically, when timer T322 expires, a STATUS ENQUIRY message may be sent using the endpoint reference of the party or the status of the party (and possibly the status of other parties) may be queried using the above extensions.

When a STATUS ENQUIRY message is received for a point-to-multipoint call and the message contains a Reference list information element that contains a list of endpoint references, the receiver shall respond with a single STATUS message, which:
- Shall contain a Call state information element with the call state of the point-to-multipoint call.
- Shall contain party state information for all or a subset of the endpoint references specified in the Reference list information element.
- Shall contain one or more Endpoint state information elements, at most one per party state .
- Each Endpoint state information element shall contain all or a subset of the endpoint references that are specified in the received Reference list information element, and that are in the endpoint reference party state specified in this Endpoint state information element.
  For example, if all the endpoint references are in either the Active state or in the Null state, then two Endpoint state information elements would be included – one with the endpoint reference party state indicating Active state followed by a list of the endpoint references from the Reference list information element that are in the Active state and – a second one with the endpoint reference party state indicating Null state followed by a list of the endpoint references from the Reference list information element that are in the Null state.
- Shall contain a Cause information element with cause No. 30, "response to STATUS ENQUIRY".

The procedures of section 5 §9.5.12/Q.2971 shall apply with the following additions:

When a STATUS message is received for a point-to-multipoint call and the message contains one or more Endpoint state information elements that contain one or more endpoint reference values, the following shall apply:

- For each Endpoint state information element, the receiver shall follow the same procedure as if it had received one STATUS message for each of the endpoint references listed in the Endpoint state information element with an Endpoint state information element indicating the same party-state as in this received Endpoint state information element and with the same Cause and Call state information elements as in the received STATUS message.
- For each endpoint reference not present in any Endpoint state information element of the STATUS message, but included in the Reference list information element in the corresponding STATUS ENQUIRY message, the receiver shall:
  - Stop timer T322 and may re-initiate the Status enquiry procedures, if the received STATUS message contains at least one endpoint reference value present in the corresponding STATUS ENQUIRY. In this case, the re-initiation of the Status enquiry procedure shall not be counted as a retransmission.
  - Keep timer T322 running, if the received STATUS message does not contain at least one endpoint reference value present in the corresponding STATUS ENQUIRY

A12.6 Compatibility with nodes not supporting the capability
[Normative]

When a STATUS ENQUIRY message with the extensions specified in this Annex is received by a node that does not support the optional procedures of this Annex, the Reference list information will be treated as an unrecognized information element and the node will respond with a STATUS message with cause No. 30, "response to STATUS ENQUIRY". If the Reference list information element in the STATUS ENQUIRY message contained call references, then the Call state information element in the STATUS message does not contain a list of call references. If the Reference list information element in the STATUS ENQUIRY message contained endpoint references, then there will be no Endpoint state information element in the STATUS message.

The node receiving the STATUS ENQUIRY message might also respond with a second STATUS message to report the unrecognized information element. This second STATUS message can be prevented by setting the instruction indicators of the Reference list information element as follows:
- The information element instruction flag field (bit 5 of octet 2) set to "follow explicit instructions", and
- The action indicator (bits 1-3 of octet 2) set to "discard information element and proceed".

When either
- a STATUS ENQUIRY message is sent with a Reference list information element containing call references and a STATUS message is received with cause No. 30, "response to STATUS ENQUIRY" and a Call state information element that does not contain a list of call references, or
- a STATUS ENQUIRY message is sent with a Reference list information element containing endpoint references and a STATUS message is received with cause No. 30, "response to STATUS ENQUIRY" and no Endpoint state information element,

then the receiver shall revert to the status enquiry procedure specified in section 2 §5.6.11/Q.2931 or section 5 §9.5.11/Q.2971 without the extensions specified in this Annex.

Annex 13: Handling of Frame Discard Indication considering the AAL type

[Normative]

A13.1 General

This Annex describes optional procedures for handling the frame discard indicator in addition to the procedures described in Section 2.2.1. These procedures define frame discard behavior in each of the forward and backward directions taking into account the signalled AAL type in addition to the setting of the corresponding frame discard indicator. This optional behavior is summarized in Table A13.1.

The following explains how to interpret table A13.1:

> Having received a frame discard indicator as specified in the leftmost column along with an AAL type as indicated in the top row, the node shall interpret the frame discard indicator as specified in the intersecting row and column.

Table A13.1   AAL dependent interpretation of the frame discard indicator

Signalled frame discard indicator	AAL type in the SETUP message as defined in Q.2931					
	Other cases (1)	AAL 0	AAL 1	AAL 2	AAL 3/4	AAL 5
Frame discard indicator set to 1 (Frame discard allowed)	Frame discard allowed (2)					Frame discard allowed
Frame discard indicator set to 0 (No frame discard allowed)	No frame discard allowed					Frame discard allowed
Frame discard indicator unspecified	No frame discard allowed					Frame discard allowed

Notes:
(1) This situation covers the following cases:
  - The ATM adaptation layer parameters information element is not present, for example, in the case of Soft PVCs
  - The ATM adaptation layer parameters information element is coded as user specific
  - The ATM adaptation layer parameters information element has an unrecognized content
  - Multiple instances of the ATM adaptation layer parameters information element are present in the SETUP message (AAL negotiation as per Annex F of Q.2931).
(2) This combination requires that a frame is delimited by the ATM user-to-user indication in the PT (Payload Type) field of the ATM header in accordance with the ATM Forum Traffic Management Specification, Version 4.1 [17].

