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QWEST DIGIPAC® SERVICE INTERFACE SPECIFICATIONS FOR PUBLIC PACKET SWITCHING NETWORK

Module 1

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NOTICE

This Technical Publication describes the interface protocols necessary for:

- Asynchronous terminals and hosts (Module 1)
- X.25 terminals and hosts (Module 2)
- X.75 connections with Interexchange Carriers to communicate via the Packet Switched Public Data Network (PSPDN) (Module 3)
- Dial-up access for X.25 devices using the X.32 recommendation (Module 4) and
- Point of Sales terminal to host communications using T3POS protocol (Module 5).

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1. Introduction

1.1 Overview

This Technical Publication describes the interface protocols necessary for:

- asynchronous terminals and hosts (Module 1)
- X.25 terminals and hosts (Module 2)
- X.75 connections with Inter-exchange Carriers to communicate via the Packet Switched Public Data Network (PSPDN) (Module 3)
- dial-up access for X.25 devices using the X.32 recommendation (Module 4) and
- Point of Sales terminal to host communications using T3POS protocol (Module 5).

Network level signaling messages are transmitted as American Standard Code for Information Interchange (ASCII) text. The terms used herein are consistent with the text of the International Telecommunications Union (ITU), formerly International Telegraph and Telephone Consultative Committee (CCITT), Recommendations specified in this document. All reference in this Technical Publication to ITU recommendations are per the 1988 issue "blue book", unless specified otherwise.

The asynchronous interface is based on ITU Recommendation X.28 which defines the protocol between the asynchronous device and the PSPDN. The asynchronous Data Termination Equipment (DTE)/X.25 DTE interface is based on ITU Recommendation X.29 which specifies the protocol between the packet-mode DTE and the PSPDN. ITU Recommendation X.3 defines a Packet Assembly/Disassembly (PAD) facility in a PSPDN. The X.25 interface is based on ITU Recommendation X.25 which defines the protocol between the X.25 DTE and the PSPDN. The X.75 interface is based on ITU Recommendation X.75 which defines the protocol between the Inter-exchange Carriers, data service providers and the PSPDN. The X.32 interface is based on ITU Recommendation X.32 which defines the protocol and procedures for an X.25 DTE to access the PSPDN using a Dial-up connection, either to originate or terminate X.25 calls.

The T3POS interface defines the protocol, procedures, and PAD function within the PSPDN to allow Point of Sale (POS) terminals to use the Packet Network as a means to access Credit Card Association (CCA) hosts or Information Service Providers (ISP).

A table of all acronyms used in this Technical Publication can be found in Chapter 5.

All changes and reissues of this Technical Publication will be made on a QWEST wide basis.

1.2 Reason For Reissue

This document is being reissued at this time to show QWEST Communications International Inc. as the owner of this publication and the one to contact concerning the content.

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2. Asynchronous Interface

2.1 Overview

This Chapter describes the interface protocols necessary for asynchronous devices to communicate using the DIGIPAC® Network. The asynchronous interface (based on International Telecommunications Union (ITU) Recommendation X.28) defines the protocol between asynchronous Data Termination Equipment (DTE) and the Packet Switched Public Data Network (PSPDN). The asynchronous DTE/X.25 DTE interface (based on ITU Recommendation X.29) specifies the protocol between packet-mode DTEs and the PSPDN. ITU Recommendation X.3 defines a Packet Assembly/Disassembly (PAD) facility in a PSPDN.

The asynchronous interface supports originating virtual call service (permits DTE to set up a call) to X.25 or other asynchronous DTEs. The interface can also support terminating virtual call service (allows the DTE to receive incoming calls) from X.25 DTEs and other asynchronous DTEs. However, this is not offered because dedicated asynchronous access is no longer offered on the DIGIPAC® network. The interface at both ends of a connection between two asynchronous DTEs is identical, whether the remote end DTE is an asynchronous terminal or an asynchronous host computer. This connection supports all capabilities of the asynchronous DTE/X.25 DTE connection. X.29 is supported between respective Data Communications Equipment (DCE).

In switched data networks, such as a PSPDN like DIGIPAC®, the network is considered to be DCE for functions other than the physical connection of equipment (i.e., layer 2 protocol, PAD function). For clarity, the term PSPDN will be used in this document to denote the location and responsibility of these functions, whatever they may be, in the network.

2.2 PAD Profiles and Parameters

2.2.1 Defined PAD Profiles in DIGIPAC®

The PAD service in the PSPDN performs X.25 functions on behalf of the DTE. The X.25 PAD function is performed in accordance with 1988 ITU Recommendation X.3. How these basic functions are accomplished is determined by the user-set options available in the PAD Parameters. Each Parameter is identified by a reference number and is assigned a value used by the PSPDN to determine the actions to take for the particular terminal or host. The PSPDN maintains a set of Parameters, called a profile, for each active DTE.

A profile is a specific combination of Parameter values. The asynchronous interface supports user-set profiles and a user-default profile that can be defined for each direct-access interface. A listing of standard profiles currently available from DIGIPAC® can be found in Table 2-1. A user-selected profile is stored in the PSPDN. This provides a simple means of setting the desired PAD Parameters. When a user requests a user-selected profile the PSPDN immediately sets the user's Parameters (of the current session) to the values defined in that profile (see Table 2-1). The asynchronous interface supports the simple and transparent standard profiles specified in ITU Recommendation X.28. A total of up to 9 different profiles can be defined in one PAD.

Table 2-1 Currently Available User Profiles on DIGIPAC®

Pram. No.	Profile Number 1	2	3	4	5	6	7	90	91	PPSN User Friendly
1	1	1	0	1	1	0	1	1	0	1
2	0	0	0	0	0	0	1	1	0	1
3	126	2	0	2	2	0	2	126	0	126
4	0	0	20	0	0	4	0	0	20	0
5	1	0	0	0	0	0	0	1	0	2
6	1	1	0	1	1	0	1	5	0	5
7	2	21	2	21	2	0	21	2	2	2
8	0	0	0	0	0	0	0	0	0	0
9	0	2	0	2	2	0	2	0	0	0
10	0	0	0	0	0	0	0	0	0	0
11	Indicates speed of DTE									
12	1	0	0	0	1	0	0	1	0	1
13	16	4	0	16	5	0	4	16	0	16
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	1	0	0	0	0	0
16	127	127	127	127	127	127	127	127	127	127
	<DEL>	<DEL>	<DEL>	<DEL>	<DEL>	<DEL>	<DEL>	<DEL>	<DEL>	<DEL>
17	24	24	24	24	24	24	24	24	24	24
	<CAN>	<CAN>	<CAN>	<CAN>	<CAN>	<CAN>	<CAN>	<CAN>	<CAN>	<CAN>
18	18	18	18	18	18	18	18	18	18	18
	<DC2>	<DC2>	<DC2>	<DC2>	<DC2>	<DC2>	<DC2>	<DC2>	<DC2>	<DC2>
19	2	2	2	2	2	2	2	1	1	2
20	0	0	0	0	0	0	0	0	0	0
21	0	3	0	0	3	3	3	0	0	0
22	0	0	0	0	0	0	0	0	0	0

Profile 90 = 1984 ITU Simple Standard Profile
Profile 91 = 1984 ITU Simple Standard Transparent
DIGIPAC® uses the PSPDN user friendly profile as the default standard for all dial access

A user default profile is a default profile defined for each interface port. The default profile used on all public asynchronous dial access lines, is the PSPDN user friendly profile. For private dial access lines, a user profile will be set at service order time to one of the nine available profiles or the default profile if not specified by the customer. The user may alter Parameters during a session by requesting a different profile or by setting individual Parameters with X.28 commands. These changes last for the duration of the session only and do not affect the default Parameter values.

A complete list of all of the supported PAD Parameters, defined in ITU Recommendation X.3, and valid values for DIGIPAC® can be found in Table 2-2. An English description of each Parameter follows the table.

