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BELLSOUTH®

PulseLink® X.75 Interface Specification

Technical
Reference

NOTICE

This Technical Reference is published by BellSouth Telecommunications, Inc. describes the BellSouth implementation of CCITT Recommendation X.75 for interface between PulseLink® Service and ICs and VANs for the transport of packet cells outside the LATA. This interface specification is written to establish a standard interface to a technology offering.

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PULSELINK® X.75 INTERFACE SPECIFICATION

CONTENTS

PULSELINK® X.75 INTERFACE SPECIFICATION

1. INTRODUCTION

1.1 This technical reference describes the BellSouth implementation of CCITT Recommendation X.75 for interface between PulseLink® service and ICs and VANs for the transport of packet calls outside the LATA. PulseLink service is the BellSouth name for public packet switching service. This interface specification is written to establish a standard interface to a technology offering.

NOTE: References to PulseLink will appear throughout this document. PulseLink is a registered trademark of BellSouth Services Inc.

1.2 PulseLink service is a BellSouth switched data network service. It uses packet switching techniques and technology to offer business and residence customers a cost effective solution to their low to medium speed data communication requirements.

1.3 The X.75 interface allows PulseLink service customers to either place or receive packet calls from other packet switching networks. The PulseLink service X.75 interface is located in a node which serves as a junction between networks. The node is also referred to as signaling terminal (STE).

PulseLink service can be optioned at subscription to conform with either the 1988 (Blue Book), or the 1984 (Red Book) version of CCITT Recommendation X.75. Tables A−1 through A−5 in Appendix A provide the specific similarities and differences between PulseLink service and the 1988 version of Recommendation X.75. Tables B−1 through B−2 provide specifics similarities and differences between PulseLink service and the 1984 version of Recommendation X.75.

1.4 Reason for Reissue

This document is being reissued to include the PulseLink service network interface specifications for compliance with CCITT Recommendation X.75, dated 1988, and to provide general update information.

1.5 Related Documents

Other current BellSouth Technical References that describe PulseLink service network interface specification include:

TR 73513 “PulseLink® X.25 Interface Specification”, June 1987, $10.00
TR 73516, Issue B “PulseLink® Service Physical Interface Specification”, December 1988, $16.00
TR 73535 “PulseLink® Service Asynchronous Terminal Access”, August 1989, $21.00

The above listed documents may be ordered by preparing the enclosed form RF−200. Mailing and payment instructions are listed on the form.

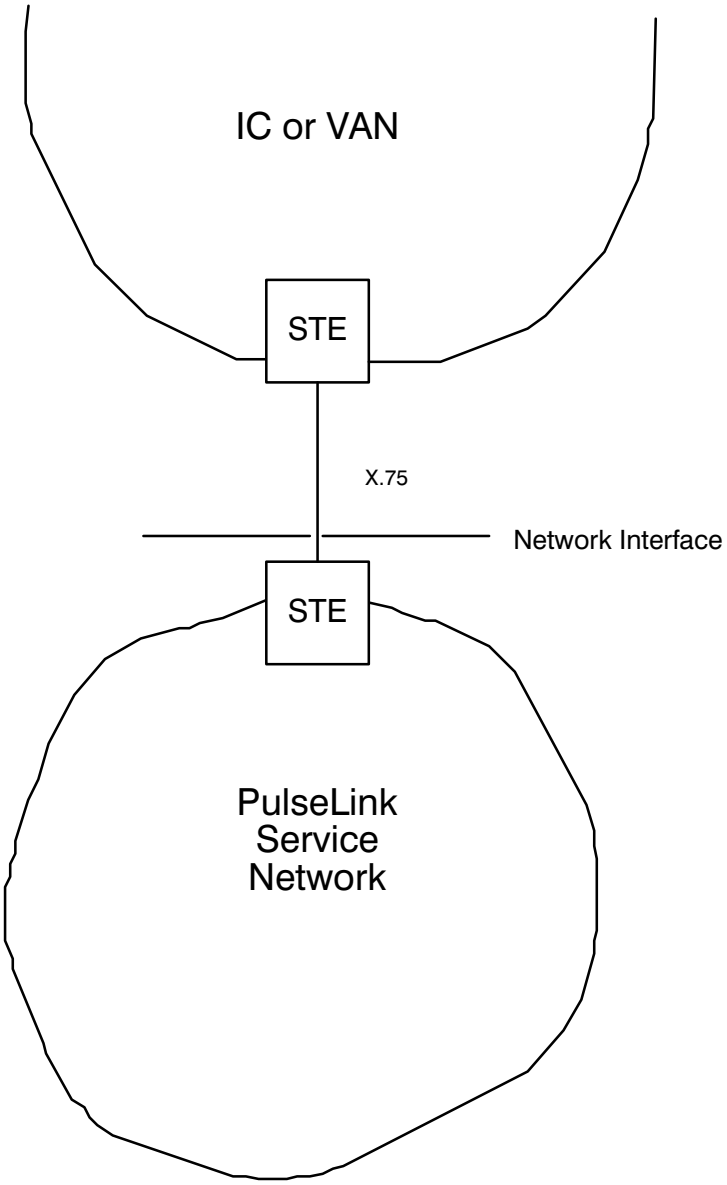

FIGURE 1 – X.75 NETWORK INTERFACE ILLUSTRATION

2. X.75 PHYSICAL INTERFACE

The physical link between a PulseLink STE and the IC/VAN STE is established using 4−wire full duplex synchronous point to point circuits operating at either 9.6 or 56 Kbps. Transmission at 9.6 and 56 Kbps requires modems/DSUs that are compatible with CCITT Recommendation V.29 and BellSouth TR73545, Issue B, respectively. Additional information on digital transmission can be found in BellSouth TR 73516, Issue B.