A13.1 Originating Procedures

When the network receives a SETUP message with one and only one ATM adaptation layer parameters information element and that information element indicates AAL 5 and the forward frame discard indicator is absent or is coded to *no frame discard allowed*, the network shall treat the SETUP message as if the forward frame discard indicator were set to *frame discard allowed*.

When the network receives a connect indication with either no backward frame discard indication, or with an indication of *no backward frame discard allowed*, and the SETUP message contained one and only one ATM adaptation layer parameters information element and that information element indicated AAL 5, the network shall treat the connect indication as if the backward frame discard indicator were set to *frame discard allowed.*

When the user (if not the endsystem) receives a CONNECT message with either no backward frame discard indication, or with an indication of *no backward frame discard allowed*, and the SETUP message contained one and only one ATM adaptation layer parameters information element and that information element indicated AAL 5, the user shall treat the CONNECT message as if the backward frame discard bit were set to *frame discard allowed.*

A13.2 Terminating procedures

When the user (if not the endsystem) receives a SETUP message with one and only one ATM adaptation layer parameters information element and that information element indicates AAL 5 and the forward frame discard bit is absent or is coded to *no frame discard allowed*, the user shall treat the SETUP message as if the forward frame discard bit were set to *frame discard allowed*.

When the network receives a CONNECT message with either no backward frame discard indication or with an indication of *no backward frame discard allowed*, and the setup indication contained one and only one ATM adaptation layer parameters information element and that information element indicated AAL 5, the network shall treat the CONNECT message as if the backward frame discard bit were set to *frame discard allowed.*

Appendix A: Example Signalling Codings

[Informative]

This Appendix gives examples of typical codings for information elements. Selection of particular codings to appear in this Appendix is not intended endorse particular applications or higher layer protocols to the exclusion of other applications or higher layer protocols. The values relevant to the examples and their binary codings in the protocol are shown in **boldface** type.

Note - In the event of discrepancies between the text of section 4.0 and this Appendix, the text of section 4.0 takes precedence.

A.1 ATM Adaptation Layer Parameters

Example of information element coding for AAL1

This example shows how the ATM adaptation layer parameters information element may be coded for a DS1 logical unrestricted service with adaptive clock recovery method.

			Bits					
8	7	6	5	4	3	2	1	Octet
ATM adaptation layer parameters								1
0	**1**	**0**	**1**	**1**	**0**	**0**	**0**	
Information element identifier								1
1 ext	Coding Standard = **ITU-T Specified**	Information Element Instruction Field = **Not Significant**						2
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Length of AAL parameter contents								3
Length of AAL parameter contents (continued) = **5** octets								4
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**	**0**	**1**	**0**	**1**	
AAL Type = **AAL1**								5
0	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
Subtype Identifier								6
1	**0**	**0**	**0**	**0**	**1**	**0**	**1**	
Subtype = **Circuit transport**								6.1
0	**0**	**0**	**0**	**0**	**0**	**1**	**0**	
CBR Rate Identifier								7
1	**0**	**0**	**0**	**0**	**1**	**1**	**0**	
CBR Rate = **1544 kbit/s (DS1)**								7.1
0	**0**	**0**	**0**	**0**	**1**	**0**	**0**	

<u>Example of information element coding for AAL5</u>

This example shows how the ATM adaptation layer parameters information element may be coded for a typical data application using AAL5.

Bits

8	7	6	5	4	3	2	1	Octet
ATM adaptation layer parameters								
0	1	0	1	1	0	0	0	1
Information element identifier								
1 ext	Coding Standard = **ITU-T** **Specified**		Information Element Instruction Field = **Not Significant**					2
1	0	0	0	0	0	0	0	
Length of AAL parameter contents								3
Length of AAL parameter contents (continued)								4
= **7** octets								
0	0	0	0	0	0	0	0	
0	0	0	0	0	1	1	1	
AAL Type = **AAL5**								5
0	0	0	0	0	1	0	1	
Forward Maximum CPCS-SDU Size Identifier								6
1	0	0	0	1	1	0	0	
Forward Maximum CPCS-SDU Size								6.1
Forward Maximum CPCS-SDU Size (continued)								6.2
= **1542 octets**								
0	0	0	0	0	1	1	0	
0	0	0	0	0	1	1	0	
Backward Maximum CPCS-SDU Size identifier								7
1	0	0	0	0	0	0	1	
Backward Maximum CPCS-SDU Size								7.1
Backward Maximum CPCS-SDU Size (continued)								7.2
= **1542 octets**								
0	0	0	0	0	1	1	0	
0	0	0	0	0	1	1	0	

A.2 Broadband Bearer Capability

<u>Example of information element coding for variable bit rate, connection oriented service with no timing requirements</u>

This example shows how the Broadband bearer capability information element may be coded for a typical variable bit rate data application.