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 1 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
1	PAD recall using a character	0 1		Not possible Character DLE	No Escape to Command Mode
2	Echo	0 1		No echo Echo	
3	Selection of date forwarding character(s)	0 1 2 4 8 16 32 64 127	 6 	No data forwarding character(s) Alphanumeric characters (A-Z, a-z, 0-9) Character CR Characters ESC, BEL, ENQ, ACK Characters CR, ESC, BEL, ENQ, ACK Characters DEL, CAN, DC2 Character ETX, EOT Characters HT, LF, FF All other ASCII control characters not included above (except DEL)	 Value formed by combination (2+4) Value formed by combination (1+2+4+8+16+32+64)

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 2 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
4	Selection of idle timer delay	0 20 255	1 to 19 21 to 254	Value of idle timer in twentieths of a second	(Note 3)
5	Ancillary device control	0 1		No use of X-ON (DC1) and X-OFF (DC3) Use of X-ON and X-OFF (data transfer)	
6	Control of PAD service signals	0 1		No PAD service signals are transmitted to the start-stop mode DTE PAD service signals are transmitted in the standard format	

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 3 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
7	Selection of idle operation of the PAD on receipt of break signal from the start-stop mode DTE	0		Nothing	
		1		PAD Send X.25 Interrupt Packet	
		2		PAD Send X.25 Reset Packet	
		4		PAD sends X.29 Indication of Break message	
			5	Interrupt and indication of break	Value formed by combination (1+4)
		8		Escape from data transfer state	
		16		Discard output to terminal	Note 4
			21	Discard output, interrupt and indication of break	Valued formed by combination (1+4+16)
8	Discard output	0		Normal data delivery	
9	Padding after carriage return (CR)	0		No padding after CR (see Note 5)	
		1 to 7		Number of padding characters inserted after CR	
10	Line folding	0		No line folding	
		1 to 255		Number of graphic characters per line	

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 4 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
11	Binary speed of start-stop mode DTE	0 2	 1 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	110 bit/s 134.5 bits/s 300 bit/s 1,200 bit/s 600 bit/s 75 bit/s 150 bit/s 1,800 bit/s 200 bit/s 100 bit/s 50 bit/s 75/1,200 bit/s 2,400 bit/s 4,800 bit/s 9,600 bit/s 19,200 bit/s 48,000 bit/s 56,000 bit/s 64,000 bit/s	The values implemented in individual PADs depend on the range of DTE data transmission rates which are supported. The allocation of decimal values to all known rates is to avoid revision of the Recommendation in the future.
12	Flow control of the PAD	0 1		No USE OF X-ON (DC1) and X-OFF (DC3) for flow control Use of X-ON (DC1) and X-OFF (DC3) for flow control	

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 5 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
13	Linefeed insertion after carriage return	0		No linefeed insertion	
		1		Insert linefeed after transmission of CR to the start-stop mode DTE	
		2		Insert line feed after CR on input from terminal	
			3	Insert linefeed after echo of CR to start-stop mode DTE	Combination (1+2)
		4			
			5	Insert linefeed after transmission to the start-stop mode DTE and after echo of CR	Combination (1+4)
			6	Insert linefeed in data stream after CR from the start-stop mode DTE and after echo of a CR to the start-stop mode DTE	Combination (2+4)
			7	Insert linefeed in the data stream to and from the start-stop mode DTE and after echo of a CR to the start-stop mode DTE	Combination (1+2+4)

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 6 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
14	Padding after linefeed	0 1 to 7		No padding after linefeed Number of padding characters inserted after linefeed	Note: Applies only to data transfer state.
15 (See Note 6)	Editing	0 1		No use of editing in the data transfer state Use of editing in the data transfer state	
16 (See Note 6)	Character delete	0 1 to 127		No Character Delete ASCII character used for character delete	
17 (See Note 6)	Line delete	0 1 to 127		No Line Delete ASCII character used for line delete	
18 (See Note 6)	Line display	0 1 to 127		No Line Display ASCII character used for line display	
19 (See Note 6)	Editing PAD service signals	1 2		Editing PAD service signals for printing terminals Editing PAD service signals for display terminals	

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
(Page 7 of 8)

Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
20 (See Notes 7 and 8)	Echo Mask	0		No echo mask (all characters echoed)	
		1		No echo of CR	
		2		No echo of LF	
		4		No echo of video terminal, HT (horizontal tab), FF(form feed)	
		8		No echo of BEL, BS	
		16		No echo of escape, ENQ (enquire)	
		32		No echo of ACK (acknowledge), NAK (<Ctrl-U>, negative acknowledge), STX (<Ctrl-B>, start of text), SOH (<Ctrl-A>, start of header), EOT (end of transmission), ETB (<Ctrl-W>, end of transmission block), ETX (end of text)	
		64		No echo of editing characters specified in Parameters 16, 17, and 18	
		128		No echo of delete and all other ASCII control characters not included above	

Table 2-2 Possible Values and Combination of Values of Pad Parameters (See Note 1)
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Parameter Reference Number	Parameter Description	Selectable possible values (Note 2)		PAD Parameter Meaning	Remarks
		Supported Values	Valid Combinations		
21	Parity treatment	0 1 2 3		No parity checking or generation Parity checking Parity generation Parity checking and parity generation	 Value formed by combination (1+2)
22	Page wait	0 1 to 255		Page wait disabled Number of line feeds sent by PAD before encountering Page Wait	

Notes:

1. Other values and possible combination of values are either not supported by DIGIPAC® or for further study.
2. These are the Parameter values supported by DIGIPAC® and are not necessarily provided in all PADs.
3. Some PAD implementations may not offer all possible values of idle time delay within the possible range. In such cases, where the value selected is not available, the PAD assumes the next higher value available.
4. 16 is not valid alone, but may be combined with the other values. This allows the PAD to discard output to the terminal, but only when some type of notification is sent to the sender.
5. There is no padding after CR except that PAD service signals contain a number of padding characters according to the data signaling rate of the start-stop mode DTE.
6. When Parameter 15 is implemented, the values of Parameters 16, 17 and 18 are either default values or are selected from the optional range shown. The editing function is provided during the PAD command state whether Parameter 15 is implemented or not. If Parameters 16, 17, and 18 are implemented, the editing characters and editing PAD service signals during the PAD command state are defined by the appropriate values of these Parameters. If Parameters 16, 17, and 18 are not implemented, default values for the functions of these Parameters are applicable to the "PAD command" state.
7. This Parameter does not apply if Parameter 2 is set to zero.
8. If Parameter 5 or 12 is set to a non-zero value, then the X-ON and X-OFF characters are not echoed.

2.3 Character Interchange and Service Initialization

The commands, procedures, and service signals described in this section comply with 1988 ITU Recommendation X.28. The character formats, used to exchange control information between the DTE and DCE, follow what is indicated in the X.28 Recommendation and that is International Alphabet No. 5, ITU Recommendation V.3.

2.3.1 Service Initialization

Service initialization is the establishment of a logical link between the terminal and the network. Prior to service initialization, the physical link must be established. If direct access service was offered, the physical link would always be connected. On dial connections the physical link is established once the two modems complete a training sequence and the PAD transmits the PAD prompt. After the physical link is set up, both the PSPDN and DTE transmit binary ones across the interface.

On dial-in connection calls to the PSPDN the transmission of the binary ones is heard as tone. The user initiates communication by transmitting a service request signal [3 periods followed by a carriage return (...<CR>)] to the PSPDN. The service request allows the PSPDN to detect the speed and parity of the DTE. It is required for terminals accessing dial-up ports so that the binary speed Parameter (Parameter 11) of the simple standard profile (default for dial-up 90) can be set accordingly.

After sending a service request, the DTE transmits binary ones. The PSPDN responds to a valid service request by sending a PAD-identification PAD-service signal. Typically, this signal welcomes the user to "DIGIPAC®". The PSPDN transmits binary ones after the PAD-identification PAD-service signal is sent. If service signals are suppressed (Parameter 6 is equal to 0) the interface goes directly into the PAD Waiting State after a valid service request is received. The logical link between the DTE and the network is established when the interface enters the PAD Waiting State.

2.3.2 Exchange of Control Information

The interface goes from the PAD waiting state to the PAD command state at the start of a PAD command signal. Command and service signals are exchanged between the DTE and PSPDN while in the PAD command state and PAD service signals state, respectively. A complete list of command and service signals, along with a brief description, is given in Tables 2-4 through 2-5. The conventions used in this publication when defining command syntax are found in Table 2-3. Command and service signals provide the following functions:

PAD command signals (DTE and PSPDN)

Establish and clear virtual calls

Allow selection of standard profiles

Allow selection of individual PAD Parameters

Request current PAD Parameter status

Send interrupt

Request circuit status

Reset virtual call

PAD service signals (PSPDN to DTE)

Call progress signals

Acknowledge receipt of PAD command signals

Transfer PAD operation information

Table 2-3 Command Conventions for Command Syntax

The following conventions have been used in this document to indicate certain syntactic conditions.	
[ ]	Optional information; you do not need to provide this information.
|	Separates options select one.
< >	Enter a value; you must provide the value required or requested in the command.
<cr>	The Carriage Return, Return, or Enter key on the key board must be depressed at this point in command
...	And so on; you may continue to repeat the previous Parameter one or more times.
XXXxxx	Underscore indicates command abbreviation; you may use this abbreviation instead of typing the entire command name.

Note: Command names are in UPPER CASE.