3. X.75 LINK LEVEL

3.1 Introduction

At the link layer, the PulseLink network utilizes the Link Access Procedure − Balanced (LAP−B) version of High Level Data Link Control (HDLC) framing, as described in CCITT Recommendation X.75. PulseLink service options include circuit configurations using either the extended (modulo 128), or non−extended (modulo 8) modes of operation. Also optional is the choice of using either the X.75 Single Link Procedure (SLP), or Multilink Procedure (MLP) for data exchange across the network interface.

Specific conformance to each section of Recommendation X.75 is provided in Appendices A and B. There are several parameters, called System Parameters, included in the X.75 link layer specifications. The values of the System Parameters are not specified by X.75. The particular value for each of these parameters must be coordinated between BellSouth and the connecting network administration prior to service to ensure proper internetwork operation.

3.2 System Parameters

Most of the System Parameters are adjustable parameters. The value of each parameter must be determined by bilateral agreement between BellSouth and the connecting administration. The link layer System Parameters are listed in this section (below).

3.2.1 Timer T1

The period, at the end of which transmission of a frame may be initiated. The adjustment range is 1 − 30 seconds. The network default value is 3 seconds.

3.2.2 Parameter T2

The period of time the network equipment (STE) must not exceed prior to transmitting an acknowledging frame towards the network interface. For PulseLink service, this parameter is not adjustable, but is set to the network value of 200 milliseconds.

3.2.3 Timer T3

The period of time, at the end of which an indication of excessively long idle time is passed to the packet layer or MLP. The adjustment range of the idle probe timer is 1 − 655 seconds. The network default is 3 seconds.

3.2.4 Parameter N2

The maximum number of attempts to complete a transmission. The adjustment range is 2 − 15. The network default value is 7 for SLP and 3 for MLP.

3.2.5 Parameter N1

The maximum number of bits in an I frame (excluding flags and 0 bits inserted for transparency). The adjustment range for N1 is 1−4208 bits. The network default value is 4208 bits.

3.2.6 Parameter K

The maximum number of sequentially numbered I frames that the network may have outstanding at any given time. The adjustment range is 1 − 7 for modulo 8, and 1 − 127 for modulo 128. The network default value is 7.

3.2.7 Additional Multilink System Parameters

The following system parameters are utilized only with multilink procedures, and are not applicable to single link procedures.

3.2.7.1 Timer MT1

Lost frame timer M1 is used by the network to identify (during low traffic periods) that the multilink frame received with MN(S) equal to MV(R) is lost. The adjustment range is 5−655 seconds. The network default value is 15 seconds.

3.2.7.2 Timer MT2

Group busy timer MT2 is provided by the network to provide an indication of buffer exhaustion. This condition should never occur in the PulseLink network. The network value of the MT2 parameter is therefore always set to infinity.

3.2.7.3 Timer MT3

MLP reset confirmation timer MT3 is used to identify that the network has not received the expected MLP frame with the C bit = 1 following the MLP frame with R bit = 1. The adjustment range is 15−655 seconds. The network default value for this adjustable parameter is 30 seconds.

3.2.7.4 Parameter MN1

The retransmission attempts MN1 parameter indicates when action may be taken at the MLP sublayer to retransmit a multilink frame at the SLP sublayer. The network value is effectively equal to N2.

3.2.7.5 Multilink Window Size MW

MW is the maximum number of unacknowledged multilink frames that may be sent to the SLP. The adjustment range is 1 − 1024 frames in both the transmit and receive directions of transmission. The network default value is 15 frames in each direction.

3.2.7.6 Receive MLP Window Guard Region MX

MX is the parameter which defines a guard region which allows the receiving MLP to recognize the highest MN(S) that can be received outside the receive window, after multilink frame loss occurs. The adjustment range for MX is 1 − 1024 frames. The network default value is 15.

4. X.75 PACKET LEVEL

4.1 Introduction

PulseLink service packet layer procedures are provided in accordance with the Packet Layer Procedures of CCITT Recommendation X.75. Specific conformance to each section of Recommendation X.75 is provided in Appendices A and B of this Technical Reference.

4.2 Adjustable Packet Layer Timers

Included in the X.75 Packet Layer Procedures are four adjustable timer parameters utilized across the network interface. These four timers are listed in this section (below). The adjustment range for each timer is 0 − 15 minutes.

4.2.1 Restart Timer T30

T30 is initiated when the network STE transmits a restart request packet, and is terminated upon receipt of a restart confirmation packet. The network default value of T30 is 180 seconds. If T30 expires before receipt of a restart confirmation packet, the following occurs:

1. After the first expiration of the timer, a second restart request packet is transmitted to the link, all virtual calls are cleared, and all permanent virtual circuits are reset.

2. After the second expiration of the timer, the network STE enters the packet level ready state.

4.2.2 Call Timer T31

T31 is initiated when the network STE issues a call request packet, and is terminated upon receipt of either a call connected packet or a clear request packet. After the first expiration of the timer, the network STE transmits a clear request packet. T31 is not restarted thereafter. T31 is not initiated for permanent virtual circuits. The network default value of T31 is 200 seconds.

