The Frame Relay Forum
SVC User-to-Network Interface (UNI) Implementation Agreement

FRF 4.1

Frame Relay Forum Technical Committee

January 21, 2000

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Revision History

Version	Date	Changes
FRF 4	November 23, 1994	• baseline document
FRF 4.1	January 21, 2000	• addition of the following X.36 facilities ▪ Transit Network Selection ▪ Closed User Group facility ▪ Service Classes and Priorities • integration of Attachments A and B to FRF.4 • addition of Enhanced Low Layer Compatibility Encoding and Negotiation • update of references • replacement of Physical Layer Interface Guidelines with reference to Physical Layer Interface Implementation Agreement • addition of NSAP support for the called and calling party numbers • addition of RESTART support • informative annex addressing peer reinitialization. • changes in the connected party number IE • Migration to ITU international standards • added multiprotocol capabilities from FRF.3.2 Annex A • procedures to handle active call processing after a data link failure. • informative appendix on X.121 and E.164 number encoding in NSAP address format.

1. INTRODUCTION

1.1 PURPOSE

This document is a frame relay switched virtual connection (SVC) user-to-network interface (UNI) implementation agreement. This Implementation Agreement (IA) covers the case where the user's equipment is attached to a non-ISDN frame relay network or to an ISDN network when using case A only.

The agreements herein were reached in the Frame Relay Forum, and are based on the relevant frame relay standards referenced in Section 2.0. They address the optional parts of these standards, and document agreements reached among vendors/suppliers of frame relay network products and services regarding the options to be implemented.

Except as noted, these agreements will form the basis of conformance test suites produced by the Frame Relay Forum.

This document may be submitted to different bodies involved in ratification of implementation agreements and conformance testing to facilitate multi-vendor interoperability.

1.1.1 Scope

This implementation agreement applies to SVCs over Frame Relay UNIs. It is applicable at UNIs whether both the user and network are private, or the user is private and the network is public. Note: Use of this implementation agreement for private to private network interconnection is not precluded.

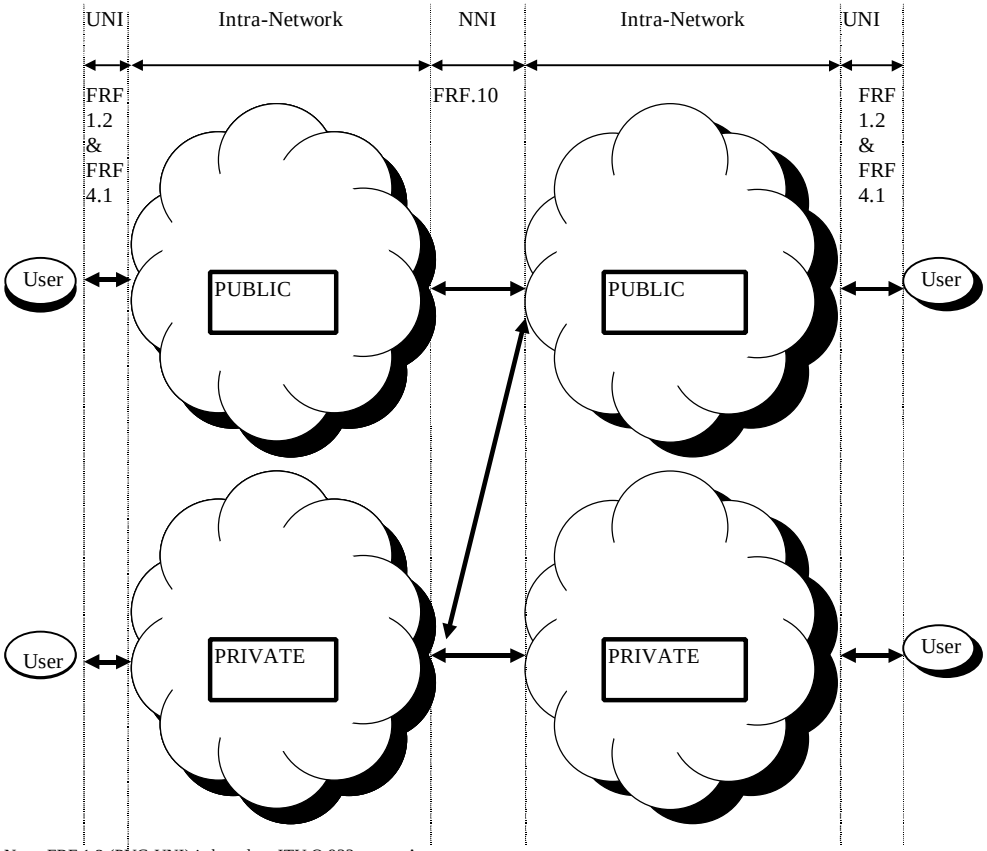

Figure 1: Reference Configuration

1.2 DEFINITIONS

- Must, Shall, or Mandatory - the item is an absolute requirement of this implementation agreement.
- Should - the item is highly desirable.
- May or Optional - the item is not compulsory, and may be followed or ignored according to the needs of the implementor.
- Not Applicable - the item is outside the scope of this implementation agreement.

1.3 RELEVANT STANDARDS

The following is a list of standards on which these implementation agreements are based upon:

[1] ITU-T Recommendation I.122, Framework for providing Additional Packet Mode Bearer Services, ITU, Geneva, 1993.

[2] ITU-T Recommendation I.233.1, ISDN Frame Relaying Bearer Service, ITU, Geneva, 1991.

[3] ITU-T Recommendation I.370 - Congestion Management for the ISDN Frame Relaying Bearer Service, ITU, Geneva, 1991.

[4] ITU-T Recommendation E.164 – The international public telecommunication numbering plan, ITU, Geneva, 1997.

[5] ITU-T Recommendation Q.922, ISDN Data Link Layer Specification for Frame Mode Bearer Services, ITU, Geneva, 1992.

[6] ITU-T Recommendation Q.921, ISDN User-Network Interface-Data Link Layer Specification ITU, Geneva, 1997.

[7] ITU-T Recommendation Q.933, ISDN Signaling Specifications for Frame Mode Switched and Permanent Virtual Connections Control and Status Monitoring, ITU, Geneva, 1995.

[8] ITU-T Recommendation Q.931, ISDN User-Network Interface Layer 3 Specification for Basic Call Control, ITU, Geneva, 1993.

[9] ITU-T Recommendation Q.850, Usage of Cause and Location in the Digital Subscriber Signaling System No. 1 and the Signaling System No. 7 ISDN User Part, ITU, Geneva, 1993.

[10] ITU-T Recommendation Q.951, Stage 3 Description for Number Identification Supplementary Services Using DSS, Clauses 3-6, ITU, Geneva, 1993.

[11] Recommendation T.50 - Information technology - 7-bit coded character set for information interchange, ITU, Geneva, 1992.

[12] ITU-T Recommendation X.36 - Amendment 1: Switched Virtual Circuit (SVC) signaling and refinements of Permanent Virtual Circuit (PVC) signaling, ITU, Geneva, 1996.

[13] ITU-T Recommendation X.36 - Amendment 2: Frame transfer priority, ITU, Geneva, 1997.

[14] ITU-T Recommendation X.36 - Amendment 3: Frame discard priority service classes, NSAP signaling and protocol encapsulation, ITU, Geneva, 1998.

[15] ITU-T Recommendation X.121 – International numbering plan for public data networks, ITU, Geneva, 1996.

[16] ITU-T Recommendation X.213 - Information technology - Open Systems Interconnection - Network service definition, ITU, Geneva, 1995, (ISO/IEC 8348).

[17] FRF.1.2, D. Sinicrope (ed.), User-to-Network Implementation Agreement (UNI), Frame Relay Forum, January 19, 2000.

[18] FRF.2.1, L. Greenstein (ed.), Frame Relay Network-to-Network Interface Implementation Agreement, Frame Relay Forum, July 10, 1995.

[19] FRF.14, K. Rehbehn (ed.), Physical Layer Interface Implementation Agreement, Frame Relay Forum, 1999.

2. IMPLEMENTATION AGREEMENTS

2.1 PHYSICAL LAYER INTERFACE GUIDELINES

Physical layer interface guidelines are provided in the Physical Interface Implementation Agreement (FRF.14).