Table 2-4 Supported PAD Command Signals
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Command	Syntax	Description
Break	B[REAK]	The BREAK command sends a "break" signal to the remote host.
BReakAction	BR[EAK]A[CTION] [value]	Sets the action to be taken if a BREAK command is issued in Command mode or Ctrl-P B is issued in Data Transfer mode. **Values:** 0 = No action 1 = Send interrupt signal 2 = Send a reset 5 = Send interrupt and indication of break 8 = Escape from data transfer state 21= Send interrupt, indication of break, and discard output from the host If this command value is set to 8 (Escape from Data Transfer State), you can escape from data transfer even if X.3 Parameter 1 (Escape Data Transfer) does not allow it. If no value is entered, the current setting is displayed. ***X.3 Effects:*** X.3 Parameter 7 (Action on Break) set to 1.
Breakin	BREAKIN [value]	The BREAKIN command alters the PAD recall character (default is Ctrl-P). By typing BREAKIN and a value modifier, you change the PAD recall character. When Ctrl-P is issued, the PAD breaks out of Data Transfer mode and performs the action specified by the value typed. You can change your recall character to use any printable character as the Escape Code, but the PAD will act on that character if it occurs during data transfer. For instance, if you change your escape code sequence to "Za" and a "Z" occurs in the binary data you transmit, the PAD ignores the "Z", expecting it to be part of the escape sequence, and data is lost. If a "Za" actually occurs in your binary data, the BREAK command will be issued.

Table 2-4 Supported PAD Command Signals
(Page 2 of 8)

Command	Syntax	Description
Call	See Table 2-8 and Table 2-9	The CALL command sets up a connection to the named host system using any requested facilities.
CLeaR	CL[EA]R	The CLEAR command closes the current connection.
Echo	ECHO [on|off]	The ECHO command specifies whether the echo comes from the PAD or the remote host. If on is selected, the PAD will echo. If off is selected, echo will come from the remote host. If no value is entered, the current echo setting is displayed. ***X.3 Effects:*** X.3 Parameter 2 (Echo) set to 0 (off) or 1 (on).
EMask	EM[ASK][value]	The EMASK command sets the echo mask to the value specified so you can choose values that should not be echoed to the screen. **Value** **Characters NOT Echoed** 0 All characters will be echoed 1 CR 2 LF 4 VT, HT, FF 8 BEL, BS 16 ESC, ENQ 32 ACK, NAK, STX, SOH, EOT, ETB, ETX 64 DEL, CAN, DC2 128 All other control characters, plus DEL Characters are not echoed if no value is set. Entered value is the sum of the combined values selected. ***X.3 Effects:*** X.3 Parameter 20 (Echo Mask) is set.

Table 2-4 Supported PAD Command Signals
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Command	Syntax	Description
Flow	F[LOW][on|off]	The FLOW command enables or disables local flow control processing of XON/XOFF control characters by the PAD. If flow control is enabled you can use Ctrl-S to halt the output to the terminal and Ctrl-Q to restart it. If no value is entered, the current setting is displayed. ***X.3 Effects:*** X.3 Parameter 12 (Flow Control by Terminal) is set to 0 (off) or 1 (on).
FORward	FOR[WARD] [value]	The FORWARD command selects the data forwarding characters. **Values**: 0 = No data forwarding characters 1 = Alphanumeric characters 2 = CR 4 = ESC, BEL, ENQ, ACK 8 = DEL, CAN, DC2 16= ETX, EOT 32= HT, LF, VT, FF 64= All other control characters The entered value is the sum of the combined values selected. If no value is entered, the current setting is displayed. ***X.3 Effects:*** X.3 Parameter 3 (Data Forward) is set.
Help	HELP[command] **or** ?[command]	The HELP command displays a one-line summary of all commands.
Hosts	H[OSTS]	The HOSTS command lists configured host names and aliases available to the user.
Int	INT	The INT command transmits an interrupt packet to the remote host.

Table 2-4 Supported PAD Command Signals
(Page 4 of 8)

Command	Syntax	Description
LFinsert	LF[INSERT][value]	The LFINSERT command sets the linefeed insertion action to be taken when a carriage return is sent or received. **Value** **Action** 0 No LF insertion 1 Add LF after CR in the data from the host 2 Add LF after CR in the data to the host 4 Add LF after CR echoed The entered value is the sum of the combined values selected. If no value is entered, the current setting is displayed. ***X.3 Effects:*** X.3 Parameter 13 (Line-Feed Insertion) is set.
LOGhost	LOG[HOST]	The LOGHOST command displays incoming and outgoing X.29 messages.
MESsage	MES[SAGE]	The MESSAGE command sets the PAD mode of operation to Message mode. This mode allows the user to define line-at-a-time exchanges between the PAD and the remote host, with the responsibility of detailed terminal control (including echoing typed input, input editing, and output formatting) resting on the PAD. ***X.3 Effects:*** This mode affects X.3 Parameters 2, 4, 10, and 15: 2 = 1 (Echo) 4 = 0 (No Idle Timer) 10 = 80 (Line Folding after 80 characters) 15 = 1 (Editing enabled)

Table 2-4 Supported PAD Command Signals
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Command	Syntax	Description
NATive	NAT[IVE]	The NATIVE command sets the PAD mode of operation to Native mode. This mode allows the user to define character-at-a-time input forwarding to the host. The host has total control of the terminal, including echoing user input, input editing, and output formatting. Characters typed in are immediately forwarded to the host. ***X.3 Effects:*** This mode affects X.3 Parameters 2, 4, 10, and 15: 2 = 0 (No Echo) 4 = 1 (1/20th second Idle Timer Delay) 10 = 0 (No Line Folding) 15 = 0 (No Editing)
PageWait	P[AGE]W[AIT][value]	The PAGEWAIT command halts output to the terminal. Valid value range is 0 to 255 lines output before the display is paused. A value of 0 disables pagewait. If no value is entered, the current setting is displayed. ***X.3 Effects:*** X.3 Parameter 22 (Page Wait) is set.
PARam	PAR[AM]	The PARAM command displays all current X.3 Parameter settings in number:value pairs.
Par?	PAR? [value]	The PAR? command displays the setting of a specified X.3 Parameter only. If no value is specified, the current values of all X.3 Parameters are displayed.

Table 2-4 Supported PAD Command Signals
(Page 6 of 8)

Command	Syntax	Description
Pipe	PIPE	The PIPE command sets the PAD mode of operation to Pipe mode. This mode allows the user to direct raw data to the host via a non-interactive autocall. Pipe mode allows no service signals. ***X.3 Effects:*** This mode affects X.3 Parameters 1, 2, 5, 6, 7, 9, 10, 12, 13, 14, 15, and 22: 1 = 0 (No Escape from Data Transfer) 2 = 0 (No Echo) 5 = 0 (No Flow Control) 6 = 0 (No Service Signals) 7 = 0 (No Action on Receipt of Break) 9 = 0 (No Carriage Return Padding) 10 = 0 (No Line Folding) 12 = 0 (No Flow Control by Terminal) 13 = 0 (No Line Feed Insertion) 14 = 0 (No Padding after Line Feed) 15 = 0 (No Editing) 22 = 0 (No Page Wait)
PRinTer	PR[IN]T[ER]	The PRINTER command sets the PAD for user's hard-copy terminal. ***X.3 Effects:*** X.3 Parameter 19 (Edit Service Signal) is set to 1 (Hard Copy Terminal).
PROFile	PROF[ILE] [value]	The PROFILE command selects a set of terminal options as a pre-defined X.3 profile. **Value** **Option** V1–5 DIGIPAC®-defined standard profiles 90 ITU-T Simple standard 91 ITU-T Transparent standard If a value is not entered, the current setting is displayed.
Quit	Q[UIT]	The QUIT command ends the current session.
ReSeT	R[E]S[E]T	The RESET command sends a reset request to the remote host.
Set	SET par:value par:value...	The SET command sets the current values of the specified X.3 Parameters in Parameter number:value pairs.

Table 2-4 Supported PAD Command Signals
(Page 7 of 8)

Command	Syntax	Description
Set?	Set? par par...	The SET? command displays the current values of the specified X.3 Parameters. If a list of Parameter settings is configured, each Parameter should be separated by a space (*e.g.*, Set? 1 2 16). You may also change settings with this command by supplying a value with the Parameter number (*e.g.*, SET? 1:1 2:2). If a Parameter number is entered without a value or with an invalid value, the Parameter value will not be changed and an INV (invalid value) message is displayed with the Parameter number.
STATus	STAT[US][ALL]	The STATUS command displays the status of the current connection and host name. If the value **ALL** is specified (*e.g.*, STATUS ALL),the following additional information is displayed: • Name of the host connected to • Terminal characteristics - echo mode - flow control state - mode of operation - etc.
TRAnsparent	TRA[NSPARENT]	The TRANSPARENT command sets the PAD mode of operation to Transparent mode. This mode allows the user to define line-at-a-time exchanges between the PAD and the remote host, with the responsibility of output formatting resting on the host. ***X.3 Effects:*** This mode affects X.3 Parameters 2, 4, 10, and 15: 2 = 1 (Echo) 4 = 0 (No Idle Timer) 10 = 0 (No Line Folding) 15 = 1 (Editing Enabled)

Table 2-4 Supported PAD Command Signals
(Page 8 of 8)

Command	Syntax	Description
VDU	VDU	The VDU command sets the PAD for user's display terminal. ***X.3 Effects:*** X.3 Parameter 19 (Edit Service Signal) is set to 2 (Video Display Terminal).
WIDth	WID[TH][value]	The WIDTH command defines the width of the terminal screen in use. On output, when the width is reached, a new line is entered. The valid range is 20 to 255. ***X.3 Effects:*** X.3 Parameter 10 (Line Folding) is set.