4.2.3 Reset Timer T32

T32 is initiated when the network STE issues a reset request packet, and is terminated upon receipt of either a reset confirmation packet or a reset request packet. After the first expiration of the timer, the network STE transmits a reset request packet towards the network interface. After the second expiration of the timer, for virtual calls the STE transmits a clear request packet and enters the clear request state, and for permanent virtual circuits the STE transmits a reset request packet and enters the flow control ready state. The network default value for T32 is 180 seconds.

4.2.4 Clear Timer T33

T33 is initiated when the network STE issues a clear request packet, and is terminated upon receipt of either a clear confirmation packet or a clear request packet. After the first expiration of the timer, a clear request packet is transmitted. After the second expiration of the timer, the logical channel is placed in the ready state. T33 is not initiated for permanent virtual circuits. The network default value of T33 is 180 seconds.

5. X.75 OPTIONAL USER FACILITIES

5.1 Introduction

The user facility field of X.75 packets normally contains signaling for user facilities which do not require network action. Other user facilities which do require network action are mapped into X.75 utilities. These are listed below.

5.2 Network Utilities

The X.75 utilities are network administrative signaling mechanisms in the call request, call connected and clear request packets. The network utility field complements the user facility and serves to separate user service signaling from network administrative signaling. PulseLink service supports the network utilities contained in the 1988 and 1984 version of CCITT Recommendation X.75. Detailed conformance information is contained in Appendices A and B of this Technical Reference.

APPENDIX A

PULSELINK SERVICE IMPLEMENTATION OF 1988 CCITT RECOMMENDATION X.75

The PulseLink Network implements the 1988 CCITT Recommendation X.75 as shown in Tables A1−A−5. In these tables, the left−hand column lists the CCITT X.75 recommendations, item by item, while the right−hand column indicates the PulseLink implementation of each recommendation. The CCITT X.75 sections are covered in separate tables as follows:

Characteristics of the Signaling Terminal/Physical Circuit interface (Physical Level) Reference: 1988 CCITT X.75 Section 1.	Table A−1
Packet Transfer Procedures Between Signaling Terminals (Link Level) Reference: 1988 CCITT X.75 Section 2.	Table A−2
Packet Signaling Procedures Between Signaling Terminals (Packet Level) Reference: 1988 CCITT X.75 Section 3.	Table A−3
Packet Formats for Virtual Calls Reference: 1988 CCITT X.75 Section 4.	Table A−4
Procedure and Formats for User Facilities and Network Facilities Reference: 1988 CCITT X.75 Section 5.	Table A−5

Table A−1

CHARACTERISTICS OF THE SIGNALING TERMINAL/ PHYSICAL CIRCUIT INTERFACE

1988 CCITT X.75 SECTION		PULSELINK SERVICE
1.	**Characteristics of the Signaling Terminal/Physical Circuit Interface**	PulseLink provides Physical Level operation using CCITT Recommendations V.29 or BellSouth TR73545, Issue B.