				Bits				
8	7	6	5	4	3	2	1	Octet
Broadband bearer capability								1
0	**1**	**0**	**1**	**1**	**1**	**1**	**0**	
Information element identifier								
1 ext	Coding Standard = **ITU-T** **Specified**		Information Element Instruction Field = **Not Significant**					2
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Length of B-BC contents								3
Length of B-BC contents (continued)								4
= **2** octets								
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**	**0**	**0**	**1**	**0**	
0/1 ext	0 Spare	0	Bearer class = **BCOB-C**					5
1	**0**	**0**	**0**	**0**	**0**	**1**	**1**	
1 ext	Susceptibility to clipping = **Not susceptible**		0 Spare	0	0	User plane connection configuration = **pt-to-pt**		6
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

A.3 Broadband Low Layer Information

Example of information element coding for multiprotocol interconnect using the LLC encapsulation

This example shows how the B-LLI information element may be coded when multiprotocol interconnection using the LLC encapsulation is to be used on the VCC (see Internet RFC draft, *Multiprotocol Encapsulation over ATM/AAL5*)

<div align="center">Bits</div>

8	7	6	5	4	3	2	1	Octet
Broadband low layer information								
0	**1**	**0**	**1**	**1**	**1**	**1**	**1**	1
Information element identifier								
1 ext	Coding Standard = **ITU-T Specified**		Information Element Instruction Field = **Not Significant**					2
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Length of B-LLI contents								3
Length of B-LLI contents (continued)								4
= **1** octet								
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
0/1 ext	1 Layer 2 id	0	User information layer 2 protocol = **LAN logical link control (ISO 8802/2)**					6
1	**1**	**0**	**0**	**1**	**1**	**0**	**0**	

Example of information element coding for transport of IP datagrams using the "Null encapsulation" over AAL5

This example shows how the B-LLI information element may be coded when IP datagrams are to be transported within an AAL service data unit without any multiprotocol encapsulation ("Null Encapsulation" — see Internet RFC draft, *Multiprotocol Encapsulation over ATM/AAL5*). Note that no encoding for User Information Layer 3 protocol exists for IP. Therefore, the ISO/IEC TR 9577 Network Layer Protocol Identifier (NLPID) value for IP is used instead.

Bits

8	7	6	5	4	3	2	1	Octet
			Broadband low layer information					1
0	**1**	**0**	**1**	**1**	**1**	**1**	**1**	
			Information element identifier					
1 ext	Coding Standard = **ITU-T Specified**		Information Element Instruction Field = **Not Significant**					2
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
			Length of B-LLI contents					3
			Length of B-LLI contents (continued)					4
			= **3** octets					
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
0	**0**	**0**	**0**	**0**	**0**	**1**	**1**	
0/1 ext	1 1 Layer 3 id		User information layer 3 protocol = **ISO/IEC TR 9577**					7
0	**1**	**1**	**0**	**1**	**0**	**1**	**1**	
0 ext	ISO/IEC TR 9577 Initial Protocol Identification (IPI) (bits 8-2) = **Internet Protocol**							7a
0	**1**	**1**	**0**	**0**	**1**	**1**	**0**	
1 ext	IPI (bit1)	0	0	0	0	0	0	7b
				Spare				
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

Example of information element coding for transport of bridged frames using the "Null encapsulation" over AAL5

This example shows how the B-LLI information element may be coded when bridged LAN frames are to be transported within an AAL service data unit without any multiprotocol encapsulation ("Null Encapsulation — see Internet RFC draft, *Multiprotocol Encapsulation over ATM/AAL5*). Note that no encoding for User Information Layer 3 protocol exists for SNAP identifier. Therefore, the ISO/IEC TR 9577 Network Layer Protocol Identifier (NLPID) value for SNAP is used as an escape to include the SNAP identifier in the B-LLI information element. In this example, the SNAP identifier '00-80-C2-00-0A' indicates bridged FDDI frames without a preserved FCS. Similar coding principles apply for other kinds of bridged MAC frames and for routed frames which can only be identified using the SNAP convention.

			Bits					
8	7	6	5	4	3	2	1	Octet
Broadband low layer information								1
0	1	0	1	1	1	1	1	
Information element identifier								
1 ext	Coding Standard = **ITU-T Specified**		Information Element Instruction Field = **Not Significant**					2
1	0	0	0	0	0	0	0	
Length of B-LLI contents								3
Length of B-LLI contents (continued) = **9** octets								4
0	0	0	0	0	0	0	0	
0	0	0	0	1	0	0	1	
0/1 ext	1 Layer 3 id	1	User information layer 3 protocol = **ISO/IEC TR 9577**					7
0	1	1	0	1	0	1	1	
0 ext	ISO/IEC TR 9577 Initial Protocol Identification (IPI) (bits 8-2) = **SNAP Identifier**							7a
0	1	0	0	0	0	0	0	
1 ext	IPI (bit1)	0	0	0 Spare	0	0	0	7b
1	0	0	0	0	0	0	0	
1 ext	0 SNAP ID	0	0	0	0 Spare	0	0	8
1	0	0	0	0	0	0	0	
SNAP Organization Unique Identifier (octet 1)								8.1
OUI octet 2								8.2
OUI octet 3 = **IEEE 802.1**								8.3
0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	
1	1	0	0	0	0	1	0	
PID (octet 1)								8.4
PID octet 2 = **FDDI without preserved FCS**								8.5
0	0	0	0	0	0	0	0	
0	0	0	0	1	0	1	0	

Appendix B :

To preserve section numbering with the previous version of this document this Appendix is intentionally blank (see section 1.6).