Table 2-5 Supported PAD Service Signals
(Page 1 of 2)

Standard Format of the PAD service signals	Description
format effector	The format effector is used as the *Acknowlegement PAD service signal.* It is comprised of the Carriage Return (CR) Line Feed (LF) characters followed by the number of padding characters specified by PAD Parameter 9, if Parameter 9 is not zero; or, if Parameter 9 is set to zero, 2 padding characters for terminals operating at 110 bps or 4 padding characters for terminals operating above 110 bps and up to and including 1200 bps.
*	*Prompt PAD service signal* This signal is presented to the DTE, if PAD Parameter 6 is set to 1, when the PAD is in the command mode and ready to receive a command.
DIGIPAC <dial port address>	*PAD identification PAD service signal* This signal is presented to the DTE once a dial connection has been established to a dial port in DIGIPAC®. The dial port address portion of the service signal will be the lead Data Telepone Number (DTN) assigned to the range of ports to which this port belongs.
RESET <reset cause> <diag code>	This RESET PAD service signal will be sent to the DTE when a reset occurs on the connection for any reason other than the DTE sending the RESET PAD command. The reset cause will be one of those listed in Table 2-6 below. The diagnostic code <diag code> will be a 3 digit decimal number corresponding the diagnostic code in the X.25 Reset Indication Packet. A complete listing of possible codes can be found in the 1988 ITU Recommendation X.25, Annex E.

Table 2-5 Supported PAD Service Signals
(Page 2 of 2)

Standard Format of the PAD service signals	Description
RESET CONF	This is the PAD service signal that will be sent to the DTE when the DTE has issued the RESET PAD Command
CLR <cause> <diag code>	Indication of clearing PAD service signal is sent by the PAD when a call is cleared for any reason other than the DTE sending the CLEAR PAD Command. The cause field will contain one of the codes listed in Table 2-7. A complete listing of possible codes can be found in the 1988 ITU Recommendation X.25, Annex E.
CLR CONF	Confirmation of clearing PAD service signal. This signal is sent by the PAD when the DTE has sent the CLEAR PAD command to the PAD and, as a result, the call has been clear by the PAD.
PAGE	Indication that a page wait condition has occurred.
FREE	Response to the *status PAD command* signal when a call is not established.
ENGAGED	Response to the *status PAD command* signal when a call has been established.
ERR	Indication that a *PAD command signal* is in error.
PAR <par>:<val|INV>, ...	The PAD service signal is sent by the PAD in response to either a *set and read PAD command* or a *read PAD command.*

Table 2-6 Reset Causes

Reset Cause Code	Description
DTE	Reset initiated by remote DTE
OUT OF ORDER	Remote DTE out of order
RPE	Remote Procedure Error
ERR	Local Procedure Error
NC	Nework Congestion
REMOTE DTE OPERATIONAL	
NETWORK OPERATIONAL	
DER	Incompatible destination
NETWORK OUT OF ORDER	

Table 2-7 Clear Causes

Clear Cause	Description
OCC	Number busy
INV	Invalid facility requested
NC	Network congestion
NA	Access barred
NP	Not obtainable, number not assigned
RPE	Remote procedure error
ERR	Local procedure error
ROO	RPOA out of order
RNA	Reverse charge not subscribed
ID	Incompatible destination
FNA	Fast select refused
SA	Ship absent
DTE	Call cleared by remote DTE
PAD	Call cleared by remote request or PAD originated clear

For dial-up connections, if the first character of a PAD command signal is not received within **20** seconds after the interface enters the PAD waiting state, the PSPDN will then clear the dial-up connection. If, after receiving the first character of a PAD command, a complete PAD command signal is not received within **20** seconds the PSPDN sends an error PAD-service signal and the interface enters the PAD waiting state. The PSPDN also sends an error PAD-service signal if it receives an unrecognized PAD command. The error PAD-service signal indicates what error has occurred. Its format is illustrated in Tables 2-5. This service signal is only sent when Parameter 6 is set to 1 or 5. If the value of Parameter 6 is set to 0 or 1, the PSPDN does not transmit a prompt to the DTE.

In addition to the default profile assignment at service order time, the interface also supports DTE selection of profiles. After service initialization is complete, the user can choose one of the user profiles as specified in Table 2-1 Generally, profile selection is more applicable to dial-access ports because direct-access ports typically provide the most compatible profile as a default when service is installed. After service initialization, the DTE can request a profile by transmitting the profile-selection PAD command signal. The identifier for network defined profiles is single or double decimal digits. Profile identifiers for the simple standard profile and the transparent standard profile are 90 and 91, respectively.

2.4 Procedures for Virtual Call Control

2.4.1 General

For all access ports, the interface supports intra-LATA, inter-LATA, and inter-network calls. (Only one data call can be on a line at a time.) Signaling procedures for RPOA (Recognized Private Operating Agency) selection (on all calls), CUG (closed user group) request and reverse charging request are supported.

On the auto reverse charge dial access ports, the interface supports intra-LATA, inter-LATA, and inter-network calls. Signaling procedures for RPOA selection and reverse charge are also supported. DTEs may, but need not, use either or both of these signaling procedures for each virtual call. Regardless of whether the DTE uses the reverse charge request, the PSPDN automatically requests reverse charging on virtual calls originating from these ports.

Call Set-up is initiated when the DTE sends a selection PAD command signal to the PSPDN. The DIGIPAC® PAD function supports two (2) formats of the selection PAD command signal and those formats are illustrated in Tables 2-8 and 2-9. The information content of a selection PAD command signal consists of an optional facility request block, an address block and a user optional call user data field.

Incoming calls are no longer supported, because dedicated asynchronous lines are no longer offered.

Table 2-8 Format 1 of Call Selection Command
(Page 1 of 2)

Call	CALL Command or selection PAD command
Syntax:	[[**C]**ALL**] <***hostname*>|<*X.121 address*>|<*10<E.164 address*>> [**+<***calling address*>] [**~<***CUD*>] [[*facilities*[f][r]] [s] [**G**[*CUG*]] [**N<***NUI*>] [**T<***RPOA*>]]<cr>
Command Components	
[[C]ALL]	Command name (optional)
<hostname>	Mnemonic address of host being called, this name must be previously defined by QWEST when service was requested.
<X.121 address>	For intra-LATA calls, only the 8 to 10 digit address is required. The first 6 digits of the address are the 3 digit NPA and 3 digit DCO code. These 6 digits would be followed by the remaining 2 to 4 digits of the address. **OR** For Inter-LATA calls or Inter-network calls, the address must be prefixed by a 1, followed by the 4 digit DNIC and then the 4 to 10 digit network specific address.
<10<E.164 address>>	For intra-LATA, Inter-LATA and Inter -network calls, the E.164 address must be prepended with the digits 10. This is the prefix and escape code. The E.164 address must be in international format and include both the Country Code (CC) and the National Significant Number (NSN). For ISDN number in North America the Country Code is equal to the digit 1 and the NSN equals the NPA NXX XXXX.
[+<calling address>]	The "+" character indicates the next field is the calling address (the calling address is optional) If a calling DTE address is not entered in the command string, the PAD will automatically enter the DTE address of the terminal placing the call.
[~<CUD>]	~ Indicates the next field is up to 124 ASCII characters of Call User Data (CUD). If the CUD is preceded by a quotation mark, the PAD reads the data between the first quote and the next quote as the CUD. If no quotation mark precedes the CUD, the PAD reads the data between the tilde (~) and the next space as the CUD. If the data in the CUD is more than 12 characters, the PAD will automatically use Fast Select. If the host does not subscribe to Fast Select, the call will be rejected.
[facilities]	Do *not* insert a space between the Fast Select (f) and Reverse Charge (r) components of the Facilities portion of the CALL command. The Reselection (s), CUG, NUI, and RPOA components, however, must be set off from the others by a space. **Example**: **fr s G1234**

Table 2-8 Format 1 of Call Selection Command
(Page 2 of 2)

[f]	Include **f** in the string to request Fast Select.
[r]	Include **r** in the string to request Reverse Charge.
[s]	Include **s** in the string to bar Reselection.
[G<CUG>]	type **G**, then enter the CUG index (up to a four-digit number).
[N<NUI>]	Network User Identifier is a string of up to 64 alphanumeric characters (assigned by the network provider), preceded by an **N**, used to identify your call for the purposes of billing or security.
[T**<***RPOA*>]	Recognized Private Operating Agency provides the call routing information about your call. Enter **T** followed by the four digit RPOA number.