2.2 DATA TRANSFER

See FRF.1.2 sections 2.2 through 2.2.3. The following exceptions apply:

2.2.1 FRF.1.2 section 2.2.2 - Frame Relay Information Field (Q.922 Annex A §A.2.5)

A maximum frame relay information field size of at least 1600 octets shall be supported by networks. In addition, maximum information field sizes less than, equal to, or greater than 1600 octets may be negotiated during SVC call setup according to ITU-T Recommendation Q.933 section 5.

2.3 CONGESTION CONTROL

See FRF.1.2 sections 2.2.4 and 2.2.5

2.4 PERMANENT VIRTUAL CONNECTION (PVC) MANAGEMENT PROCEDURES

This section is intended to be used for Frame Relay conformance testing. User devices (and the network) shall implement the mandatory procedures of ITU-T Q.933 Annex A for managing PVCs on a bearer channel where switched virtual connections and PVCs co-exist.

By bilateral agreement:

- Optional procedures of Annex A of ITU-T Q.933 may be used.

Note 1 - The number of PVCs that can be supported by Q.933 Annex A is limited by the maximum frame size that can be supported by the user device and the network on the bearer channel, (e.g., when the maximum frame relay information field size is 1600 octets, then a maximum of 317 PVC STATUS elements may be encoded in the STATUS message. At 4096 octets a maximum of 816 PVC Status elements may be encoded in the STATUS message). See Annex A of the PVC UNI Implementation Agreement [16] for procedures to support UNIs with a higher number of PVCs.

Note 2 - When a user or network equipment provides both switched virtual connections and PVCs on a bearer channel, it simultaneously supports two protocols: SVC procedures according to §3.4 (below), and PVC management procedures. Each protocol independently determines whether it is successfully communicating with its peer. The equipment should consider the status of both protocols when reporting the status of the bearer channel (e.g., to user or network management).

2.5 SWITCHED VIRTUAL CONNECTION (SVC) PROCEDURES

Implementations of the Frame Relay UNI signaling procedures for switched virtual connections (SVCs) shall be based on ITU-T Q.933 with the following exceptions:

This implementation agreement covers only Frame Relay Case A of Q.933 (see §1.2 item 1). Case B (see §1.2 item 2) is not supported by this implementation agreement.

According to Case A of Q.933, a physical connection between the user and the remote frame relay handler must be in place before the frame mode connections can be established. Optionally, when using ISDN, the physical connection may be established using the procedures of §§5.1.1.1 and 5.2.1.1.

Q.933 requires a reliable link layer protocol. The link layer protocol used in this implementation agreement is ITU-T Recommendation Q.922. All Q.933 signaling messages of this implementation agreement shall be sent using DLCI 0.

Note: The default time to be used for Q.922 T200 is 1 second.

This section is intended to be used for Frame Relay conformance testing.

This implementation agreement follows Frame Relay Case A of ITU-T Recommendation Q.933 with the following exceptions:

2.5.1 Numbering Plans

Both the ITU-T E.164 and X.121 numbering plans are applicable. The numbering plan used is service provider dependent.

Some ATM networks use the Network Service Access Point (NSAP) structure to address end systems. To interwork between those ATM networks and frame relay networks, Annex E of this implementation agreement describes the encoding of frame relay DTE X.121 and E.164 numbers as NSAP.

2.5.2 Section 1/Q.933. - Purpose, scope and structure

Section 1.2 - Scope: Item 2 is not applicable.

2.5.3 Section 2/Q.933. - Overview of frame mode connection control

2.5.3.1 Section 2.0/Q.933 - Overview of frame mode connection control:

Figure 2-2/Q.933 is not applicable.

2.5.3.2 Section 2.1.1/Q.933 - Call states at the user side of the interface:

States U4, U7, and U8 are not applicable.

2.5.3.3 Section 2.1.2/Q.933 - Call states at the network side of the interface:

States N4, N7, N8, and N22 are not applicable.

2.5.4 Section 3/Q.933. - Message functional definitions

2.5.4.1 Section 3.1/Q.933 - Messages for frame mode connection control

Messages ALERTING, CONNECT ACKNOWLEDGE and PROGRESS are not applicable.

2.5.4.2 Section 3.1.1/Q.933 - Alerting:

This section is not applicable.

2.5.4.3 Section 3.1.2/Q.933 - Call proceeding:

- Length of Call Reference information element is fixed 3 octets and not 2-*.
- Length of DLCI information element is fixed at 4 octets or 6 octets.
- The following information elements are not applicable:
    - Channel identification
    - Progress indicator
    - Display
- Notes 1, 3, 4 and 5 are not applicable.

2.5.4.4 Section 3.1.3/Q.933 - Connect:

- Length of Call Reference information element is fixed 3 octets and not 2-*.
- Length of DLCI information element is fixed at 4 octets or 6 octets.
- The following information elements are not applicable.
    - Channel identification
    - Progress indicator
    - Display
    - End-to-end transit delay
    - Packet layer binary parameters
    - Link layer protocol parameters
    - X.213 priority
- Note: Low layer compatibility - See Annex C for enhanced LLC format and negotiation.
- Notes 1, 3, 4, 5, 6, 7, 9, 11 and 12 are not applicable.
- Length of link layer core parameters IE is 2-31 octets, not 2-27.

2.5.4.5 Section 3.1.4/Q.933 - Connect Acknowledge:

This section is not applicable.

2.5.4.6 Section 3.1.5/Q.933 - Disconnect:

- Length of Call Reference information element is fixed 3 octets and not 2-*.
- The following information elements are not applicable.
    - Display
    - Connected number
    - Connected sub-address
    - User-user
- Notes 1 to 5 are not applicable.

2.5.4.7 Section 3.1.6/Q.933 - Progress:

This section is not applicable.

2.5.4.8 Section 3.1.7/Q.933 - Release:

- The second paragraph, "In case B, the bearer channel will be released when releasing the frame mode connection", is not applicable.
- Length of Call Reference information element is fixed 3 octets and not 2-*.
- The following information elements are not applicable.
    - Display

- Connected number
- Connected sub-address
- User-user

- Notes 3, 4, 5, 6, and 7 are not applicable.

2.5.4.9 Section 3.1.8/Q.933 - Release Complete:

- Replace the first paragraph as follows: "This message is sent by the user or the network to indicate that the equipment sending the message has released the call reference. The receiving equipment shall release the call reference."
- Length of Call Reference information element is fixed 3 octets and not 2-*.
- The following information elements are not applicable.
  - Display
  - Connected number
  - Connected sub-address
  - User-user
- Notes 3, 4, 5, 6, and 7 are not applicable.

2.5.4.10 Section 3.1.9/Q.933 - Setup:

- Length of Call Reference information element is fixed 3 octets and not 2-*.
- Length of DLCI information element is fixed at 4 octets or 6 octets.
- Length of Low layer compatibility information element is 2-8 octets and not 2-16.
  See Annex C for enhanced LLC format and negotiation.
- The following information elements are not applicable.
  - Channel identification
  - Progress indicator
  - Network-specific facilities
  - Display
  - End-to-end transit delay
  - Packet layer binary parameters
  - Link layer protocol parameters
  - X.213 priority
  - Repeat indicator
  - High layer compatibility
- Notes 1, 3, 4, 5, 6, 7, 8, 10, 11, 17, and 19 are not applicable.
- Note 2 is replaced by the following : "Mandatory in the network-to-user direction. Not included in the user-to-network direction."

- Note 12 is replaced by: "May be included by the calling user to identify the calling user. The calling party number shall be included in the SETUP message from the network to the called user. The called user need not reject a SETUP with the calling party number IE missing."
- Note 14 is replaced by "The Called Party Number information element shall be included by the user to convey called party number information to the network."
- Applicable facilities are described in Annex A X.36 SVC Facilities on page 19.
- Length of Link layer core parameters IE is 2-31 not 2-27.
- Note: for Transit Network Selection see section A.1 Transit Network Selection Facility for details on Transit Network Selection support

2.5.4.11 Section 3.1.10/Q.933 - Status:

- Length of Call Reference information element is fixed 3 octets and not 2-*.
- The Display information element is not applicable.
- Notes 1 and 2 are not applicable.