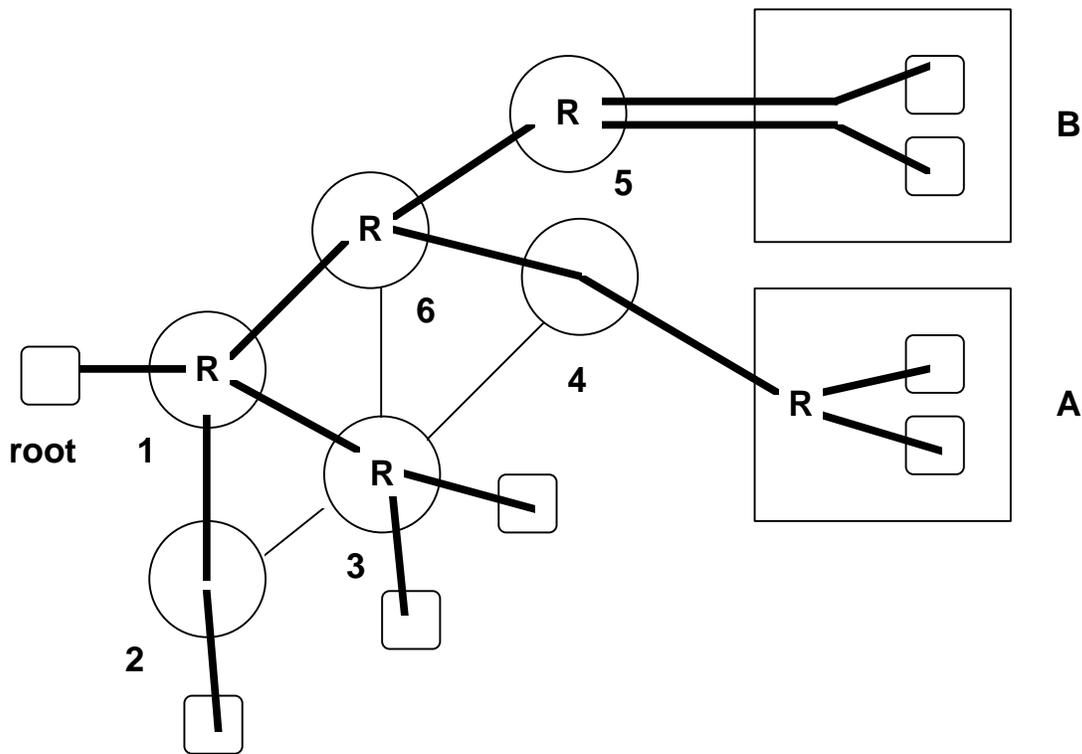## Appendix C: Point-to-Multipoint Connections - Cell Replication

[Informative]

This Appendix attempts to clarify the cell replication concept by showing the replication points on an example point to multipoint connection tree. Consider a point-to-multipoint connection as shown in the figure below.

In this figure, seven leaves are shown joined to the point to multipoint connection. The root's switch (1) makes two copies of each cell received from the root on this VCC and forwards one cell down each of the three links which are part of the point-to-multipoint VCC. Switch 3 similarly replicates each cell received and forwards one copy to each of the two leaves which are joined to the connection.

Endsystems A and B each contain two leaves joined to the pt-mpt connection. At switch 4, Clause 10/Q.2971 procedures are in operation on A's UNI, and the second leaf has been added to the connection with an ADD PARTY message. In this case endsystem A performs the cell replication for the two leaves.

At the UNI between switch 5 and endsystem B, Clause 9/Q.2971 procedures are operating. In this case two separate connections are made across the UNI to join each the two leaves, and switch 5 replicates the cell stream forwarding one copy of each cell down each virtual channel.

Key:

R Cell replication point
Boxes represent the root and leaves of a point to multipoint connection;
Circles represent switches;
Bold lines represent paths followed by the point to multipoint connection;
Normal lines represent other UNI or NNI links.

Appendix D: Known Differences Between Section 8 and Q.2962

[Informative]

The following is a list of known (intentional) differences between Section 8, SIG 4.1 and Q.2962 negotiation procedures.

Note: this list may not include all of the differences.

1. The Alternative ATM traffic descriptor information element, in section 8.1.2.1, allows the Best Effort indication.
2. In 8.3.3, the ATM traffic descriptor information element is optionally included in the CONNECT message.