Table A−2

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.	**LINK LAYER PROCEDURES BETWEEN SIGNALING TERMINALS**	
2.1	**Scope And Field of Application**	Implemented as specified.
2.2	**Frame Structure**	
2.2.1	**Frame Formats**	Implemented as specified.
2.2.2	**Flag Sequence**	Implemented as specified.
2.2.3	**Address Field**	Implemented as specified.
2.2.4	**Control Field**	Implemented as specified.
2.2.5	**Information Field**	Implemented as specified.
2.2.6	**Transparency**	Implemented as specified.
2.2.7	**Frame Checking Sequence (FCS)**	Implemented as specified.
2.2.8	**Order of Bit Transmission**	Implemented as specified.
2.2.9	**Invalid Frames**	Implemented as specified.
2.2.10	**Frame Abortion**	Implemented as specified.
2.2.11	**Interframe Time Fill**	Implemented as specified.
2.2.12	**Link Channel States**	Implemented as specified.
2.2.12.1	**Active Channel State**	Implemented as specified.
2.2.12.2	**Idle Channel State**	Implemented as specified when Idle Probe mechanism is employed (See Section 2.3.4.2).
2.3	**Elements of Procedure**	
2.3.1		Implemented as specified.
2.3.2	**Control Field Formats and State Variables**	
2.3.2.1	**Control Field Format**	Implemented as specified.
2.3.2.1.1	Information Transfer Format − I	Implemented as specified.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.3.2.1.2	Supervisory Format S	Implemented as specified.
2.3.2.1.3	Unnumbered Format	Implemented as specified.
2.3.2.2	**Control Field Parameters**	Implemented as specified.
2.3.2.2.1	**Modulus**	Implemented as specified.
2.3.2.2.2	**Send State Variable V(S)**	Implemented as specified.
2.3.2.2.3	**Send Sequence Number N(S)**	Implemented as specified.
2.3.2.2.4	**Receiver State Variable V(R)**	Implemented as specified.
2.3.2.2.5	**Receiver Sequence Number N(R)**	Implemented as specified.
2.3.2.2.6	**Poll/Final (P/F) Bit**	Implemented as specified.
2.3.3	**Functions of the Poll/Final BIT**	Implemented as specified.
2.3.4	**Commands and Responses**	Implemented as specified.
2.3.4.1	**Information (I) Commands**	Implemented as specified.
2.3.4.2	**Receive Ready (RR) Command and Response**	Implemented as specified, except when Idle Probe mechanism is chosen as a subscription time option. In that case, a Receive Ready (RR) is lost and I frames remain unacknowledged, then the network enters the timer recovery condition when time T1 expires.
2.3.4.3	**Receive Not Ready (RNR) Command and Response**	To force the acceptance of more frames by the far end of the link, PulseLink utilizes RNR when it has too many frames queued for transmission. If the busy condition is forced clear by far end (SABM/UA, CMDR/SABM /UA...), PulseLink responds with RNR to the next received I−frame.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.3.4.4	**Reject (REJ) Command and Response**	Implemented as specified.
2.3.4.5	**Set Asynchronous Balanced Moode (SABM) Command Set Asynchronous Balanced Extended Mode (SABME) Command**	PulseLink uses LAPB as the link level protocol and LAPB uses SABM.
2.3.4.6	**Disconnect (DISC) Command**	Implemented as specified.
2.3.4.7	**Unnumbered Acknowledge (UA) Response**	Implemented as specified.
2.3.4.8	**Disconnected Mode (DM) Response**	Implemented as specified.
2.3.4.9	**Frame Reject (FRMR) Response**	1) Implemented as specified. 2) Implemented as specified. 3) Implemented as specified. 4) Implemented as specified. 5) DM is transmitted by the network in lieu of FRMR. 6) DM is transmitted by the network in lieu of FRMR. 7) No FRMR is sent by network upon receipt of an invalid N(s).
2.3.5	**Exception Condition Reporting and Recovery**	
2.3.5.1	**Busy Condition**	Implemented as specified.
2.3.5.2	**N(S) Sequence Error**	
2.3.5.2.1	**REJ Recovery**	Implemented as specified.
2.3.5.2.2	**Time−Out Recovery**	Implemented as specified.
2.3.5.3	**Invalid Frame and Condition**	Implemented as specified.
2.3.5.4	**Rejection Condition**	Implemented as specified, except as described in Section 2.3.4.9.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.3.5.5	**Excessive Idel Channel State Condition On Incoming Channel** idle probe mechanism is utilized	Implemented as specified. An by the network to insure the customer equipment is connected and responding (See Section 2.3.4.2).
2.4	**Description of the Procedure**	
2.4.1	**Extended and Non−extended Modes of Operation**	Implemented as specified.
2.4.2	**Procedure for Addressing**	Implemented as specified.
2.4.3	**Procedure for the Use of the P/F Bit**	Implemented as specified.
2.4.4	**Procedure for Link Set−up And Disconnection**	
2.4.4.1	**Link Set−Up**	Implemented as specified.
2.4.4.2	**Information Transfer Phase**	Implemented as specified.
2.4.4.3	**Link Disconnection**	Implemented as specified.
2.4.4.4	**Disconnected Phase**	Implemented as specified.
2.4.4.5	**Collision of Unnumbered Commands**	Implemented as specified.
2.4.5	**Procedures for Information Transfer**	
2.4.5.1	**Sending I Frames**	Implemented as specified.
2.4.5.2	**Receiving an I Frame**	Implemented as specified.
2.4.5.2.1		Implemented as specified.
2.4.5.2.2		Implemented as specified.
2.4.5.3	**Reception of Invalid Frames**	Implemented as specified.
2.4.5.4	**Reception of Out of Sequence I Frames**	Implemented as specified.
2.4.5.5	**Receiving Acknowledgment**	Implemented as specified.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.4.5.6	**Receiving an REJ Frame**	1) Implemented as specified. 2) Implemented as specified. 3) LAP−B completes the transmission of the currently transmitting I frame before commencing transmission of the requested I frame. 4) Implemented as specified.
2.4.5.7	**Receiving an RNR Frame**	Implemented as specified.
2.4.5.8	**STE Busy Condition**	Implemented as specified.
2.4.5.9	**Waiting Acknowledgment**	Implemented as specified.
2.4.6	**Conditions for Link Resetting or Link Reinitialization (Link Set−up)**	Implemented as specified.
2.4.7	**Procedures for Link Resetting**	Implemented as per 1984 CCITT X.75, Section 2.4.5.7.
2.4.8	**List of System Parameters**	PulseLink obtains all system parameters from the service data.
2.4.8.1	**Timer T1**	The period of the timer at the end of which transmission of a frame may be initiated. T1 range = 1 − 30 seconds (network default value = 3 sec.) If T1 or T3 is set to a value other than the network default of 3 seconds, it must be ensured that the value of T3 is greater than the value of T1.
2.4.8.2	**Parameter T2**	The amount of time available at the network STE before acknowledging frame is transmitted. Default value = 200 milliseconds.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.4.8.3	**Timer T3**	Period after which an indication of excessively long idle channel condition is passed to the packet layer or MLP. T3 range = 1 − 655 seconds (network default value = 3 seconds). If T1 or T3 is set to a value other than the network default of 3 seconds, it must be ensured that the value of T3 is greater than the value of T1.
2.4.8.4	**Maximum Number of Attempts to Complete aTransmission N2**	The maximum number of transmissions: N2 range = 2 − 15 (network default value = 7)
2.4.8.5	**Maximum Number of Bits in an I Frame N1**	The maximum number of bits in an I frame: N1 range = adjustable (network default value = 4208 bits)
2.4.8.6	**Maximum Number of Outstanding I Frames k**	The maximum number of outstanding I frames: k range = 1 − 7 for module 8; 1 − 127 for module 128 (network default value = 7)
2.5	**Multilink Procedure (MLP)**	
2.5.1	**Field of Application**	Implemented as specified.
2.5.2	**Multilink Frame Structure**	
2.5.2.1	**Multilink Control Field**	Implemented as specified.
2.5.2.2	**Multilink Information Field**	Implemented as specified.
2.5.3	**Multilink Control Field Format and Parameters**	
2.5.3.1	**Multilink Control Field Format**	Implemented as specified.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.5.3.2	**Multilink Control Field Parameters**	Implemented as specified.
2.5.3.2.1	**Void Sequencing Bit(V)**	Implemented as specified.
2.5.3.2.2	**Sequence Check Option Bit(S)**	Implemented as specified.
2.5.3.2.3	**MLP Reset Request Bit(R)**	Implemented as specified. Optional reset cause is not included in the ML reset frame.
2.5.3.2.4	**MLP Reset Confirmation Bit(C)**	Implemented as specified.
2.5.3.2.5	**Multiple Send State Variable MV(S)**	Implemented as specified.
2.5.3.2.6	**Multilink Sequence Number MN(S)**	Implemented as specified.
2.5.3.2.7	**Transmitted Multilink Sequence Acknowledged State Variable MV(T)**	Implemented as specified.
2.5.3.2.8	**Multilink Receive State Variable MV(R)**	Implemented as specified.
2.5.3.2.9	**Multilink Window Size MW**	Implemented as specified. The values of MW in the trans− mit and receive directions are adjustable. The network default value for each is 15.
2.5.3.2.10	**Receive MLP Window Guard Region MX**	Implemented as specified. The value of MX is adjustable. The network default value is 5.
2.5.4		
2.5.4.1	**Initialization**	Implemented as specified.
2.5.4.2	**Multilink Resetting Procedure**	Implemented as specified. Multilink Resetting Procedure uses any SLP to transmit a multilink frame during resetting procedure, and awaits indication from SLP of successful transmission of the frame before transmitting the next multilink frame.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
2.5.4.3	**Transmitting Multilink Frames**	
2.5.4.3.1	**General**	Implemented as specified.
2.5.4.3.2	**Transmission of Multilink Frames**	Implemented as specified. The network assigns each multi−link frame to only one available single link, in lieu of several. The network does not remove unacknowledged multilink frames from the SLP upon indication of a busy condition from the far end.
2.5.4.4	**Receiving Multilink Frames**	Implemented as specified. The network discards frames with V and/or S equal to 1. The network initiates the Multilink reset procedures whenever MT1 expires.
2.5.4.5	**Retransmission of Multilink Frames**	Not implemented. All SLPs within a multilink group have the same N2 value. After attempting to retransmit the frame N2 times, it is returned to MLP for retransmission over the same or another SLP.
2.5.4.6	**Taking an SLP Out of Service**	Implemented as specified.
2.5.5	**List of Multilink System Parameters**	
2.5.5.1	**Lost−Frame Timer MT1**	Implemented as specified. MT1 is adjustable. Network default value is 15 seconds.
2.5.5.2	**Group Busy Timer MT2**	Implemented as specified. Network value of MT2 is infinity.