2.5.4.12 Section 3.1.11/Q.933 - Status Enquiry:

- Length of Call Reference information element is fixed 3 octets and not 2-*
- The Display information element is not applicable.
- Notes 1 and 2 are not applicable.

2.5.4.13 Section 3.2/Q.933 - Messages used with the global call reference:

- Refer to Annex B section B.2 for a description of the RESTART and RESTART ACKNOWLEDGE messages.
- Refer to section 2.5.4.11 and 2.5.4.12 for a description of the STATUS and STATUS ENQUIRY messages respectively.

2.5.5 Section 4/Q.933. - General message format and information element coding

2.5.5.1 Section 4.4/Q.933 - Message types:

The following messages in Table 4-1/Q.933 are not applicable:

- ALERTING,
- CONNECT ACKNOWLEDGE,
- PROGRESS,
- SEGMENT.

2.5.5.2 Section 4.5.1/Q.933 - Coding rules:

- The following information elements in Table 4-2/Q.933 are not applicable.
    - Shift
    - Repeat indicator
    - Segmented message
    - Channel identification
    - Progress indicator

- Network specific facilities
- Display
- End-to-end transit delay
- Packet layer binary parameters
- Link layer protocol parameters
- X.213 priority
- High layer compatibility
- Escape for extension

- Notes 3, 5 and 6 in Table 4-2/Q.933 are not applicable.

2.5.5.3 Section 4.5.2/Q.933 - Extensions of codesets:

This section is not applicable.

2.5.5.4 Section 4.5.3/Q.933 - Locking shift procedures:

This section is not applicable.

2.5.5.5 Section 4.5.4/Q.933 - Non-locking shift procedures:

This section is not applicable.

2.5.5.6 Section 4.5.5/Q.933 - Bearer capability:

- Note 2 in Figure 4-2/Q.933 is not applicable.
- Code point for ITU-T Recommendation Q.922 in octet 6 of Table 4-3/Q.933 is not applicable.

2.5.5.7 Section 4.5.6/Q.933 - Call state:

The following call states are not applicable: U4, U7, U8, N4, N7, N8 and N22.

2.5.5.8 Section 4.5.7/Q.933 - Called party number:

8	7	6	5	4	3	2	1	Bits/ Octet
Called party number information element identifier								1
0	1	1	1	0	0	0	0	
Length of called party number contents								2
1	Type of number			Numbering plan identification				3
Number digits (IRA characters)								4 etc.

Figure 2: Called Party Number

Type of number (octet 3)

Bits

7 6 5

0 0 0 Unknown (Note 1)

0 0 1 International number (Note 2)

All other values are not applicable.

Note 1 - The type of number "unknown" is used when prefixes are used. E.g., with the E.164 Numbering Plan and prefixes for North America 011:international. Type of number = Unknown is only used with bilateral agreement between the user and the network. Use of this codepoint is discouraged and should be replaced with Type of number = international.

Note 2 - Prefix or escape digits shall not be included. Escape codes are withdrawn in the year 2000.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

Numbering plan identification (octet 3)

Bits

4 3 2 1

0 0 0 1 ISDN/telephony numbering plan (Recommendation E.163 or E.164)

0 0 1 1 Data numbering plan (Recommendation X.121)

All other values are not applicable.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

Number digits (octet 4, etc.)

This field is coded with IRA [11] characters, according to the formats specified in the appropriate numbering/dialing plan.

The number digits appear in multiple octet 4's in the same order in which they would be entered; that is, the number digit which would be entered first is located in the first octet 4.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

2.5.5.9 Section 4.5.9/Q.933 - Calling party number:

8	7	6	5	4	3	2	1	Bits/ Octet
Calling party number information element identifier								1
0	1	1	0	1	1	0	0	
Length of calling party number contents								2
0/1 ext	Type of number			Numbering plan identification				3
1 ext	Presentation indicator		0	0 spare	0	Screening indicator		3a*
Number digits (IRA characters)								4 etc

Figure 3: Calling Party Number

Type of number (octet 3)

Bits

7 6 5	
0 0 0	Unknown (Note 1)
0 0 1	International number (Note 2)

All other values are not applicable.

Note 1 - The type of number "unknown" is used when prefixes are used. E.g., with the E.164 Numbering Plan and prefixes for North America 011:international. Type of number = Unknown is only used with bilateral agreement between the user and the network. Use of this codepoint is discouraged.

Note 2 - Prefix or escape digits shall not be included. Escape codes are withdrawn in the year 2000.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

Numbering plan identification (octet 3)

Bits

4 3 2 1	
0 0 0 1	ISDN/telephony numbering plan (Recommendation E.163 or E.164)
0 0 1 1	Data numbering plan (Recommendation X.121)

All other values are not applicable.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

Presentation indicator (octet 3a) (Note 1)

Bits

7 6	
0 0	Presentation allowed
0 1	Presentation restricted (Note 2)
1 0	Number not available (Note 2)
1 1	reserved

All other values are not applicable.

Note 1 If octet 3a is omitted, the value "0 0 - presentation allowed" is assumed.

Note 2 – For example, these code points may be used for interworking between frame relay and ATM. The use of these code points is not backward compatible with FRF.4.0 implementations.

Screening indicator (octet 3a)

Bits

2 1	
0 0	User provided, not screened
0 1	User provided, verified and passed
1 0	User provided, verified and failed
1 1	Network provided

Note 1 - If octet 3a is omitted, "0 0 User provided, not screened" is assumed.

Note 2 - The meaning and use of this field is defined in Recommendation Q.951 §§ 3 and 4.

Number digits (octet 4, etc.)

This field is coded with IRA [11] characters, according to the formats specified in the appropriate numbering/dialing plan.

The number digits appear in multiple octet 4's in the same order in which they would be entered; that is, the number digit which would be entered first is located in the first octet 4.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

2.5.5.10 Section 4.5.11/Q.933 - Cause:

Octets 3a is not applicable. The modified information element is given below:

8	7	6	5	4	3	2	1	Bits/ Octet
Cause information element identifier								1
0	0	0	0	1	0	0	0	
Length of cause contents								2
1 ext	Coding Standard		Spare 0	Location				3
1 ext	Cause value							4
Diagnostic(s)								5 Note

Figure 4: Cause

Note - Use of the diagnostic field (starting with octet 5) is optional. When used a value appropriate for frame relay shall be selected according to ITU-T Recommendation Q.850 (e.g., Cause # 9, preemption - circuit reserved for reuse is not appropriate for frame relay).

2.5.5.11 Section 4.5.12/Q.933 - Channel identification:

This section is not applicable.

2.5.5.12 Section 4.5.13/Q.933 – Connected Number:

8	7	6	5	4	3	2	1	Bits/ Octet
Connected number information element identifier								1
0	1	0	0	1	1	0	0	
Length of calling party number contents								2
0/1 ext	Type of number			Numbering plan identification				3
1 ext	Presentation indicator		0	0 spare	0	Screening indicator		3a*
Number digits (IRA characters)								4 etc

Figure 5: Connected Number

Type of number (octet 3)

Bits

7 6 5	
0 0 0	Unknown (Note 1)
0 0 1	International number (Note 2)

All other values are not applicable.

Note 1 - The type of number "unknown" is used when prefixes are used. E.g., with the E.164 Numbering Plan and prefixes for North America 011:international. Type of number = Unknown is only used with bilateral agreement between the user and the network. Use of this codepoint is discouraged.

Note 2 - Prefix or escape digits shall not be included. Escape codes are withdrawn in the year 2000.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

Numbering plan identification (octet 3)

Bits

4 3 2 1	
0 0 0 1	ISDN/telephony numbering plan (Recommendation E.163 or E.164)
0 0 1 1	Data numbering plan (Recommendation X.121)

All other values are not applicable.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

Presentation indicator (octet 3a) (Note 1)

Bits

7 6	
0 0	Presentation allowed
0 1	Presentation restricted (Note 2)
1 0	Number not available (Note 2)
1 1	reserved

All other values are not applicable.

Note 1 - If octet 3a is omitted , the value "0 0 - presentation allowed" is assumed..

Note 2 – For example, these code points may be used for interworking between frame relay and ATM. The use of these code points is not backward compatible with FRF.4.0 implementations.