Appendix E: Known Differences with UNI 3.1

[Informative]

The following is a list of known (intentional) differences between SIG 4.1 and UNI 3.1 for capabilities of UNI 3.1. In addition, the additions to UNI 4.0 included in this document constitute differences with UNI 3.1 (see to section 1.6). This Appendix is intended as an aid to the implementers and is not represented as complete. In case of differences with the main body (the normative text) of this Specification, the main body of this Specification take precedence over items in this Appendix.

E.1 Overview of Changes

- Added procedures, information elements, and new ATM traffic descriptor parameters to support the ABR capability

- Addition of information elements and procedures to support parameterized QoS.

- Mandating the error handling procedures for the Instruction Indicators (for messages and information elements)

- Addition of the ALERTING and PARTY ALERTING messages and the associated procedures, timers, and protocol states

- Addition of the Notification information element (to most messages), NOTIFY message, and the associated procedures

- Addition of Tagging procedures which allow the use of the ATM traffic descriptor information element in the CONNECT message (no procedures were provided in UNI 3.1)

- Addition of End-to-end transit delay (to SETUP, ADD PARTY, CONNECT, and ADD PARTY ACKNOWLEDGE messages) and associated procedures

- Addition of the Generic identifier transport information element (to SETUP message) and associated procedures

- Allowed VC channel negotiation procedures

- User side Timer T310 is 30 to 120 sec. versus 10 sec.

- User side Timer T399 is 34 to 124 seconds (sum of T301 and T310) versus 14 seconds.

- In the ATM traffic descriptor information element the unused bits in the Traffic Management Options field are spare bits (i.e. ignored) versus reserved (i.e. considered a content error if non-zero).

- When AAL reset occurs calls in the establishment phase shall be cleared (versus maintained in UNI 3.1)

- For point-to-multipoint calls it is a subscription option whether an ADD PARTY or SETUP message is used for additional parties.

- Point-to-multipoint error handling procedures revised which can result in different cause being provided.

- Added procedures and allow the inclusion of Broadband low layer information and AAL Parameter information elements in the ADD PARTY ACKNOWLEDGE message to support the addition of leaves that do not support the point-to-multipoint procedures

- Allow the addition of parties after receiving the ALERTING message

- Made the use of endpoint reference value of 0 optional for the first party of a point-to-multipoint call

- Added procedures and revised codings to support switched VPs

- Added messages, procedures, and information elements to support narrowband services over ATM

- Added procedures, Connection scope selection information element, group AFIs for IDP part of a ATM Endsystem address, and new MIB object to support the ATM Anycast capability

- Support NSAP addresses by allowing the Calling party subaddress and the Called party subaddress to be occur twice in the SETUP message

- Revised coding of the ATM traffic descriptor information element and added procedures to support the frame discard capability

- Added procedures to support the Proxy signalling capability

- Added procedures and information elements (Connected number and User to user information) to support the following supplementary services Direct Dialing In (DDI), Multiple Subscriber Number (MSN), Calling Line Identification Presentation (CLIP), Calling Line Identification Restriction (CLIR), Connected Line Identification Presentation (COLP), Connected Line Identification Restriction (COLR), Subaddressing (SUB), and User to User Signalling (UUS).

- Added procedures to support multiple virtual UNIs on a physical UNI.

- Added procedures and new information elements (Minimum ATM traffic descriptor and Alternate ATM traffic descriptor) to support bandwidth modification

- Modified the Broadband bearer capability information element to include an ATM Transfer Capability field

E.2 Specific Changes

2.1.1.4/Q.2931 Call Delivered (U4): New State.

2.1.1.6/Q.2931 Call Received (U7): New State.

2.1.2.4/Q.2931 Call Delivered (N4): New State.

2.1.2.6/Q.2931 Call Received (N7): New State.

3.1.1/Q.2931 ALERTING: New message

3.1.2/Q.2931 CALL PROCEEDING: New information element 'Notification Indicator' added.

3.1.3/Q.2931 CONNECT:
New information element 'End-to-end transit delay' added.
New information element 'Notification indicator' added.

3.1.4/Q.2931 CONNECT ACKNOWLEDGE: New information element 'Notification indicator' added.

3.1.5/Q.2931 RELEASE: New information element 'Notification indicator' added.

3.1.7/Q.2931 SETUP:
New information element 'End-to-end transit delay' added.
New information element 'Notification indicator' added.
New information element 'Generic identifier transport' added.
The QoS parameter information element is made optional.
'Connection Identifier' is optional in network-to-user direction and in the user-to-network direction.
The subaddress information elements may be repeated twice.

3.1.10/Q.2931 NOTIFY:
New message

3.2/Q.2931 Additional or modified messages related for the support of 64 Kbits/s based ISDN circuit-mode services
Exceptions noted for section 3.1 above apply to this section as well. In addition, the following changes apply:

3.2.2/Q.2931 CALL PROCEEDING
New information element 'Narrowband bearer capability' added.
New information element 'Narrowband high layer compatibility' added.
New information element 'Progress Indicator' added.

3.2.3/Q.2931 CONNECT
New information element 'Narrowband bearer capability' added.
New information element 'Narrowband high layer compatibility' added.
New information element 'Narrowband low layer compatibility' added.
New information element 'Progress Indicator' added.