Table 2-9 Format 2 of Call Selection Command
(Page 1 of 2)

Syntax:	[facility[,facility]-]<X.121 address>|<10<E.164 address>>|<.mnemonic address[*]>[P|D<CUD>]
Command Components	
[facility[,facility]-]	Optional facility for facilities to be used on the call. if more than one facility is requested they are separated by a comma (,). When optional facilities are present in the command, the hyphen is used to separate the facilities from the address field.
[G<cug>]	CUG facility: <cug> - closed user group index one or two digits
[R]	reverse charging facility
[F]	non-restricted fast select facility
[T<rpoa>}	RPOA transit facility: <rpoa> - 4 digit DNIC of recognized private operating agency
[N<nui>]	NUI facility: <nui> NUI string
[Q]	restricted fast select facility
[S]	Prevent or bar Reselection.

Table 2-9 Format 2 of Call Selection Command
(Page 2 of 2)

<X.121 address>	For Intra-LATA calls, only the 8 to 10 digit address is required. The first 6 digits of the address are the 3 digit NPA and 3 digit DCO code. These 6 digits would be followed by the remaining 2 to 4 digits of the address. **OR** For Inter-LATA calls or Inter-network calls, the address must be prefixed by a 1, followed by the 4 digit DNIC and then the 4 to 10 digit network specific address.
<10<E.164 address>>	For intra-LATA, Inter-LATA and Inter -network calls, the E.164 address must be prepended with the digits 10. This is the prefix and escape code. The E.164 address must be in international format and include both the Country Code (CC) and the National Significant Number (NSN). For ISDN number in North America the Country Code is equal to the digit 1 and the NSN equals the NPA NXX XXXX.
<.mnemonic address[*]>	X.28 Abbreviated Address referred to in the ITU X.28 Recommendation; format is as follows: The Address is always prefixed by the character IA5 2/4 (.). One or more characters in columns 2 to 7 or IA5, except * (2/10/), + (2/11), , (2/12), DEL (7/15) The call user data field is separated from the Abbreviated Address signal by the character IA5 2/10 (*). The character IA5 2/0 (blank) is ignored in the Abbreviated Address. The length of the Abbreviated Address is up to 40 characters and is provisioned by the QWEST at the request of the customer.
[P|D<CUD>]	Up to 12 alpha-numeric data characters (124 for non-restricted fast select calls) separated from the network address by a P or D character.

2.4.2 Facility Request Block and Call User Data

The facility request block, for both format 1 and 2 of the selection command, identifies the facilities used to establish the call. The available facilities include Network User Identification (NUI), closed user group (CUG), reverse charging, fast select and RPOA. Formats for the facility block are given in Tables 2-8 and 2-9 for Formats 1 and 2 respectively. On any given call, any number or any combination of these facilities may be used.

2.4.2.1 Network User Identification (NUI)

The NUI signal is used to provide secure access to the network. The need to identify users, limits the use of this facility to direct access ports and private dial ports. If the NUI facility is not selected, the network begins clearing procedures with the reason for clearing given as user failure to specify the NUI facility. The NUI signal is not used for auto reverse charge ports because it is not required that the user identity be known by the PSPDN. For direct access to the PSPDN, user identity is known because of the physical termination on the PSPDN.

2.4.2.2 Closed User Group (CUG)

Closed user groups (CUG) allow members to communicate with other members of the group but preclude communication with non-members. This privacy feature can be used to derive a private sub-network from the components of the public network. This capability is provided via the ITU defined closed user group facility (see Recommendation X.25). The need to identify users, limits the use of this facility to private dial ports.

2.4.2.3 Reverse Charge Originating

Reverse charge originating facility is optional on asynchronous interfaces. On private dial ports, it allows users to request, via signaling procedures for each originating call, that the call be reverse charged. For public dial access, the interface ports are designated as automatic reverse charge. On these ports, the PAD automatically requests reverse charging on all virtual calls.

2.4.2.4 Fast Select Unrestricted

Fast Select Unrestricted permits the insertion of up to 124 octets of user data in the call initiation packet and acceptance of up to 124 octets of data in the call termination packet. In addition the called DTE is allowed to accept the call and the pad will enter the data transfer state and additional data packets will be accepted following the acceptance of the call initiation packet.

2.4.2.5 Fast Select Restricted

Only available with Format 2 of selection PAD command. As with Fast Select Unrestricted, up to 124 octets of user data may be inserted in the call initiation packet and the call termination packet. However, the called DTE is not allowed to accept the call and therefore the PAD will not enter the data transfer state.

2.4.2.6 Recognized Private Operating Agency (RPOA)

Recognized Private Operating Agency (RPOA) facility allows users to specify the transit network for the carrying of inter-network calls. The user will enter the four digit Data Network Identification Code (DNIC) of the transit network. Currently DIGIPAC® only allows the user to enter one RPOA.

2.4.2.7 Prevent Reselection

The Prevent Reselection facility, when used in the selection PAD command, will notify the PAD to not accept the X.29 Reselection message from the called DTE.

2.4.2.8 Call User Data Field

The call user data field of a selection PAD command signal is optional and is used to append up to 12 characters (124 characters if fast select) of application dependent information to a call request. The Carriage Return (CR) and Plus (+) characters should not be used in the call user data field because they will be treated as a PAD command signal delimiter and not transmitted to the remote DTE. The editing characters, as defined by Parameters 16, 17, and 18, should not be used as they will be treated as providing the editing function.

2.4.3 Procedures for Selection PAD command

After the DTE transmits the selection PAD command signal, it transmits binary ones and the interface enters the DTE Waiting state. The interface remains in this state until a valid selection PAD command signal is received by the DCE. Upon receipt of the valid selection PAD command signal, the PSPDN does the following depending upon whether or not service signals have been suppressed.

- If the value of Parameter 6 is set to 0, the PSPDN does not send any service signals and the interface enters the connection-in-progress state. It remains in this state until the Virtual Call (VC) is established or cleared.
- If Parameter 6 is set to 1, on receipt of a valid selection PAD command signal, the PSPDN transmits an acknowledgment PAD service signal (see Table 2-5) followed by binary ones and the interface is in the connection-in-progress state. To indicate whether the call has been accepted or cleared, the PSPDN either sends a connected PAD service signal or a clear-indication-PAD service signal, respectively.

The interface enters the PAD service signals state upon initiation of these signals. This state is bypassed if Parameter 6 is set to 0. PAD service signals responding to previously transmitted PAD command signals have priority over PAD service signals arising from events within the network. No characters are echoed and no PAD commands are accepted while the interface is in state 8 (transmission of service signals). If the interface is in state 7 (connection in progress), the only command accepted is a clear request PAD command.

If the virtual call is not accepted, the interface enters the PAD waiting state after the clear-indication PAD service signal is sent to the DTE. If the interface on a dial-up connection enters the PAD waiting state more than 10 times after receiving a service request signal without a virtual call being set up, the PSPDN disconnects the physical access. If the virtual call is established, the interface enters the data transfer state after the connected PAD service signal is sent to the DTE. Data transfer is discussed in Paragraph 2.5.1.

2.4.4 Clearing

Clearing the virtual call can be initiated by either the DTE or the PSPDN. A DTE can clear a virtual call in one of two ways. The first is to actually disconnect the physical access path (hanging up a dial connection or turning off the terminal). Also, the DTE could clear the call by escaping to the command mode and issuing a clear-request PAD command signal. If a clear request is used and Parameter 6 is set to 1, the PSPDN responds with clear-confirmation PAD service signal. If an invalid clear-request PAD command signal is sent, the PSPDN includes a local procedural error cause in the clear-indication PAD service signal. The format of these signals is given Table 2-4 and Table 2-5. After transmitting a clear-indication PAD service signal, the interface is in the PAD waiting state and the DTE is allowed a follow-on call. If service signals were suppressed (Parameter 6 is set to 0), no follow-on call is allowed and physical access is disconnected when the PSPDN receives the clear request.

The PSPDN initiates virtual call clearing by transmitting a clear-indication PAD service signal to the DTE. After sending the signal, the interface is in the PAD waiting state. The DTE stops sending data when it receives the signal and transmits binary ones. If service signals were suppressed, the interface goes directly to the PAD waiting state without the DTE being notified of call clearing. If the call is to a dial-up port, the PSPDN then clears the dial-up connection.

If physical access is disconnected for any reason, the call attempt or virtual call is cleared by the PSPDN.