Screening indicator (octet 3a)

Bits

2 1	
0 0	User provided, not screened
0 1	User provided, verified and passed
1 0	User provided, verified and failed
1 1	Network provided

Note 1 - If octet 3a is omitted, "0 0 User provided, not screened" is assumed.

Note 2 - The meaning and use of this field is defined in Recommendation Q.951 §§ 3 and 4.

Number digits (octet 4, etc.)

This field is coded with IRA [11] characters, according to the formats specified in the appropriate numbering/dialing plan.

The number digits appear in multiple octet 4's in the same order in which they would be entered; that is, the number digit which would be entered first is located in the first octet 4.

Note: For support of NSAP formatted numbers see Annex E of this agreement.

2.5.5.13 Section 4.5.15/Q.933 - Data link connection identifier:

- The second paragraph is changed as follows: "The maximum length of this information element is either 4 or 6 octets".
- In Figure 4-3/Q.933, the first occurrence of octets 3b is not applicable.
- In Figure 4-3/Q.933, note 4 is not applicable.
- In Figure 4-3/Q.933, remove the reference to a three octet DLCI from Note 1.
- In Figure 4-3/Q.933, change Note 5 to read " These octets shall both be included only when subscription allows a four octet DLCI (23 bits).
- In Figure 4-3/Q.933, remove Note 4.
- In Table 4-4/Q.933 the Preferred/Exclusive (octet 3 bit 7) field only 1 (exclusive) is supported. Code point 0 is not applicable.

2.5.5.14 Section 4.5.16/Q.933 - Display:

This section is not applicable.

2.5.5.15 Section 4.5.17/Q.933 - End-to-end transit delay:

This section is not applicable.

2.5.5.16 Section 4.5.18/Q.933 - High layer compatibility:

This section is not applicable.

2.5.5.17 Section 4.5.19/Q.933 - Link Layer Core Parameters:

- In Figure 4-4/Q.933 replace Note 1 with: "1 All the parameters are position independent. All parameters are optional, except for Outgoing Maximum Frame Mode Information Field (FMIF) size. If certain parameters are not included, the network default value will be used. The term "outgoing" is defined in the direction from calling user to called user. The term "incoming" is defined in the direction from called user to calling user.

2.5.5.18 Section 4.5.20/Q.933 - Link layer protocol parameters:

This section is not applicable.

2.5.5.19 Section 4.5.21/Q.933 - Low layer compatibility:

See Annex C for enhanced LLC format and negotiation.

- The second paragraph is not applicable.
- The third paragraph is changed as follows: "The maximum length of this information element is 15 octets".
- Octet 3a, 5, 5a, 5b, 5c and 5d in Figure 4-6/Q.933 are not applicable.
- Notes 2 of Figure 4-6/Q.933 is not applicable.
- The text in Table 4-7/Q.933 (Sheets 1 to 4) on octets 3a, 5, 5a, 5b, 5c and 5d are not applicable.

- The text "or octet 5, 5a, and 5b will indicate the use of synchronous protocol sensitive mode of Recommendation V.120 terminal adaptation" in Note 1 of octet 6 Table 4-7/Q.933 (Sheets 4 of 6) is not applicable.
- The text "or octet 5, 5a, and 5b will indicate the use of synchronous protocol sensitive mode of Recommendation V.120 terminal adaptation" in Note 2 of octet 6 Table 4-7/Q.933 (Sheets 5 of 6) is not applicable.
- The text "or octet 5, 5a, and 5b will indicate the use of synchronous protocol sensitive mode of Recommendation V.120 terminal adaptation" in Note 3 of octet 6 Table 4-7/Q.933 (Sheets 5 of 6) is not applicable.

2.5.5.20 Section 4.5.22/Q.933 - Network-specific facilities:

This section is not applicable.

2.5.5.21 Section 4.5.23/Q.933 - Packet layer binary parameters:

This section is not applicable.

2.5.5.22 Section 4.5.24/Q.933 - Progress indicator:

This section is not applicable.

2.5.5.23 Section 4.5.25/Q.933 - Repeat indicator:

This section is not applicable.

2.5.5.24 Section 4.5.26/Q.933 - Segmented message:

This section is not applicable.

2.5.5.25 Section 4.5.29/Q.933 - X.213 priority:

This section is not applicable.

2.5.6 Section 5/Q.933. - Frame mode call control procedures

2.5.6.1 Section 5/Q.933 - General:

The text in this section is replaced by the following text:

This section describes the signaling procedures in support of frame relay communications.

The user may access frame handling facilities by one of the following means:

1. ISDN circuit-switched connection. This connection may be initiated by the user or the RFH.
2. Any other, non-ISDN circuit-mode connection. If this connection is switched, it may be initiated by the user or the RFH.

Signaling between the RFH and the user is provided using in-channel signaling. The term "user" refers to the user equipment which may consist of a frame relay terminal.

One physical type of semi-permanent connection is possible: physical layer connection semi-permanently established between the user and the RFH.

In semi-permanent connection as indicated above, the procedures in § 5.1.1.2/5.1.2 and § 5.2.1.2/5.2.2 of this Recommendation are followed for call establishment. The procedures in § 5.4 of this Recommendation are followed for call release. The link layer establishment and release procedures are end-to-end, and are dependent on the link layer protocol being operated between the users.

2.5.7 Section 5.1/Q.933- Outgoing Call

2.5.7.1 Section 5.1/Q.933 - Outgoing call:

The section is not applicable.

2.5.7.2 Section 5.1.1/Q.933 - Circuit switched access to remote frame handling services (Case A):

- Replace the section title as follows: "Access to remote frame handling services (Case A)."
- Replace the first sentence as follows: "A physical connection between the originating user and the RFH must be in place before the frame mode connections can be established."

2.5.7.3 Section 5.1.1.1/Q.933 - Circuit-switched connection establishment:

Add a new implementation agreement note before the first paragraph as follows: "When using ISDN, the physical connection may be a circuit switched connection; if so, proceed as follows:". Otherwise this section is not applicable.

2.5.7.4 Table 5-1/Q.933 - Establishment of connection for frame mode service:

Entries of Case B in Demand and Semi-permanent access connections are not applicable.

Add a new Note 3 to Case A of Establishment of access connection in Demand mode.

The Note is as follows:

"Note 3 - This applies only to ISDN. See the implementation agreement note in section 5.1.1.1."

2.5.7.5 Section 5.1.1.2/Q.933 - Frame mode connection setup:

- Item 3 "the channel identification information element shall be used as specified in §5.1.3.1" is not applicable.
- The last sentence in the third paragraph "When low layer compatibility negotiations are required, procedures described in Annex J of Recommendation Q.931 will be followed" is not applicable.
- Fourth paragraph "The SETUP message may .....it may contain neither one. See § 5.1.3 below" is not applicable.
- Add a new implementation note as follows: Upon accepting a CONNECT message from the network indicating that the called party has accepted the call, the calling user shall stop T310 and enter the active state (U10).

2.5.7.6 Section 5.1.2/Q.933 - Access to the frame mode virtual circuit service (case B):

This section is not applicable.

2.5.7.7 Section 5.1.3.1/Q.933 - Channel negotiation:

This section and Table 5-2/Q.933 are not applicable.

2.5.7.8 Section 5.1.3.2/Q.933 - Data link connection identifier negotiation:

The text in this section is replaced by the following text.

The user shall not include a DLCI information element in the SETUP message; the network reserves an available DLCI. The reserved DLCI is indicated in the first response to the SETUP message (e.g., CALL PROCEEDING).

If a DLCI is not available, a RELEASE COMPLETE message is sent with cause #34 "no circuit/channel available."

2.5.7.9 Section 5.1.3.3.1/Q.933 - Rationale:

Replace the first three paragraphs with the following text:

The QOS parameter (throughput) is negotiated during frame relay call establishment. Other link layer core parameter that are negotiated are: frame mode information field size, committed burst size and excess burst size. These parameters are negotiated between calling user, the network and the called user.

2.5.7.10 Section 5.1.3.3.2/Q.933 - Parameter negotiation procedures:

The list item "2) Frame Switching bearer service:" is not applicable.