3.2.5/Q.2931 PROGRESS:
New message

3.2.6/Q.2931 RELEASE: New information element 'Progress Indicator' added.

3.2.7/Q.2931 SETUP
New information element 'Narrowband bearer capability' added.
New information element 'Narrowband high layer compatibility' added.
New information element 'Narrowband low layer compatibility' added.
New information element 'Progress Indicator' added.

4.4.1/Q.2931 Message type
New message type '0 0 0 0 0 0 0 1 - ALERTING' defined.
New message type '0 0 0 0 0 0 1 1 - PROGRESS' defined.
New message type '0 0 0 0 1 1 1 0 - NOTIFY' defined.

4.5.1/Q.2931 Coding rules
New information element type '0 1 1 1 1 1 0 0 - Narrowband low layer compatibility' defined.
New information element type '0 1 1 1 1 1 0 1 - Narrowband high layer compatibility' defined.
New information element type '0 0 1 0 0 1 1 1 - Notification Indicator' defined.
New information element type '0 0 0 1 1 1 1 0 - Progress Indicator' defined.
New information element type '0 0 0 0 0 1 0 0 - Narrowband bearer capability' defined.
New information element type '0 1 0 0 0 0 1 0 - End-to-end Transit delay' defined.
New information element type '0 1 1 1 1 1 1 1 - Generic identifier transport' defined.
New information element type '1 1 1 0 1 0 1 1 - Connection scope selection' defined.
'Calling party subaddress' and 'Called party subaddress' can be repeated twice without a repeat indicator.

4.5.6/Q.2931 ATM traffic descriptor

'Frame Discard' fields added to Octet 17.1.

4.5.7/Q.2931 Broadband bearer Capability
New codepoint for bearer class '11000 - Transparent VP Service' added.
Restructured octet 5a to create the ATM Transfer Capability field.

4.5.8/Q.2931 Broadband high layer information
Allow the use of the codepoint '0000 100'.

4.5.9/Q.2931 Broadband low layer information
Added new codepoints in octet 7 to support the multimedia terminal capability (i.e., H.310, H.321).

4.5.10/Q.2931 Call state
New state '000100 - U4 - N4 - Call Delivered' added.
New state '000111 - U7 - N7 - Call Received' added.

4.5.15/Q.2931 Cause:
Cause #93 is used instead of Cause #78 for "AAL parameters cannot be supported"

4.5.16/Q.2931 Connection identifier
New codepoint '001 - Exclusive VPCI; any VCI' added for Pref./Ex field.
New codepoint '100 - Exclusive VPCI; no VCI' added for Pref./Ex field.

4.5.17/Q.2931 End-to-end transit delay: New information element.

4.5.19/Q.2931 Restart indicator
New codepoint '001 - All Virtual channels in the indicated VPC which are controlled via the signalling virtual channel on which the RESTART message is sent' added for Class field.

4.5.22/Q.2931 Notification indicator:
New information element.

4.6.2/Q.2931 Narrowband bearer capability:
New information element

4.6.3/Q.2931 Narrowband high layer compatibility:
New information element

4.6.4/Q.2931 Narrowband low layer compatibility:
New information element

4.6.5/Q.2931 Progress Indicator:
New information element

5.1.2.2/Q.2931 Non-Associated Signalling
The user may or may not include a connection identifier in the SETUP message to request a specified VPCI/VCI.
New procedures specified for Switched VP Connections (SVPCs).

5.1.6/Q.2931 Call/Connection confirmation indication
New procedures specified for ALERTING message.

5.2.2.2/Q.2931 Non-Associated Signalling
The network may or may not include a connection identifier in the SETUP message to request a specified VPCI/VCI.

New procedures specified for Switched VP Connections (SVPCs).

5.2.5.2/Q.2931 Receipt of CALL PROCEEDING and ALERTING
New procedures specified for ALERTING message.

5.5/Q.2931 Restart Procedures:
New procedures specified for Switched VP Connections (SVPCs).

5.6.9/Q.2931 Signalling AAL reset:
Calls in the establishment phase shall be cleared.

5.7/Q.2931 Error procedures with explicit error indication
New procedures added for support of explicit error handling specified in the message compatibility instruction indicator or information element instruction field.

5.9/Q.2931 Notification procedures:
New procedures specified for NOTIFY message.

6/Q.2931 Procedures for the support of 64 Kbits/s based circuit mode ISDN services in B-ISDN and access signalling interworking between N-ISDN and B-ISDN
New section added to support N-ISDN (overlap sending and receiving not supported).

7.1/Q.2931 Timers in the network side
New timer T301 added.
New timer T304 added.

7.2/Q.2931 Timers in the user side
New timer T301 added.
New timer T304 added.

Annex E/Q.2931 Mapping functions to support 64 kbit/s based circuit-mode ISDN service in B-ISDN and interworking between N-ISDN and B-ISDN (DSS1/DSS2):
New annex.

Annex J/Q.2931 Definitions, Abbreviations and References
New annex. References are augmented by 1.3/UNI 4.0.

Appendix 1/Q.2931 Guidelines for the use of Instruction indicators:
New appendix.