2.4.5 Procedures for Setting, Changing and Reading PAD Parameters

When the interface is in the PAD command state, the DTE may change the values of one or more Parameters by sending a set or set-and-read PAD command signal. As illustrated in Table 2-4, the commands include Parameter references(s) and values(s). If Parameter 6 is set to 1 or 5, the PSPDN responds to a valid set-and-read PAD command by sending a Parameter value PAD service signal. This signal indicates the newly set Parameters and also indicates any invalid PAD Parameters that were requested (invalid Parameters are not invoked). The PSPDN responds to a valid set PAD command signal by transmitting an acknowledgment PAD signal. Both service signals are shown in Table 2-4 and Table 2-5. When Parameter 6 is set to 0, the PSPDN accepts and invokes valid Parameters without advising the DTE of any invalid Parameters or Parameter values.

A DTE may inquire about the current values of one or more Parameters by transmitting a read PAD command signal (see Table 2-4). The PSPDN responds with a Parameter value PAD service signal. If service signals are suppressed, the read command is ignored.

2.4.6 Packet Forwarding Conditions

A packet is forwarded when:

- Enough data to fill a packet has been received.
- A data forwarding character is sent.
- A break signal is transmitted (if Parameter 7 is not set to 0).
- A PAD command signal is sent.
- The idle timer delay period is allowed to elapse. The idle time is restarted each time a character is received by the PSPDN. If a character is not received within the specified delay period (set in Parameter 4) the packet is forwarded. If the packet cannot be forwarded because of flow control constraints, characters continue being added to the packet until either flow control permits forwarding or the packet is full. This forwarding condition does not apply if Parameter 15 is set to 1.

If none of the above conditions take place, packet forwarding also occurs upon expiration of the maximum assembly times delay period. This timer begins when the first character to be assembled into the packet is received by PSPDN. The value of the time-out, when implemented, is twenty fifths of a second (40 ms).

2.4.7 Reset Procedures

The DTE resets a virtual call by escaping from the data transfer state and transmitting a reset PAD command signal to the PSPDN. The format of this signal is given in Table 2-4. The PSPDN interprets a break signal as a reset PAD command signal if Parameter 7 is set to 2. The PSPDN acknowledges the reset, if Parameter 6 is set to 1 or 5 by sending an acknowledgment PAD service signal. If the remote DTE or the network resets the virtual call, the PSPDN sends a reset PAD service signal to the DTE when Parameter 6 is set to 1 or 5. This signal indicates whether the reset was caused by the remote DTE, a local procedural error, or network congestion. The format for the reset PAD service signal is illustrated in Tables 2-5. If Parameter 6 is set to 0, the PSPDN does not inform the DTE of a reset.

2.4.8 Flow Control

If Parameter 5 is set to 1, the PSPDN can flow control the data input from the DTE. When the PSPDN can no longer accept characters from the DTE, it transmits an X-OFF character. When it can receive another character, the PSPDN transmits the X-ON character. A network-defined variable specifies the number of characters the PSPDN continues to accept after the X-OFF has been set. X-ON and X-OFF are used to switch a transmitting device on and off. For this Parameter to have any effect, the DTE must recognize standard International Alphabet No. 5 (IA5) X-ON and X-OFF characters and respond to them (i.e., stop input on X-OFF, resume input on X-ON). If the interface is in the data transfer state and Parameter 12 is set to 1, the DTE can flow control the PSPDN by using X-ON and X-OFF characters.

2.4.9 Echo

The value of Parameter 2 dictates whether characters are echoed by the PAD or the remote DTE. Typically, they are echoed by the PAD (Parameter 2 is set to 1) which reduces the amount of data transmitted between the PAD and the remote DTE. In the data transfer mode, characters to be echoed have priority over data characters waiting to be delivered. Characters that cannot be accepted by the PSPDN, because of flow restrictions, are not echoed.

2.4.10 Procedure on Break

When a Break is entered from the DTE, it results in a physical break on the communications line. This physical occurrence cannot be transmitted over a packet switched network so another means of notifying the remote DTE that a break has occurred is required. The settings for Parameter 7 define ways of accomplishing this (see Table 2-2). The setting relies on the remote DTE knowing what to do with the information indicating that break has occurred. Parameter 8 is used in conjunction with Parameter 7 being set to 21. It indicates whether data destined for the DTE is being flushed by the PSPDN or is being delivered.

2.4.11 Editing

The PSPDN provides editing functions for the DTE when Parameter 15 is set to 1, so it can edit character input to the PSPDN before it is processed. The editing buffer is at least 128 characters. Editing is always available in the command mode. The three functions provided are Character Delete, Line Delete, and Line Display. The characters used to perform these functions are determined by the settings of Parameters 16, 17, 18 and 19 or may be network default characters. Any default character may be overridden by the setting of a Parameter. Editing during the data transfer mode is selected by setting Parameter 15. If editing is selected, the value of the idle timer (Parameter 4) is ignored during data transfer.

2.4.12 Parameter Priority

This section describes the procedures to resolve a situation where different Parameters use the same character as a Parameter value [e.g., if both the line delete character and line display character (Parameters 17 and 18) are designated as ASCII Character No. 24, Control X.

The asynchronous terminal interface does not check for character duplication, even if duplication occurs while changing Parameters. If this situation occurs, the PSPDN performs the function of the Parameter with the highest priority among those Parameters whose values are duplicated. The following is the priority assignment to Parameters that may be duplicated:

(Highest)
1. PAD recall character (Parameter 1)
2. PAD command signal delimiter
3. X-ON, X-OFF (Parameter 12)
4. Character delete (Parameter 16)
5. Line display (Parameter 18)
6. Data forwarding character (Parameter 3)

(Lowest)
7. Line delete (Parameter 17)

2.4.13 PAD Parameter and Call Clearing

The following condition applies when a call is cleared without being physically disconnected: Upon reception of a clear packet either before or after call set-up, the PSPDN resets the Parameters to the values specified in the default profile.

2.5 Procedures for the Exchange of User Data

2.5.1 Data Transfer State

The interface enters the data transfer state when the DTE receives the connected PAD service signal. It remains in this state until either an escape to command mode character is sent by the DTE or the virtual call is cleared. Any character sequence, except functional characters specified in the Parameters, can be sent from DTE to remote DTE while in the data transfer state. Procedures for sending the 1/0 (DLE) character (when Parameter 1 is set to set to 1) are described in the beginning of the following Paragraph.

The DTE can escape from data transfer by sending either an escape character (set in Parameter 1) or a break signal (if Parameter 7 is set to 8) to the PSPDN. If Parameter 6 is set to 5 the PSPDN responds by sending a prompt PAD service signal. Upon receipt of the escape signal, the interface enters the waiting for command state. All data destined for the DTE is delayed until the interface returns to the data transfer state. The next character sent by the DTE is interpreted as follows:

- If the character is 1/0 (DLE), the interface returns to the data transfer state and this character is treated as user data.
- If the character is the PAD command delimiter (+ or CR), the PSPDN does not transfer it and the interface returns to the data transfer state.
- If the character is the first letter of a PAD command, the interface enters the PAD command state. This is a packet forwarding condition.

- If the complete PAD command is not received within 20 seconds, or an invalid command is sent, the PSPDN responds with a PAD service signal (if service signals are not suppressed) indicating the error. The interface then returns to the data transfer state. Following the transmission of a valid PAD command, the interface goes from the service signals state (bypassed if service signals are suppressed) to either the data transfer state, connection in progress state, or the PAD waiting state, whichever is appropriate (i.e., a valid selection PAD command leads to the connection in progress state). Upon escape from data transfer, the DTE can use any of the following procedures or PAD commands:
- Procedures described in Section 2.4.4 to clear a virtual call.
- Procedures described in Section 2.4.7 to reset a virtual call.
- If Parameter 5 is set to 1, the DTE can check to see if a virtual call exists by sending a status PAD command signal. The PSPDN responds by sending either a call-established or a call-idle PAD service signal. The format of these signals is illustrated in Tables 2-4 and 2-5.
- A request that an interrupt packet be sent to the remote DTE by transmitting an interrupt PAD command signal (see Table 2-4) to the PSPDN. If Parameter 6 is not set to 0, the PSPDN responds with an acknowledgment PAD service signal.
- The profile selection is: set, set-and-read, and read PAD command signals (see Table 2-4).

2.5.2 Other Terminal-Dependent Parameters

The DTE can specify, by means of Parameter 9, the number of padding characters to be inserted after each carriage return transmitted or echoed to it. Padding ensures that characters are not printed when the mechanical device (carriage) is being returned to the left margin of the user's display device. The value of Parameter 9 indicates how much padding, either non-printing characters of time fill, is required. This value also specifies the padding inserted after the Line Feed (LF) character of the format effector (see Table 2-5).

Through Parameter 10, the DTE can select a line folding option and specify the maximum number of characters that the PSPDN can send to it as single line. After K characters (value of K set in Parameter 10) in an output line the PSPDN inserts a format effector and provides appropriate format effector padding (Parameter 9).