2.5.8 Section 5.2/Q.933. - Incoming Call

2.5.8.1 Section 5.2.1/Q.933 - Access to remote frame handling service (Case A):

Replace the first sentence as follows: "A physical connection between the RFH and the called user must be in place before the incoming frame mode call can be offered."

2.5.8.2 Section 5.2.1.1/Q.933 - Circuit-switched connection establishment:

Add a new implementation agreement note before the first paragraph as follows: "When using ISDN, the physical connection may be a circuit switched connection; if so, proceed as follows:". Otherwise this section is not applicable.

2.5.8.3 Section 5.2.1.2/Q.933 - Frame mode connection establishment:

Item 3 "the channel identification information element shall be used as specified in §5.2.3.1" is not applicable.

Add a new implementation note as follows: Upon accepting a CONNECT message indicating that the called user has accepted the call, the network shall stop timer T310 or T303 if T310 is not running, and enter the active state (N10). Upon sending a CONNECT message, the user shall enter the active state.

2.5.8.4 Section 5.2.2/Q.933 - Access from the ISDN frame mode virtual circuit service (case B):

This section is not applicable.

2.5.8.5 Section 5.2.3.1/Q.933 - Channel selection through call offering:

This section and Table 5-3/Q.933 are not applicable.

2.5.8.6 Section 5.2.3.2/Q.933 - Data link connection identifier negotiation:

The text in this section is replaced by the following text:

The RFH always includes the Data link connection identifier information element in a SETUP message.

The user shall include the Data link connection identifier information element in a CALL PROCEEDING, or a CONNECT message sent as the first response to a SETUP message. The value of the DLCI indicated in this response shall be the same as the value of the DLCI received in the SETUP message.

2.5.8.7 Section 5.2.3.3/Q.933 - Parameter negotiation:

The remainder of the text in this section beginning "In addition to the above the link layer protocol parameters (LLPP) are examined and the following actions are taken:" is replaced by the following text.

The parameter values indicated in the CONNECT message are those used for the connection. These parameter values shall be carried unchanged by the network and delivered to the calling user in a CONNECT message.

2.5.9 Section 5.3/Q.933 - Frame mode data transfer phase protocol

List item 2 in the second paragraph is not applicable.

2.5.10 Section 5.4/Q.933 - Call clearing

2.5.10.1 Section 5.4.2/Q.933 - Exception Conditions:

The following additional clarification is included as a part of this implementation agreement and replaces the existing text.

The user selects an appropriate clearing message according to the call state that exists on the user side of the interface; the network selects an appropriate clearing message according to the call state that exists on the network side of the interface:

State U10 or N10 (Active) : DISCONNECT

State U0 or N0 (Null) : RELEASE COMPLETE

Any other state : RELEASE.

2.5.10.2 Section 5.4.3/Q.933 - Clearing initiated by the user:

The text in this section is replaced by the following text:

Section 5.3.2/Q.931 applies to frame relay calls, as follows:

1. The user shall disconnect the DLCI upon sending the DISCONNECT message.
2. Upon receipt of the DISCONNECT message, the network shall disconnect the DLCI.
3. On receipt of the RELEASE message, the user shall release the DLCI, in addition to the Call reference.
4. On receipt of the RELEASE COMPLETE message, the network shall release the DLCI, in addition to the Call reference.

2.5.10.3 Section 5.4.4/Q.933 - Clearing initiated by the network:

The text in this section is replaced by the following text:

Sections 5.3.4.2 and 5.3.4.3 of Recommendation Q.931 applies to frame relay calls, as follows:

1. The network shall disconnect the DLCI upon sending the DISCONNECT message.
2. Upon receipt of the DISCONNECT message, the user shall disconnect the DLCI.
3. On receipt of the RELEASE message, the network shall release the DLCI, in addition to the Call reference.
4. On receipt of the RELEASE COMPLETE message, the user shall release the DLCI, in addition to the Call reference.

2.5.11 Section 5.5/Q.933 - Restart procedures:

See Annex B - Restart Procedures for restart of Frame Relay Switched Virtual Connections.

2.5.11.1 Sections 5.5.1/Q.933 - Case A:

Applies only when the circuit mode access connection is an ISDN bearer channel. Otherwise it is not applicable.

2.5.11.2 Sections 5.5.2/Q.933 - Case B:

This section is not applicable.

2.5.12 Section 5.6/Q.933 - Call collision:

The second paragraph of this section is not applicable.

2.5.13 Section 5.7/Q.933 - Handling of error conditions:

The following additional clarification is included as part of this implementation agreement.

The paragraphs in section 5.7 related to global call reference are replaced by the following:

There are several error conditions related to the global call reference, which shall be handled as follows:

See section B.4.1 for details on receiving STATUS, STATUS ENQUIRY, RESTART and RESTART ACKNOWLEDGE with the global call reference

When a message other than STATUS, STATUS ENQUIRY, RESTART or RESTART ACKNOWLEDGE is received with the global call reference, a STATUS message with cause #81-invalid call reference value is returned. The call reference is coded with the global call reference.

2.5.13.1 Handling of messages not implemented

When an implementation receives a message it has not implemented, it shall treat it as an "unrecognized message" according to ITU-T Recommendation Q.931 § 5.8.4. It shall return a STATUS message with cause No. 97 "message type non-existent or not implemented" and remain in its current state.

2.5.13.2 Handling of information elements not implemented

When an implementation receives a message with an information element it has not implemented or does not recognize, it shall follow the procedures of ITU-T Recommendation Q.931 § 5.8.7.1.

2.5.13.3 Data Link Reset

Whenever an entity is informed of a data link reset by means of the DL_ESTABLISH indication primitive, the following procedures shall apply:

1. For calls in the clearing phase (states N11, N12, N19, U11, U12, and U19), no action shall be taken
2. Calls in the establishment phase (states N1, N3, N6, N9, U1, U3, U6, and U9), shall be maintained according to the normal or error handling procedures contained in other parts of section 2 of this document.
3. Calls in the active state (U10 and N10) shall be maintained. according to the normal or error handling procedures contained in other parts of this document.

2.5.13.4 Data Link Failure

When the layer 3 entity is informed of a data link failure by means of a DL_Release_indication the following procedures shall apply:

Any switched virtual connections shall be cleared internally.

2.5.14 Section 5.8/Q.933. - List of system parameters:

2.5.14.1 Section 5.8.1/Q.933 - Timers in the network side:

The timers T301, T309, and T312 are not applicable. It is implied that since T309 is not applicable, all calls shall be cleared internally in response to the layer 2 entity releasing the data link.

2.5.14.2 Section 5.8.2/Q.933 - Timers in the user side:

The timers T301, T309, and T313 are not applicable. It is implied that since T309 is not applicable, all calls shall be cleared internally in response to the layer 2 entity releasing the data link.

2.5.15 Annex C/Q.933 - Provision of connection mode network services:

This section is not applicable.

ANNEX A X.36 SVC FACILITIES
(OPTIONAL)

This section contains a subsetted list of optional Frame Relay UNI signaling facilities included from X.36 Amendment 1. Exceptions to the included facilities are as noted below. All other X.36 facilities are excluded unless stated otherwise.

A.1 TRANSIT NEWORK SELECTION FACILITY

Use of the transit network selection facility is described in X.36 Amendment 1 section 10.6.9. The information element and code points are described in X.36 sections 10.4.8 and 10.5.19.

Only one transit network selection information element is coded in the SETUP message. Support of more than one transit network selection up to the maximum allowed by X.76 at the SVC NNI is for further study.

A.2 CLOSED USER GROUP

Use of the closed user group facility is described in X.36 Amendment 1 section 10.6.8. The information element and code points are described in X.36 Amendment 1 sections 10.4.8 and 10.5.11. No exceptions are noted.

A.3 PRIORITIES & SERVICE CLASS PARAMETERS

This section describes the frame transfer and discard priority as well as service class facility for frame relay SVCs The descriptions of this facility are in:

- X.36 Amendment 2, section 13.1 Frame transfer priority with no exceptions.
- X.36 Amendment 3, section 13.2 Frame Discard Priority with no exceptions
- X.36 Amendment 3, section 13.3 Frame Relay Service Class with no exceptions
- X.36 Amendment 3, section 13.4 Support of both Service Classes and Priorities with no exceptions

ANNEX B RESTART PROCEDURES
(MANDATORY)

In general, the Restart Procedures of X.36 Amendment 1 shall be used with the following changes.