2.1.1/UNI 4.0 Generic Identifier Transport Information Element:
New information element

3.3.4.2.3/UNI 4.0 ATM Address Organizational Membership Scope Indication:
Added new object 'atmfAddressOrgMemberScope' to support the ATM Anycast and group multicast.

7.2.1/Q.2971 B-ISDN party states:
New party state 'Party Alerting Delivered (P3)' added.
New party state 'Party Alerting Received (P4)' added.

8.1.1.1/Q.2971 ALERTING:
New message

8.1.1.7/Q.2971 NOTIFY:
New message

8.1.2.1/Q.2971 ADD PARTY:
New information element 'End-to-end Transit Delay' added.

8.1.2.2/Q.2971 ADD PARTY ACKNOWLEDGE:
New information element 'End-to-end Transit Delay' added.

8.1.2.3/Q.2971 PARTY ALERTING:
New message

8.2.2/Q.2971 Endpoint state
New codepoint '00 0100 - Party Alerting Delivered' added for Endpoint reference party state.
New codepoint '00 0111 - Party Alerting Received' added for Endpoint reference party state.

8.2.3/Q.2971 New message type code points
New codepoint '1000 0101 - PARTY ALERTING' added.

9.1.1/Q.2971 Set up of the first party:
New procedures specified for ALERTING message.

9.1.4/Q.2971 Party alerting:
New procedures specified for PARTY ALERTING message.

9.2/Q.2971 Add party establishment at the destination interface
Procedures are specified for network to add new parties using SETUP message, in place of ADD PARTY messages. These procedures may be used with bilateral arrangement between the user and the network.
New procedures specified for ALERTING message.

9.2.1/Q.2971 Leaf does not support multipoint procedures
New procedures specified for the network to support leaves that do not support point-to-multipoint procedures.

9.6/Q.2971 Notification procedure:
New procedures specified for NOTIFY message.

10/Q.2971 Procedures at the T_B reference point for interworking with private B-ISDNs
Exceptions specified in section 9 applies here also.

13.1/Q.2971 Timers at the user side:
New timer T397 added.
Value of T399 changed

13.2/Q.2971 Timers at the network side: New timer T397 added.

7.0/UNI 4.0 ATM Anycast Capability
New procedures specified to support the ATM Anycast capability.
New AFIs added for the IDP part of ATM Endsystem addresses.
New information element '1110 1011 - Connection Scope Selection' added to SETUP message.

8.0/UNI 4.0 Connection Characteristics Negotiation During Establishment Phase
New section.

9.0/UNI 4.0 Signalling of Individual QoS Parameters
New section.

10.0/UNI 4.0 Available Bit Rate (ABR) Capability
New section.

Annex 2/UNI 4.0 Proxy Signalling Capability.
New procedures specified to support Proxy Signalling Capability.

Annex 4/UNI 4.0 Supplementary Services
Support added for the following supplementary services:
A4.1 Direct Dialling In (DDI)
A4.2 Multiple Subscriber Number (MSN)
A4.3 Calling Line Identification Presentation (CLIP)
A4.4 Calling Line Identification Restriction (CLIR)
A4.5 Connected Line Identification Presentation (COLP)
> New information elements 'Connected number' and 'Connected subaddress' added to CONNECT and ADD PARTY ACKNOWLEDGE.

A4.6 Connected Line Identification Restriction (COLR)
A4.7 Subaddressing (SUB)
A4.8 User to User Signalling (UUS)
New information element 'User to user information' added to SETUP, ALERTING, CONNECT, RELEASE, RELEASE COMPLETE, ADD PARTY, PARTY ALERTING, ADD PARTY ACKNOWLEDGE, ADD PARTY REJECT, DROP PARTY and DROP PARTY ACKNOWLEDGE messages.

Annex 6/UNI 4.0 Connection Scope Selection
Guidelines to support Connection Scope Selection information element.

Annex 7/UNI 4.0 Procedure When Optional Capabilities Are Not Supported
New Annex.

Annex 8/UNI 4.0 Virtual UNIs
New Annex.

Annex 9/UNI 4.0 Guidelines on the Use of Bearer Class, Traffic Parameters and QoS
Revision of Appendix F/UNI 3.1.

Annex 10/UNI 4.0 Handling of the Cumulative RM fixed round trip time field
New Annex.

Appendix C/UNI 4.0 Point-to-Multipoint Connections - Cell Replication
New Appendix, replaces Appendix C/UNI 3.1.

Appendix D/UNI 4.0 Known Differences Between Section 8 and Q.2962
New Appendix.

Appendix F: Overview of Some Referenced ITU-T Documents

This appendix provides an overview of the content of the following ITU-T Documents, which are included by reference in this specification.

- Second Edition of Q.2610 [6]
- Q.2931 Amendment 2 [22]
- Q.2931 Amendment 4 [23]
- Corrigendum 1 to Q.2931 Amendment 2 [24]
- Q.2971 Corrigendum 1[25]
- Q.2941.2 [26]
- Q.2941.3 [27]
- Q.2951.9 [28]
- Q.2957 Amendment 1 [29]
- Implementors' Guide For Q.2110 [31].
- Q.2951 Corrigendum 1 [48]

F.1 Q.2610 Edition 2: Cause Codes

In addition to referencing the latest edition of Q.850, Edition 2 of Q.2610 includes the cause codes (i.e. 32, 73, and 89) which were defined in Q.2971. The diagnostic for cause #37 "User cell rate not available" was also modified to allow any traffic parameter subfield identifier to be specified.