Parameter 13 allows the DTE to specify the action taken by the PSPDN, with respect to line insertion, when it deals with a carriage return data transfer.

Parameter 14 specifies whether or not padding is done after a line feed is transmitted to the DTE.

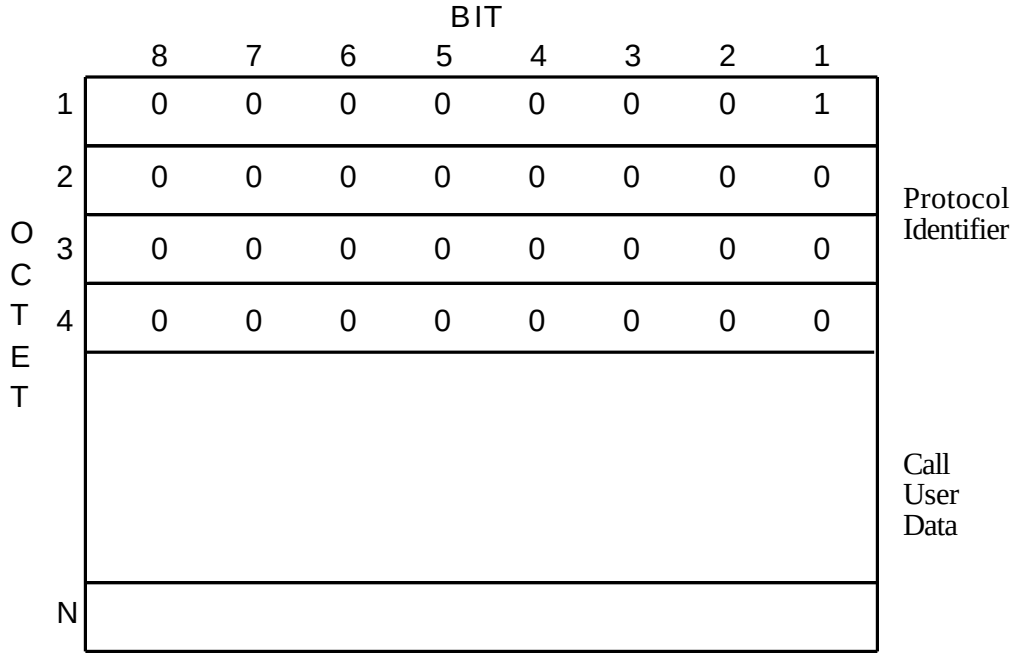
2.6 Interface Procedures (Asynchronous DTE to X.25 DTE)

2.6.1 General

This section describes the protocol required in the X.25 Interface Specification to provide interconnection with asynchronous terminals. This protocol is compatible with ITU Recommendation X.29. For the following description, the asynchronous device is the "local DTE" and the X.25 device is the "remote DTE".

2.6.2 Call Set-Up

When the local PAD receives a selection PAD command signal from the local DTE (refer to Section 2.4.) it maps the information contained in the signal into a call request packet and sends this packet to the remote PAD. The remote PAD in turn sends an incoming call packet to the remote DTE. (For packet formats refer to Recommendation X.25.) The call user data field of an incoming call and call request packet is divided into a protocol identifier field and a call field. The format of the protocol identifier field is illustrated in Figure 2-1. The call data field contains any user data that was sent by the local DTE in the selection PAD command signal. A call request may also be initiated by the remote DTE. In this instance, the call user data field is optional and the PSPDN still accepts the call if none is provided.



4<N<16 Octets or 128 if Fast Select
Ref. 1984 ITU X.29 Paragraph 4.2

Figure 2-1 Call User Data Field Format

2.6.3 Data Transfer

After the call has been established, the PSPDN and remote DTE can exchange the complete repertory of packet types. The user data fields of DATA packets are used to carry either PAD messages or user data. The Qualifier bit (Q-bit), in the packet header, distinguishes user data transfer from PAD messages. DATA packets that contain user data, have the Q-bits set to zero (0) indicating the data is intended for the local DTE or has originated from the local DTE. DATA packets that contain a PAD message have the Q-bit set to one (1); indicating the data is intended for the PAD or has originated from the PAD.

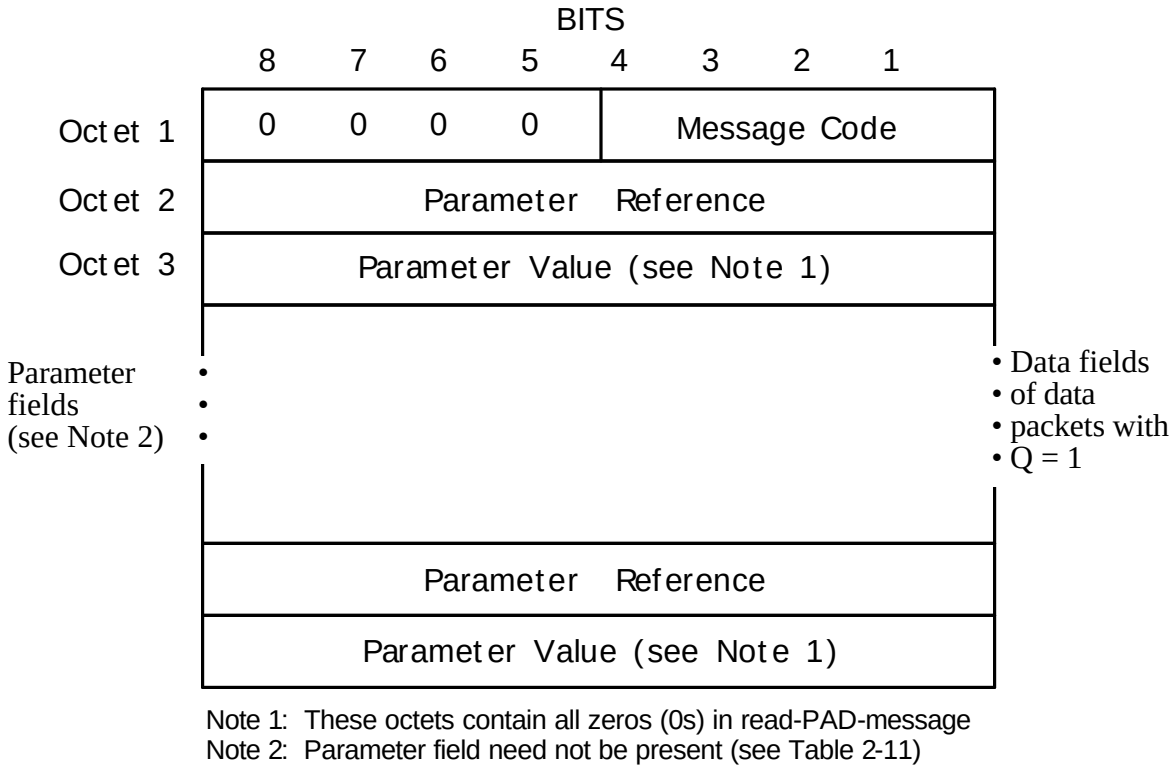
The D bit in the packet header governs what entity is responsible for acknowledgment of the receipt of data. If the D bit is set to a one (1) it is assumed that there is end to end acknowledgment of data. If the D bit is set to zero (0) the network will acknowledge the receipt of data as it received from the local DTE.

The PSPDN sets the D bit to zero (0) in all transmitted data packets containing user data. The PSPDN takes the following actions when receiving data packets containing user data. If the D bit is set to one (1), the PSPDN acknowledges the packet when the data is transmitted to the local DTE. The significance of the acknowledgment, is that the data has been transmitted to the local DTE, but there is not acknowledgment by the local DTE. The PSPDN need not withhold the acknowledgment if the data pack has the D bit set to zero (0).

2.6.4 PAD Messages

2.6.4.1 Set, Read, and Set and Read Messages and Procedures

PAD messages allow the remote DTE to set Parameters, read Parameters and initiate call clearing from the PAD. PAD messages allow the PSPDN to indicate the value of Parameters (in response to a read from the remote DTE), indicate that the terminal sent a break and indicate a remote DTE PAD message in error. All PAD messages contain a control identifier field and a message code field (refer to Figure 2-2). Some PAD messages also include a Parameter field. The control identifier field (bits 5 through 8 of the first octet) contain all zeros. The message code field is bits 1 through 4 of the first octet and the possible values can be found in Table 2-10.