B.1 STATES

Section 10.3.3 - States used with the restart facility

Add with no changes

B.2 MESSAGES

X.36 Amendment 1 - Section 10.4 - Message definitions

1. Section 10.4.6 Restart - Table10-7/X.36
   - Add with no changes.
2. 10.4.7 Restart Acknowledge - Table10-8/X.36
   - Add with no changes.
3. Section 10.4.9 - Status - Table 10-10/X.36
   - Use the STATUS message in section 2.5.4.11 of this document.
4. Section 10.4.10 - Status enquiry - Table 10-11/X.36
   - Use the STATUS ENQUIRY message in section 2.5.4.12 of this document.

B.3 INFORMATION ELEMENTS

X.36 Section 10.5 General message format and information element coding

Section 10.5.5 Call state: See section 2.5.5.7 of this document.

The global interface state values apply to the Call state information element.

B.4 PROCEDURES

B.4.1 X.36 Amendment 1 section 10.6.5.3 Receipt of the STATUS message with the global call reference

Remove the current paragraph and replace it with:

"On receipt of a STATUS message specifying the global call reference and reporting an incompatible state in the restart request or restart state, the receiving entity shall inform layer management and take no further action on this message. When in the Null (REST0) state, on receipt of a STATUS message specifying the global call reference no action shall be taken.

NOTE - Further actions as a result of higher layer activity (e.g. system or layer management) are implementation dependent (including the retransmission of RESTART). Except for the above case, the error handling procedures when receiving a STATUS message specifying the global call reference are an implementation option."

B.4.2 X.36 Amendment 1 section 10.6.6 Restart Procedure

1. Section 10.6.6 Restart procedure

    - 2nd sentence - Change "The restart procedure is used to recover from internal failure, after power-up or …" to "The restart procedure may be used to recover from internal failure, after power-up or …". Add "All connections identified in a restart request shall be cleared internally prior to sending a RESTART message."

      Note: It is not mandatory to RESTART the UNI at internal failure, power up, etc. Other methods may result in the interface being cleared, e.g. data link failure. The DTE or DCE must clear the calls identified in a restart request prior to sending a RESTART to ensure that calls may be accepted immediately after receiving a RESTART ACKNOWLEDGE.

2. Section 10.6.6.1 Sending a Restart message, paragraph 2, last sentence

    Change "When this limit is reached the originator of the restart attempt shall consider the restart procedure successfully completed and the DTE/DCE interface is available for new calls." to "When the limit is reached the originator of the RESTART shall: record an error, take appropriate actions and consider the interface available for new calls. An example of such action is the release and re-establishment of the data link."

ANNEX C
ENHANCED LOW LAYER COMPATIBILITY ENCODING AND NEGOTIATION
(MANDATORY)

This section describes the additional message formats and procedures needed to support enhanced low layer compatibility encoding and negotiation.

C.1 3.1.9 SETUP

- Length of Low Layer compatibility information element is 2-15.
- Low layer compatibility is included in the DCE-to-DTE direction at the called DTE/DCE interface if it was included by the calling DTE. This information element may be repeated according to the procedures in section C.4

C.2 3.1.3 CONNECT

Change the low layer compatibility information element in the CONNECT message to:

Low layer compatibility	4.5.21	both	O (NOTE A)	2 - *

NOTE A: Included in the DCE-to-DTE direction at the calling DTE/DCE interface if it was included in the DTE-to-DCE direction at the called DTE/DCE interface

C.3 4.5.21 LOW LAYER COMPATIBILITY

The purpose of the Low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity(e.g. remote DTE or an interworking unit or a high layer function of a DCE node addressed by the calling DTE). The Low layer compatibility information element(s) are transferred transparently by a frame relay network between the calling DTE and the addressed entity. The Low layer compatibility information element is coded as follows. Low layer compatibility negotiation may be performed according to the procedures in Annex C section C.4.

8	7	6	5	4	3	2	1	Octet
Low Layer Compatibility								
0	1	1	1	1	1	0	0	1
Information element identifier								
Length of the Low Layer Compatibility Length contents								2
1 ext	Coding Standard		Information transfer capability					3
1 ext	Transfer Mode		Reserved					4
			0	0	0	0	0	
0/1 ext	Layer 2 ident.		User information layer 2 protocol LAN Logical Link Control (ISO/IEC 8802/2)					6* (Note 1) (Note 4)
	1	0						
1 ext	User specified layer 2 protocol information							6a*
1 ext	Reserved		SREJ use	Modulo		Address Inclusion		6a*
	0	0						
0/1 ext	Layer 3 ident.		User information layer 3 protocol					7* (Note 4)
	1	1						
1 ext	User specified layer 3 protocol information							7a*
1 ext	FRF.3.2 Annex A							7a* (Note 5)
0 ext	ISO/IEC TR 9577 Initial Protocol Identifier (IPI)							7a* (Note 2)
1 ext	IPI (bit 1)		spare					7b* (Note 2)
		0	0	0	0	0	0	
1 ext	SNAP ID		spare					8* (Note 3) (Note 4)
	0	0	0	0	0	0	0	
OUI Octet 1								8.1*
OUI Octet 2								8.2*
OUI Octet 3								8.3*
PID Octet 1								8.4*
PID Octet 2								8.5*

NOTE 1 - Octet group 5 defined in Recommendation Q.933 is not used in FRF.4.1.

NOTE 2 - These octet(s) may be present only if octet 7 indicates ISO/IEC TR 9577. When included, both octets 7a and 7b must be present.

NOTE 3 - This octet group shall be present only if octet 7 indicates ISO/IEC TR 9577 and octets 7a and 7b indicate IEEE 802.1 SNAP. When included, octets 8.1 -8.5 must be present.

NOTE 4 - Octet groups 6 - 8 are position dependent. If present, they shall be included in order as specified above.

NOTE 5 - This octet is present only if octet 7 indicates FRF.3.2 Annex A.

Figure 6: Low layer compatibility information element

Coding Standard (octet 3)
Bits 7 6
0 0 CCIT standardized coding as described below

Information transfer capability (octet 3)
Bits 5 4 3 2 1
0 1 0 0 0 Unrestricted digital information
All other values are reserved.

Transfer Mode (octet 4)
Bits 7 6
0 1 Frame Mode
All other values are reserved

User information layer 2 protocol (octet 6)
Bits 5 4 3 2 1
0 0 0 0 1 Basic ISO 1745
0 0 1 1 0 ITU-T Recommendation X.25 link level (NOTE 1)
0 0 1 1 1 ITU-T Recommendation X.25 multilink level (NOTE 2)
0 1 0 0 0 Extended LAPB for half duplex operation (T.71) (NOTE 1)
0 1 0 0 1 HDLC ARM (ISO/IEC 4335) (NOTE 3)
0 10 1 0 HDLC NRM (ISO/IEC 4335) (NOTE 3)
0 1 0 1 1 HDLC ABM (ISO/IEC 4335) (NOTE 3)
0 1 1 0 0 LAN logical link control (ISO/IEC 8802/2) (NOTES 4 and 5)
0 1 1 0 1 ITU-T Recommendation X.75 Single link procedure (SLP) (NOTE 1)
0 1 1 1 0 ITU-T Recommendation Q.922 (NOTE 6)
1 0 0 0 0 User specified (NOTE 7)
1 0 0 0 1 ISO/IEC 7776 DTE to DTE operation (NOTE 1)
All other values are reserved.
NOTE 1: Normally the LAPB address is not provided. When provided, octet 6a will indicate that the address is present. When the LAPB address is provided, the calling DTE assumes address A (value 3) and the called DTE assumes address B (value 1).
NOTE 2: Normally the X.25 multilink address is not provided. When provided, octet 6a will indicate that the address is present. When the X.25 multilink address is provided, the calling DTE assumes address C (value 15) and the called DTE assumes address D (value 7).
NOTE 3: Normally the HDLC address is not provided. When provided, octet 6a will indicate that the address is present.
NOTE 4: Destination service access point (DSAP) and source service access point (SSAP) are included. When a logical link control frame (which contains a logical link control PDU) is required (transparent inter-connection of similar LANs by frame relay), Octet 6a will indicate that the logical link control frame is encapsulated. The contents of a logical link control frame is defined in the LAN media access control (MAC) standards (e.g. ISO/IEC 8802/5).
NOTE 5: The indication of command or response bit in the frame relay address will be ignored.
NOTE 6: Address is not encapsulated.
NOTE 7: When this coding is included, octet 6a will include the code point for user specified layer 2 protocol.