Table A−2 (cont'd)

PACKET TRANSFER PROCEDURES BETWEEN SIGNALING TERMINALS

1988 CCITT X.75 SECTION			PULSELINK SERVICE
2.5.5.3	**MLP Reset Confirmation Timer MT3**		Implemented as specified. MT3 is adjustable. Network default value is 30 seconds.
2.5.5.4	**Retransmission Attempts MN1**	Not implemented.	MN1 is effectively equal to the same value as N2 (See Section 2.5.4.2).

Table A−3 PACKET SIGNALING PROCEDURES BETWEEN PACKET SIGNALING TERMINALS

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PACKET LEVEL INTERFACE

1988 CCITT X.75 SECTION		PULSELINK SERVICE
3.	**Packet Layer Procedures Between Signalinh Terminals**	Implemented as specified. The network interprets the combined logical channel group and the logical channel numbers as a single 12−bit LCN field.
3.1	**Procedures for Virtual Call Set−Up**	
3.1.1	**Ready State**	Implemented as specified.
3.1.2	**Call Request Packet**	Implemented as specified.
3.1.3	**Call Connected Packet**	Implemented as specified.
3.1.4	**Call Collision**	Implemented as specified.
3.1.5	**Call Request Packet and Call Progress Signals**	Implemented as specified.
3.1.6	**Clear Confirmation Packet**	Implemented as specified.
3.1.7	**Clear Collision**	Implemented as specified.
3.2	**Procedure for Permanent Virtual Circuits**	This procedure remains for further study.
3.3	**Procedure for Data and Interrupt Transfer**	
3.3.1	**States for Data Transfer in Virtual Calls**	Implemented as specified.
3.3.2	**Numbering of Data Packets**	Implemented as specified.
3.3.3	**Data Field Length of Data Packets**	Implemented as specified.
3.3.4	**Delivery Confirmation, More Data Bit and Qualifier Bits**	Implemented as specified.
3.3.5	**Interrupt Procedure**	Implemented as specified.
3.4	**Procedure for Flow Control**	
3.4.1	**Procedure for Flow Control**	Implemented as specified.
3.4.1.1	**Window Description**	Only Modulo 8 used as window size W.