F.2 Q.2931 Amendment 2: Revised AAL parameters information element Coding

This amendment revises the coding of the AAL parameters information element. This amendment includes support for the following Recommendations: I.361 parts 1, 2, 3, and 5 (AAL 1, 2, 3/4, and 5), I.365.1 (FR-SSCS), I.365.2 (SSCF for connection-oriented network service), I.365.3 (SSCF for connection oriented transport service), I.366.1 (SAR SSCS for AAL2), I.366.2 (AAL2 SSCS for Trunking), Q.2110 (SSCOP), Q.320, Q.322, Q.323- (Signalling System R1), Q.441 (1988) - (Signalling System R2) and IEEE Std 802-1990, IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture.

F.3 Corrigendum 1 to Amendment 2 of Q.2931

Corrects the coding of the OUI field in the AAL parameters information element.

F.4 Q.2931 Amendment 4

Numerous errata and extensions to Q.2931, including:

- CONNECTION AVAILABLE message

- Broadband report type included in SETUP, ALERTING, CONNECT, and CONNECTION AVAILABLE messages. The information element is used for modification confirmation, Adaptive clock, and end-to-end connection completion

- AAL negotiation

- End-to-end transit delay information was moved to Q.2965.2 [30] and now includes the "Network generated indicator"

- Correction of the coding of the OUI in the B-HLI

- Clarify use of B-HLI and B-LLI

- Clarify coding of B-LLI

- Extend B-LLI coding to support H.310, H.321

- Rename NSAP to AESA

- Support X.121 numbering plan (not supported by this specification)

- Support public land Mobile network identification code (MNIC) in Transit network selection information element (not supported by this specification)

- Specifies that the Notification indicator is transported transparently

F.5 Q.2941.2 Generic Identifier Transport Part 2

Q.2941.2 defines DSS2 Generic identifier transport signalling capability to carry H.321 and H.310 End Station Identifier, H.245 portNumber, ATM VCC Identifier, the signalling correlation tag, Internet related Identifiers and MPOA VPN Identifier. The maximum length of this information element is 63 (previous limit was 33).

Identifier related standard/application (octet 5)
Bits
8 7 6 5 4 3 2 1
0 0 0 0 0 0 1 1   IPv4
0 0 0 0 0 1 0 0   ST2
0 0 0 0 0 1 0 1   IPv6
0 0 0 0 0 1 1 0   MPLS
0 0 0 0 0 1 1 1   MPOA (af-mpoa-0129.000)
0 0 0 0 1 0 0 0   ATM Forum to identify the ATM Forum ATM VCC trunking application (af-
vtoa-0113.000)
0 0 0 0 1 0 0 1   Recommendation Q. 2630.1
0 0 0 0 1 0 1 1   Recommendations H.323

Identifier type (Octet 6, 7, ..., N)
Bits
8 7 6 5 4 3 2 1
0 0 0 0 0 0 0 1   Session
0 0 0 0 0 0 1 0   Resource
0 0 0 0 0 0 1 1   End Station
0 0 0 0 0 1 1 1   MPOA VPN identifier
0 0 0 0 1 0 0 0   ATM VCC identifier
0 0 0 0 1 0 0 1   Signalling VCC identifier
0 0 0 0 1 0 1 0   Signalling correlation tag
0 0 0 0 1 0 1 1   H.245 PortNumber
0 0 0 1 0 0 0 0   to   Reserved
1 1 1 1 1 1 0 1
1 1 1 1 1 1 1 0   Experimental/organization specific identifier
1 1 1 1 1 1 1 1   Reserved

F.6 Q.2941.3 Generic Identifier Transport Part 3

Q.2941.3 defines DSS2 Generic identifier transport signalling capability to support the Backbone Network Connection Identifier (BNC-Id) for Bearer Independent Call Control (BICC).

Identifier related standard/application (octet 5)
Bits
8 7 6 5 4 3 2 1
0 0 0 0 1 0 1 0   BICC, ITU-T Recommendation Q.1901
Identifier type (Octet 6, 7, ..., N)
Bits
8 7 6 5 4 3 2 1
0 0 0 0 1 0 1 0   BNC-Id

F.7 Q.2951.9 AESA Supplementary Services

Specifies DDI, MSN, CLIP, and COLP for AESA numbers.

F.8 Q.2957 Amendment 1 User-user information element

Adds the following protocol discriminator codepoint: "00000110 Internet protocol/application".

F.9 Q.2971 Corrigendum 1

Errata for Q.2971.

F.10 Implementors' Guide For Q.2110 [31].

In section 5.1 this document provides alternative procedures and SDL to address a problem during power-up connection establishment.

F.11 Q.2951 Corrigendum 1 [48].

Errata for Q.2951.