Octet 6a coding for user specified code point:
User information layer 2 protocol (octet 6a) (applies for layer 2 = User specified)
User specified.

Octet 6a coding for Address inclusion:
User information layer 2 protocol (octet 6a) (NOTE 9)
Bits 2 1
0 1 Address included (NOTE 10)
1 0 Encapsulation of logical control frame (NOTE 11)
All other values are reserved.

NOTE 9: When the octet is present, the indication of C/R bit in the frame relay core aspects address will be ignored.
NOTE 10: Applies for the following layer 2 protocols specified in octet 6: Recommendation X.25 link layer, Recommendation X.25 multilink, extended LAPB for half duplex operation (see recommendation T.71) HDLC ARM, HDLC NRM, HDLC ABM and Recommendation X.75 single link procedures (SLP).
NOTE 11: Applies for the following layer 2 protocol specified in octet 6: LAN logical link control (ISO/IEC 8802/2).

Bits 4 3 (Only applicable when octet 6 is coded as ISO/IEC 7776)
- 0 0 Modulo 8
- 0 1 Modulo 128
- 1 0 Modulo 32,768
- 1 1 Modulo 2,147,483,648

Bits 5 (Only applicable when octet 6 is coded as ISO/IEC 7776)
- 0 Selective Reject (SREJ) not used
- 1 Selective Reject (SREJ) used

User information layer 3 protocol (octet 7)

Bits 5 4 3 2 1
- 0 0 1 1 0 ITU-T Recommendation X.25 packet level
- 0 0 1 1 1 ISO/IEC 8208 (X.25 packet level protocol for DTE)
- 0 1 0 0 0 Recommendation X.223 or ISO/IEC 8878 (use of ISO/IEC 8208 and X.25 to provide the OSI-CONS)
- 0 1 0 0 1 ISO/IEC 8473 (OSI connectionless mode protocol)
- 0 10 1 0 Recommendation T.70 minimum network layer
- 0 1 0 1 1 ISO/IEC TR 9577 (Protocol identification in the network layer) (NOTE 13)
- 1 0 0 0 0 User specified (NOTE 12)
- 1 1 0 0 0 FRF.3.2 Annex A (NOTE 14)
- All other values are reserved.

NOTE 12: When this coding is included, octet 7a will include the code point for user specified layer protocol.
NOTE 13 – If extension octets (7a-7b) are not included, more than one protocol may be encapsulated over the SVC using the FRF.3.1 Multiprotocol encapsulation format.
If extension octets are present one protocol is carried on the SVC. The ISO/IEC TR 9577 Initial Protocol Identifier (IPI) as well as the subsequent protocol identification octets are not carried in the user plane.
NOTE 14: When this coding is included, octet 7a will indicate which capabilities are to be used according to Frame Relay Forum Multiprotocol Encapsulation implementation agreement FRF.3.2 Annex A.

Optional layer 3 protocol information (octet 7a)
User specified.

FRF.3.2 Annex A (octet 7a)
See Frame Relay Forum Multiprotocol encapsulation implementation agreement FRF.3.2 Annex A for codepoints and bit assignments.

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

C.4 LOW LAYER COMPATIBILITY NEGOTIATION PROCEDURES

C.4.1 General Purpose

The Low layer compatibility negotiation procedures in this annex are based on Q.931/Annex J. The purpose of the Low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g. a remote user or an interworking unit or high layer function network node addressed by the calling user). The Low layer compatibility information element is transferred transparently by an frame relay network between the call originating entity (e.g. the calling user) and the addressed entity.

The user information protocol fields of the Low layer compatibility information element indicate the low layer attributes at the call originating entity and the addressed entity. This information is not interpreted by the frame relay network and therefore the bearer capability provided by the frame relay network is not affected by this information. The call originating entity and the addressed entity may modify the low layer attributes by the negotiation described below.

The Low layer compatibility information element is coded according to C.3.

C.4.2 Low layer capability notification to the called user

When the calling user wishes to notify the called user of its information transfer attributes (OSI layer 2 and layer 3 attributes), then the calling user shall include a Low layer compatibility information element in the SETUP message; this element is conveyed by the network and delivered to the called user. However, if the network is unable to convey this information element, it shall act as described in section 2.18 (unrecognized information element).

C.4.3 Low layer compatibility negotiation between users

If the user wishes to indicate alternative values of low layer compatibility parameters (e.g. alternative protocol suites), the Low layer compatibility information element is repeated in the SETUP message. Up to *three* Low layer compatibility information elements may be included in a SETUP message. The first Low layer compatibility information element in the list is the default and is used if the network or called user does not support negotiation. The order of appearance of the subsequent Low layer compatibility information elements indicates the order of preference of end-to-end low layer parameters.

If the network or called user does not support repeating of the Low layer compatibility information element, and therefore discards the subsequent Low layer compatibility information elements, only the first Low layer compatibility information element is used in the negotiation.

Note: If the called user supports LLC negotiation, it chooses from the list of LLC IEs selecting from the subsequent IEs first using the default as a last choice.

Note: It is recommended that the default Low layer compatibility IE in the SETUP be coded without the IPI in octets 7a and 7b and without octet group 8. This favors interoperability with DTEs that do not support the extensions on section C.3.

Note: It is recommended that the default the Low layer compatibility IE in the SETUP be coded such that it is less than or equal to 8 octets in length. This favors networks not supporting the increased length or multiple LLC IEs in a SETUP message, allowing them to transport at least one LLC IE in the SETUP

The called user indicates a single choice from among the options offered in the SETUP message by including the Low layer compatibility information element in the CONNECT message. Absence of a Low layer compatibility information element in the CONNECT message indicates acceptance of the first Low layer compatibility information element in the SETUP message.

C.4.4 Backward compatibility considerations

Since the initial versions of frame relay implementations typically do not support Low Layer Compatibility negotiation it is important that these implementations still interoperate with implementations of FRF.4.1 that do support the Low Layer Compatibility negotiation. Because the Low Layer Compatibility is an end to end function and was previously not negotiated, a called DTE that does not support LLC negotiation will accept the call based on its comprehension of the first Low Layer Compatibility presented in the SETUP, and it will send a CONNECT without a Low Layer Compatibility or it will clear the call. The calling DTE interprets the absence of an LLC IE in the CONNECT as an acceptance of the first LLC presented in

the SETUP. In either case this is acceptable behavior to the negotiation procedures proposed and provides consistent function to the older implementation.

Since a calling DTE that does not support negotiation can only send one LLC IE in the SETUP this indicates to the called DTE that the calling DTE does not support negotiation or does not wish to negotiate the LLC for the call. The call, if accepted, will use the LLC IE from the SETUP and no LLC will be returned in the CONNECT.

If any network connecting two DTEs does not support LLC negotiation, all but the first LLC IE in the SETUP will be discarded and the call is progressed to the called DTE. The called DTE interprets the call as though the calling DTE does not support negotiation or does not wish to negotiate the LLC. The call, if accepted, will use the LLC IE from the SETUP and no LLC will be returned in the CONNECT.

C.5 EXAMPLE ENCODINGS FOR MULTIPROTOCOL ENCAPSULATION USING SVCS

The following are examples of how one would encode the Low Layer Compatibility IE to signal the use protocol indicated.