Table A−3 (cont'd) PACKET SIGNALING PROCEDURES BETWEEN PACKET SIGNALING TERMINALS

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PACKET LEVEL INTERFACE

1988 CCITT X.75 SECTION		PULSELINK SERVICE
3.4.1.2	**Flow Control Principles**	Implemented as specified.
3.4.1.3	**STE Receive Ready (RR) Packet**	Implemented as specified.
3.4.1.4	**STE Receive Not Ready (RNR)**	Implemented as specified.
3.4.2	**Procedure for Reset**	
3.4.2.1	**Reset Request Packet**	Implemented as specified.
3.4.2.2	**Reset Collision**	Implemented as specified.
3.4.2.3	**Reset Confirmation Packet**	Implemented as specified, except under timeout conditions for permanent virtual circuits. In this case, the network sends a reset request packet upon the first timeout, the network places the permanent virtual circuit back into flow control ready state.
3.4.2.4	**Effects of Reset Procedure on Data and Interrupt Packets**	Implemented as specified.
3.5	**Procedure for Restart**	
3.5.1	**Restart by the STE**	Implemented as specified. The remote STE can initiate a restart by sending a restart request packet to the local STE. The network, upon receipt of the request, enters a remote restarting state and clears the virtual calls on all active logical channels. Once this operation completes, the local STE sends a restart confirmation packet to the remote STE.
3.5.2	**Restart Collision**	Implemented as specified.
3.6	**Relationship Between Levels**	Implemented as specified.

Table A−4 PACKET FORMATS FOR VIRTUAL CALLS

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PACKET FORMATS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
4.	**Packet Formats for Virtual Calls and Permanent Virtual Calls**	
4.1	**General**	
4.1.1	**General Format Identifier**	Implemented as specified, with the following interpretation: Only Modulo 8 is supported.
4.1.2	**Logic Channel Group Number**	Implemented as specified.
4.1.3	**Logical Channel Number**	Due to the varying demands on memory, as required by different facilities, the network will not simultaneously support 4095 logical channels on any single interface.
4.1.4	**Packet Type Identifier**	Implemented as specified.
4.2	**Call Set−Up and Clearing Packets**	
4.2.1	**Call Request Packet**	
4.2.1.1	**General Format Identifier**	Implemented as specified.
4.2.1.2	**Address Length Field**	Implemented as specified.
4.2.1.3	**Address Field**	Implemented as specified.
4.2.1.4	**Network Utility Length Field**	Implemented as specified.
4.2.1.5	**Network Utility Field**	Implemented as specified.
4.2.1.6	**User Facility Length Field**	Implemented as specified.
4.2.1.7	**User Facility Field**	Implemented as specified.
4.2.1.8	**Call User Data Field**	The network does not act on the contents of the call user data field in a CALL REQUEST packet.
4.2.2	**Call Connected Packet**	Implemented as specified.

Table A−4 (cont'd) PACKET FORMATS FOR VIRTUAL CALLS

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PACKET FORMATS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
4.2.3	**Clear Request Packet**	
4.2.3.1	**Clearing Cause Field**	Implemented as specified.
4.2.3.2	**Diagnostic Code Field**	Implemented as specified.
4.2.3.3	**Extended Format**	
4.2.3.3.1	**Extended Format**	Implemented as specified.
4.2.3.3.2	**Address Field**	Implemented as specified.
4.2.3.3.3	**Network Utility Length Field**	Implemented as specified.
4.2.3.3.4	**Network Utility Field**	Implemented as specified.
4.2.3.3.5	**User Facility Length Field**	Implemented as specified.
4.2.3.3.6	**User Facility Field**	Implemented as specified.
4.2.3.3.7	**Clear User Data Field**	Implemented as specified.
4.2.4	**Clear Confirmation Packet**	Implemented as specified.
4.3	**Data and Interrupt Packets**	
4.3.1	**Data Packet**	
4.3.1.1	**Qualifier (Q) Bit**	Implemented as specified.
4.3.1.2	**Delivery Confirmation (D) Bit**	Implemented as specified.
4.3.1.3	**Packet Receive Sequence Number**	Implemented as specified.
4.3.1.4	**More Data Bit**	Implemented as specified.
4.3.1.5	**Packet Send Sequence Number**	Implemented as specified.
4.3.1.6	**User Data Field**	Implemented as specified.
4.3.2	**Interrupt Packet**	Implemented as specified.
4.3.2.1	**Interrupt User Data Field**	Implemented as specified.
4.3.3	**Interrupt Confirmation Packet**	Implemented as specified.

Table A−4 (cont'd) PACKET FORMATS FOR VIRTUAL CALLS

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PACKET FORMATS

1988 CCITT X.75 SECTION		PULSELINK SERVICE
4.4	**Flow Control and Reset Packets**	
4.4.1	**Receive Ready (RR) Packet**	
4.4.1.1	**Packet Receive Sequence Number**	Implemented as specified.
4.4.2	**Receive Not Ready (RNR) Packet**	
4.4.2.1	**Packet Receive Sequence Number**	Implemented as specified.
4.4.3	**Reset Request Packet**	Implemented as specified.
4.4.3.1	**Resetting Cause Field**	Implemented as specified.
4.4.3.2	**Diagnostic Code Field**	Implemented as specified.
4.4.4	**Reset Confirmation Packet**	Implemented as specified.
4.5	**Restart Packets**	Implemented as specified.
4.5.1	**Restart Request Packet**	Implemented as specified.
4.5.1.1	**Restarting Cause Field**	Implemented as specified.
4.5.1.2	**Diagnostic Code Field**	Implemented as specified.
4.5.2	**Reset Confirmation Field**	Implemented as specified.