8	7	6	5	4	3	2	1	Octet
Low Layer Compatibility								
0	1	1	1	1	1	0	0	1
Information element identifier								
Length of the Low Layer Compatibility Length contents								2
1	Coding Standard		Information transfer capability					3
ext	0	0	0	1	0	0	0	
1	Transfer Mode		Reserved					4
ext	0	1	0	0	0	0	0	
1	Layer 3 ident.		User information layer 3 protocol ISO/IEC TR 9577					
ext	1	1	0	1	0	1	1	7

Figure 7 - Encoding for ISO/IEC TR 9577 Multiprotocol Encapsulation (FRF.3.1)

8	7	6	5	4	3	2	1	Octet
Low Layer Compatibility								
0	1	1	1	1	1	0	0	1
Information element identifier								
Length of the Low Layer Compatibility Length contents								2
1	Coding Standard		Information transfer capability					3
ext	0	0	0	1	0	0	0	
1	Transfer Mode		Reserved					4
ext	0	1	0	0	0	0	0	
1	Layer 3 ident.		User information layer 3 protocol ISO/IEC TR 9577					7
ext	1	1	0	1	0	1	1	
0	ISO/IEC TR 9577 Initial Protocol Identifier (IPI) for IP (bits 8-2)							7a
ext	1	1	0	0	1	1	0	
1	IPI(bit 1)	spare						7b
ext	0	0	0	0	0	0	0	

Figure 8 - Single protocol encoding for IP

8	7	6	5	4	3	2	1	Octet
Low Layer Compatibility								
0	1	1	1	1	1	0	0	1
Information element identifier								
Length of the Low Layer Compatibility Length contents								2
1	Coding Standard		Information transfer capability					3
ext	0	0	0	1	0	0	0	
1	Transfer Mode		Reserved					4
ext	0	1	0	0	0	0	0	
1	Layer 2 ident.		User information layer 2 protocol LAN Logical Link Control (ISO/IEC 8802/2)					6
ext	1	0	0	1	1	0	0	
0	Layer 3 ident.		User information layer 3 protocol ISO/IEC TR 9577					7
ext	1	1	0	1	0	1	1	
0	ISO/IEC TR 9577 Initial Protocol Identifier (IPI) for SNAP (bits 8-2)							7a
ext	1	0	0	0	0	0	0	
1	IPI(bit 1)	spare						7b
ext	0	0	0	0	0	0	0	
1	SNAP ID		spare					8
ext	0	0	0	0	0	0	0	
OUI Octet 1								
0	0	0	0	0	0	0	0	8.1
OUI Octet 2								
0	0	0	0	0	0	0	0	8.2
OUI Octet 3								
0	0	0	0	0	0	0	0	8.3
PID Octet 1								
1	0	0	0	0	0	0	1	8.4
PID Octet2								
0	0	1	1	0	1	1	1	8.5

Figure 9 - Single protocol encoding for Protocol Identified via SNAP convention (IPX)

8	7	6	5	4	3	2	1	Octet
Low Layer Compatibility								
0	1	1	1	1	1	0	0	1
Information element identifier								
Length of the Low Layer Compatibility Length contents								2
1	Coding Standard		Information transfer capability					3
ext	0	0	0	1	0	0	0	
1	Transfer Mode		Reserved					4
ext	0	1	0	0	0	0	0	
1	Layer 2 ident.		User information layer 2 protocol LAN Logical Link Control (ISO/IEC 8802/2)					6
ext	1	0	0	1	1	0	0	
0	Layer 3 ident.		User information layer 3 protocol User specified					7
ext	1	1	1	0	0	0	0	
1	SNA – Subarea (FID4)							7a
ext	1	0	0	0	0	0	0	

Figure 10 - Single protocol encoding for Protocol Identified via Q.933 convention
(Layer 2: IEEE 802.2 Layer 3: SNA subarea (FID 4))

8	7	6	5	4	3	2	1	Octet
Low Layer Compatibility								
0	1	1	1	1	1	0	0	1
Information element identifier								
Length of the Low Layer Compatibility Length contents								2
1	Coding Standard		Information transfer capability					3
ext	0	0	0	1	0	0	0	
1	Transfer Mode		Reserved					4
ext	0	1	0	0	0	0	0	
0	Layer 2 ident.		User information layer 2 protocol ISO/IEC 7776 DTE to DTE operation					6
ext	1	0	1	1	0	0	1	
1	Reserved		SREJ use	Modulo		Address Inclusion		6a
ext	0	0	1	1	0	0	1	

Figure 11 - Single protocol encoding for ISO/IEC 7776 with use of SREJ and modulo 32768

ANNEX D SYSTEM REINITIALIZATION PROCEDURES
(INFORMATIVE)

The method of resetting the UNI is to use the RESTART procedures in Annex B. However, in some cases the peer device may not support the RESTART procedures in this agreement, (e.g., an FRF.4 implementation). As an option, devices that have lost all SVC calls (e.g., due to system re-initialization, or other events) and have exhausted the RESTART procedures unsuccessfully may release and re-establish the data link (i.e., send DISC P=1, wait and receive UA F=1; then send SABME wait and receive UA) . This action will trigger a DL_RELEASE_INDICATION to the peer layer 3 which causes the peer layer 3 to clear all SVC calls, (See section 2.5.13.4).

ANNEX E USE OF NSAP ADDRESSES AT THE SVC UNI
(OPTIONAL)

See X.36 Amendment 3 Annex F. X.36 Annex F is applied to the Called and calling party sections of this document, (Sections 2.5.5.8 and 2.5.5.9). The NSAP formats in X.36 Annex F that shall be supported are as follows:

1. X.121
2. E.164
3. ICD
4. DCC

APPENDIX I E.164 AND X.121 NUMBERS CODED AS NSAP ADDRESSES (INFORMATIVE)

I.1 INTRODUCTION

ITU-T Recommendation X.213 and ISO/IEC 8348 define rules for coding NSAP addresses. These rules are known as the "preferred binary encoding" rules. The ATM Forum and ITU-T Recommendation X.36 followed them respectively for the ATM End System Address (AESA) encoding and for frame relay signaling at the UNI for calling and called party numbers coded as NSAP. This appendix briefly reviews NSAP format and coding and illustrates through an example the coding of X.121 and E.164 numbers as NSAP addresses.

I.2 NSAP FORMAT

Figure 1 shows the NSAP address structure. The NSAP address consists of two main fields:

1. The initial domain part (IDP) which is divided into the authority and format identifier (AFI) and the initial domain identifier (IDI).
2. The domain specific part (DSP).

Note: The maximum length of an NSAP address is 20 octets.

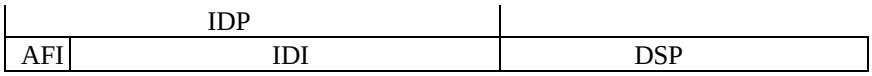

Figure 12: NSAP Structure

I.3 NSAP CODING

1. The AFI consists of an integer with a value between 0 and 99. The "preferred binary coding" specifies to use one byte to represent the two digits of the AFI. Each digit is in the range of 0000 and 1001.

2. X.213 | ISO/IEC 8348 allocate two AFI values for most IDI formats. For each IDI one AFI value is used when the first significant digit of the IDI is non-zero and the other one when the first significant digit of the IDI is zero.

3. An E.164 and an X.121 is coded as an IDI respectively with a maximum length of 15 and 14 digits.

4. E.164 AFI used in the ATM Forum specification is 45 and X.121 AFI used in Recommendation X.36 is 37. These two AFI values are allocated in X.213 | ISO/IEC 8348 and indicate that the first digit of the IDI (in this case E.164 or X.121 number) is a non-zero.

5. The IDI is coded as follows:
   a) First, the IDI is padded, if necessary, with leading zeros to obtain the maximum length. E.164 maximum length is 15 digits and X.121 maximum length is 14 digits. Each digit is coded with a value ranging between 0000 and 1001. Two digits occupy one byte.

   b) Secondly, if necessary, the value 1111 is added as a PAD after the IDI digits to obtain an integral number of bytes.

6. The DSP is coded as a binary number.

I.4 EXAMPLE

As an example, let us code the number 3141592654 as an X.121 IDI and an E.164 IDI.

IDI Coding rules	Coding as an X.121 IDI	Coding as an E.164 IDI
Number to code in the IDI field of the NSAP address	3141592654	3141592654
Rule 1 Left padding with 0s to obtain maximum length.	X.121 max length is 14 digits: **00 00** 31 41 59 26 54	E.164 max length is 15 digits: **00 00 0**3 14 15 92 65 4⊥
Rule 2 Right pad with 1111 to obtain an integral number of bytes.	Right padding not required. After rule 1 is applied, an integral number of bytes was obtained.	00 00 03 14 15 92 65 4**F**

Figure 13: Example of X.121 and E.164 numbers coded as NSAP