Table A−5 PROCEDURE AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PROCEDURES AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

1988 CCITT X.75 SECTION		PULSELINK SERVICE
5.	**Procedures and Formats for User Facilities and Network Utilities**	
5.1	**Description of Optional User Facilities**	Implemented as specified.
5.2	**Formats for Optional User Facilities**	Implemented as specified.
5.3	**Procedures for Network Utilities**	Implemented as specified.
5.3.1	**Transit Network Identification**	The transit network ID codes may not be present in clear request packets that are issued by the network as a direct response to a call request packet.
5.3.2	**Call Identifier**	Implemented as specified.
5.3.3	**Throughout Class Indication**	Implemented as specified.
5.3.4	**Window Size Indication**	Implemented as specified.
5.3.5	**Packet Size Indication**	Implemented as specified.
5.3.6	**Fast Select Indication**	Implemented as specified.
5.3.7	**Closed User Group Indication**	Implemented as specified.
5.3.8	**Closed User Group with Outgoing Access Indication**	Implemented as specified.
5.3.9	**Reverse Charging Indication**	Implemented as specified.
5.3.10	**Called Line Address Modified Notification**	Implemented as specified.
5.3.11	**Clearing Network Identification Code**	Implemented as specified.
5.3.12	**Traffic Class Indication**	Under study.

5.3.13	**Transit Delay Indication**	Implemented as specified.

Table A−5 (cont'd) PROCEDURE AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PROCEDURES AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

1988 CCITT X.75 SECTION		PULSELINK SERVICE
5.3.14	**Transit Delay Selection**	Implemented as specified.
5.3.15	**Tariffs**	Implemented as specified.
5.3.16	**Network User Identification (NUI)**	Not supported.
5.3.17	**RPOA Selection**	Implemented as specified. The network does not allow a sequence of RPOA selection utilities in the call request packet.
5.3.18	**Utility Marker**	Implemented as specified.
5.4	**Formats for Utility Networks**	
5.4.1	**General**	Implemented as specified.
5.4.2	**Coding of Utility Code Field**	Implemented as specified.
5.4.3	**Coding of Utility Parameter Field**	
5.4.3.1	**Coding of Transit Network Identification Utility Parameter**	Implemented as specified.
5.4.3.2	**Coding of Call Identifier Utility Parameter**	Implemented as specified.
5.4.3.3	**Coding of Throughput Class Indication Utility Parameter**	Implemented as specified.
5.4.3.4	**Coding of Window Size Selection Utility Parameter**	Implemented as specified.
5.4.3.5	**Coding of Packet Size Indication Utility Parameter**	Implemented as specified.
5.4.3.6	**Coding of Fast Select and/or Reverse Charging Indication Utility Parameter**	Implemented as specified.
5.4.3.7	**Coding of Closed User Group Code and Closed User Group with Outgoing Access**	Implemented as specified.

5.4.3.7.1	**Utility Parameter Length**	Implemented as specified.

Table A−5 (cont'd) PROCEDURE AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PROCEDURES AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

1988 CCITT X.75 SECTION		PULSELINK SERVICE
5.4.3.7.2	**Utility Parameter**	Implemented as specified.
5.4.3.8	**Coding of Called Line Address Modified Notification Utility Parameter**	Implemented as specified.
5.4.3.9	**Coding of Clearing Network Identification Code Utility Parameter**	Implemented as specified.
5.4.3.10	**Coding of Traffic Class Indication Utility Parameter**	For further study.
5.4.3.11	**Coding of Transit Delay Indication Utility Parameter**	Implemented as specified.
5.4.3.12	**Coding of Transit Delay Selection Utility Parameter**	Implemented as specified.
5.4.3.13	**Coding of the Tariffs Utility Parameter**	Implemented as specified.
5.4.3.14	**Coding of the Network User Identification Utility Parameter**	Under study.
5.4.3.15	**Coding of RPOA Selection Utility Parameter**	Implemented as specified.
5.4.3.16	**Coding of the Utility Marker Utility Parameter**	Implemented as specified.

APPENDIX B

PULSELINK SERVICE IMPLEMENTATION OF 1984 CCITT RECOMMENDATION X.75

The PulseLink service network interface can be optioned to conform to the 1984 version of CCITT Recommendation X.75. Appendix B consists of tables which specify the detailed PulseLink service implementation the 1984 version. The individual tables are:

Characteristics of the Signaling Terminal/Physical Circuit Interface Reference: 1984 CCITT X.75, Section 1.	Table B−1
Packet Transfer Procedures Between Signaling Terminals (Link Level) Reference: 1984 CCITT X.75, Section 2.	Table B−2
Packet Signaling Procedures Between Signaling Terminals (Packet Level) Reference: 1984 CCITT X.75, Section 3.	Table B−3
Packet Formats for Virtual Calls Reference: 1984 CCITT X.75, Section 4.	Table B−4
Procedure and Formats for User Facilities and Network Facilities Reference: 1984 CCITT X.75 Section 5.	Table B−5

Table B−1

CHARACTERISTICS OF THE SIGNALING TERMINAL/PHYSICAL CIRCUIT INTERFACE

1984 CCITT X.75 SECTION		PULSELINK SERVICE
1.	**Characteristics of the Signaling Terminal/Physical Circuit Interface**	See 1988 Compliance (Appendix A, Table A−1)

Table B−2

LINK LAYER PROCEDURES BETWEEN SIGNALING TERMINALS

1984 CCITT X.75 SECTION		PULSELINK SERVICE
2.	**Link Layer Procedures Between Signaling Terminals**	See 1988 Compliance (Appendix A, Table A−2)

Table B−3

PACKET LAYER PROCEDURES BETWEEN SIGNALING TERMINALS

1984 CCITT X.75 SECTION		PULSELINK SERVICE
3.	**Packet Layer Procedures Between Signaling Terminals**	See 1988 Compliance (Appendix A, Table A−3)

Table B−4

PACKET FORMATS FOR VIRTUAL CALLS AND PERMANENT VIRTUAL CIRCUITS

1984 CCITT X.75 SECTION		PULSELINK SERVICE
4.	**Packet Formats for Virtual Calls and Permanent Virtual Circuits**	See 1988 Compliance (Appendix A, Table A−4)

Table B−5 PROCEDURE AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PROCEDURES AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

1984 CCITT X.75 SECTION		PULSELINK SERVICE
5.	**Procedures and Formats for User Facilities and Network Utilities**	
5.1	**Description of Optional User Facilities**	Implemented as specified.
5.2	**Formats for Optional User Facilities**	Implemented as specified.
5.3	**Procedures for Network Utilities**	
5.3.1	**Transit Network Identification**	The transit network ID codes may not be present in clear request packets that are issued by the network as a direct response to a call request packet.
5.3.2	**Call Identifier**	Implemented as specified.
5.3.3	**Throughout Class Indication**	Implemented as specified.
5.3.4	**Window Size Indication**	Implemented as specified.
5.3.5	**Packet Size Indication**	Implemented as specified.
5.3.6	**Fast Select Indication**	Implemented as specified.
5.3.7	**Closed User Group Indication**	Implemented as specified.
5.3.8	**Closed User Group with Outgoing Access Indication**	Implemented as specified.
5.3.9	**Reverse Charging Indication**	Implemented as specified.
5.3.10	**Called Line Address Modified Notification**	Implemented as specified.
5.3.11	**Clearing Network Identification Code**	Implemented as specified.
5.3.12	**Traffic Class Indication**	Under study.

5.3.13	**Transit Delay Indication**	Implemented as per 1988 CCITT X.75, Section 5.3.13.

Table B−5 (cont'd) PROCEDURE AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

PULSELINK IMPLEMENTATION OF CCITT X.75 −− PROCEDURES AND FORMATS FOR USER FACILITIES AND NETWORK UTILITIES

1984 CCITT X.75 SECTION		PULSELINK SERVICE
5.3.14	**Transit Delay Selection**	Implemented as per 1988 CCITT X.75, Section 5.3.14.
5.3.15	**Tariffs**	Implemented as per 1988 CCITT X.75, Section 5.3.15.
5.3.16	**Address Extension**	Under study.
5.3.17	**Utility Marker**	Implemented as specified.
5.4	**Formats for Utility Networks**	
5.4.1	**General**	Implemented as specified.
5.4.2	**Coding of Utility Code Field**	Implemented as specified.
5.4.3	**Coding of Utility Parameter Field**	Implemented as specified.
5.4.3.1	**Coding of Transit Network Identification Utility Parameter**	Implemented as specified.
5.4.3.2	**Coding of Call Identifier Utility Parameter**	Implemented as specified.
5.4.3.3	**Coding of Throughput Class Indication Utility Parameter**	Implemented as specified.
5.4.3.4	**Coding of Window Size Selection Utility Parameter**	Implemented as specified.
5.4.3.5	**Coding of Packet Size Indication Utility Parameter**	Implemented as specified.
5.4.3.6	**Coding of Fast Select and/or Reverse Charging Indication Utility Parameter**	Implemented as specified.
5.4.3.7	**Coding of Closed User Group Code and Closed User Group with Outgoing Access**	Implemented as specified.
5.4.3.8	**Coding of Called Line Address Modified Notification Utility Parameter**	Implemented as specified.

5.4.3.9	**Coding of Clearing Network ID Parameter**	Implemented as specified.
5.4.3.10	**Coding of Traffic Class Indication Utility Parameter**	Under study.
5.4.3.11	**Coding of Transit Delay Indication Utility**	Implemented as per 1988 CCITT X.75, Section 5.4.3.13.
5.4.3.12	**Coding of Transit Delay Selection Utility Parameter**	Implemented as per 1988 CCITT X.75, Section 5.4.3.14.
5.4.3.13	**Coding of the Tariffs Utility Parameter**	Implemented as per 1988 CCITT X.75, Section 5.4.3.15.
5.4.3.14	**Coding of the Address Extension Utility Parameter**	Under study.
5.4.3.15	**Coding of Utility Marker Utility Parameter**	Implemented as specified.
5.4.3.16	**Coding of RPOA Selection Utility Parameter**	Implemented as per CCITT X.75, Section 5.4.3.15