Note 1: These octets contain all zeros (0s) in read-PAD-message
Note 2: Parameter field need not be present (see Table 2-11)

Figure 2-2 Set, Read, Set-And-Read And Parameter Indication Pad Message Format

Table 2-10 Type and Coding of OCTET 1 of Pad Messages

TYPE	Message Code					Decimal Value
	Bits	4	3	2	1	
Set PAD message		0	0	1	0	2
Read PAD message		0	1	0	0	4
Set-and-Read PAD message		0	1	1	0	6
Parameter indication PAD message		0	0	0	0	0
Invitation to clear PAD message		0	0	0	1	1
Indication of break PAD message		0	0	1	1	3
Reselection PAD message		0	1	1	1	7
Error PAD message		0	1	0	1	5

Ref. 1988 ITU X.29 4.4.2
Note: The possibility of extending the message code field is for further study.

Successive octets (this does not apply to message types 1, 5 and 7) are interpreted in pairs where the first octet indicates the PAD Parameter reference number and the second octet indicates the value of the Parameter. The PSPDN supports PAD message lengths of at least 61 octets. This allows for one octet containing the control identifier field and message code, followed by up to 30 Parameter fields. If a Parameter reference appears more than once in a PAD message, only the last appearance is taken into account. The PSPDN does not set the D bit to 1 when transmitting data packets containing PAD messages.

The PSPDN takes the following actions when receiving data packets containing PAD messages. If the D is set to one (1), the PSPDN acknowledges the packet when the command contained in the PAD message has been affected. The significance of the acknowledgment is that the PSPDN has completed the actions specified by the PAD message (command). The PSPDN need not withhold the acknowledgment if the data packet has the D bit set to zero (0). When the PSPDN receives a set, read or set-and-read PAD message, any data destined to the local DTE is delivered before action is taken in response to the message. Receipt of this PAD message is also a data forwarding condition. The occurrence of a packet forwarding condition does not cause the PSPDN to transmit empty data packets.

The PSPDN responds to a valid read or set-and-read PAD message by sending a Parameter indication PAD message after making the appropriate Parameter modifications if the set-and-read message was received. The Parameter-indication PAD message contains the specified Parameter reference numbers and their current values (after modification, if any). A Parameter-indication PAD message is not sent in response to a set PAD message. Table 2-11 specifies the PSPDN'S response to set, read, and set-and-read PAD messages.

Table 2-11 Pad Messages Transmitted by the Pad in Response to Set, Set-and-Read, and Read Pad Messages

PAD MESSAGE RECEIVED BY THE PAD		ACTION UPON PAD PARAMETERS	CORRESPONDING PARAMETER INDICATION PAD MESSAGE TRANSMITTED TO THE PACKET MODE DTE
TYPE	PARAMETER FIELD		
Set	None	Reset all implemented Recommendation X.3 Parameters to their initial values corresponding to the initial profile	None
	List of selected Parameters with the desire values	Set the selected Parameters to the given values: a) if no error is encountered b) if the PAD fails to modify the values of some Parameters	a) None b) List of these invalid Parameters (see Note)
Set-and Read	None	Reset all implemented Recommendation X.3 Parameters to their initial values corresponding to the initial profile	List all implemented recommendation X.3 Parameters and their initial values
	List of selected Parameters with the desired values	Set the selected Parameters to the given values	List these Parameters with their new current values (see Note)
Read	None	None	List implemented Recommendation X.3 Parameters with their current values
	List of selected Parameters	None	List of these Parameters with their current values (see Note)

Note: If any of the Parameters contain an error, then the error bit is set and the Parameter value field is coded as described in Table 2-12.

The Parameter field of these PAD messages, when present consists of successive parts of reference fields and value fields; each one (1) octet long (see Figure 2-2). Parameter reference numbers are binary coded in bits 1 to 7 of the reference field. The PSPDN ignores bit 8 in all PAD messages it receives and only interprets bits 1 to 7. If bits 1 to 7 contain an invalid Parameter reference (see Section 2.6.4.4) the PSPDN sets bit 8 to 1 in the Parameter-indication PAD message to inform the remote DTE of an error. Parameter values are coded in bits 1 to 8 of the Parameter value field. The value fields in read PAD messages contain the value zero (0). In set and set-and-read PAD messages, the value fields contain the requested Parameter values. If the preceding reference field has 8 set to 1, the value field indicates the reason for error as given in Table 2-12.

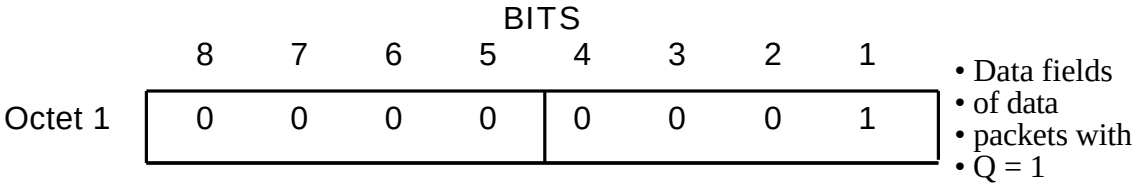
Table 2-12 Coding of Parameter Value Field in Case of Error

ERROR TYPE	Parameter Value Field Code								
	Bits								Decimal
	8	7	6	5	4	3	2	1	
No additional information.	0	0	0	0	0	0	0	0	0
The Parameter reference does not exist or has not been implemented in the PAD.	0	0	0	0	0	0	0	1	1
The Parameter value is invalid or has not been implemented in the PAD.	0	0	0	0	0	0	1	0	2
The Parameter value cannot be altered from the current setting.	0	0	0	0	0	0	1	1	3
The Parameter is read only.	0	0	0	0	0	1	0	0	4
The Parameter follows an invalid Parameter separator.	0	0	0	0	0	1	0	1	5

Ref. 1988 ITU X.29 4.4.5.3

2.6.4.2 Indication To Clear PAD Message and Procedures

The remote DTE can request that the PAD clear a virtual call be sending it an invitation-to-clear PAD message. Upon receipt of this message, the PSPDN sends all previously transmitted data to the local DTE. The PSPDN then sends a clear indication packet to the remote DTE with the clearing cause field of this packet set to "DTE clearing". The invitation to clear PAD message consists of only one octet (control identifier field and message code). This is illustrated in Figure 2-3.



Reference 1988 ITU X.29 Paragraph 4.4.8

Figure 2-3 Invitation To Clear Pad Message Format

2.6.4.3 Indication Of Break PAD Message and Procedures

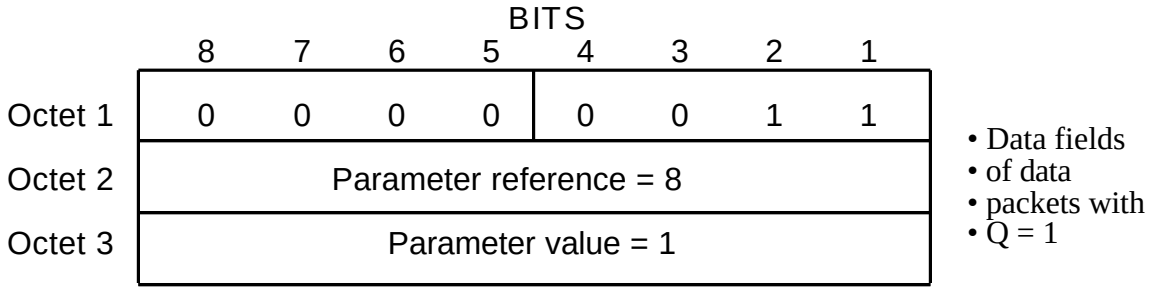
The following procedures apply when the local DTE transmits a break and Parameter 7 is set to 21. The PSPDN sends an interrupt packet with the user data field set to 0 followed by an indication-of-break PAD message (refer to Figure 2-4). The Parameter field of this message indicates that Parameter 8 is set to 1 (discard output). The remote DTE must send a set or set-and-read PAD message, changing the value of Parameter 8 to 0 (normal data delivery) before data transmission to the PSPDN can resume.

If the PSPDN receives an indication-of-break PAD message from the remote DTE with no Parameter field, it transmits a break signal to the local DTE but will not respond to the remote DTE. If the PSPDN receives an indication-of-break PAD message from the remote DTE in the same format as depicted in Figure 2-4, the PAD will transmit a break signal to the local DTE and respond to the remote DTE with a set PAD message as described in the paragraph above.

If the local DTE sends an interrupt PAD command or break signal to the PSPDN and Parameter 7 is set to 1, the PSPDN responds by transmitting an interrupt packet with the user data field coded as 0000000l. If the PAD receives an interrupt packet it will confirm it in accordance with X.25 procedures. The PAD will not transmit the contents of the interrupt user data field to the local DTE.

If the local DTE sends a break signal to the PAD and Parameter 7 is set to 5, the PAD will transmit an interrupt packet with all bits of the interrupt packet set to zero (0), followed by an indication of break PAD message. The PAD message will not contain a Parameter field as depicted in Figure 2-4 below.

Procedures for reset are described in ITU Recommendation X.25. A reset results in Parameter 8 being set to 0 (normal data delivery). All other Parameters maintain their current values.

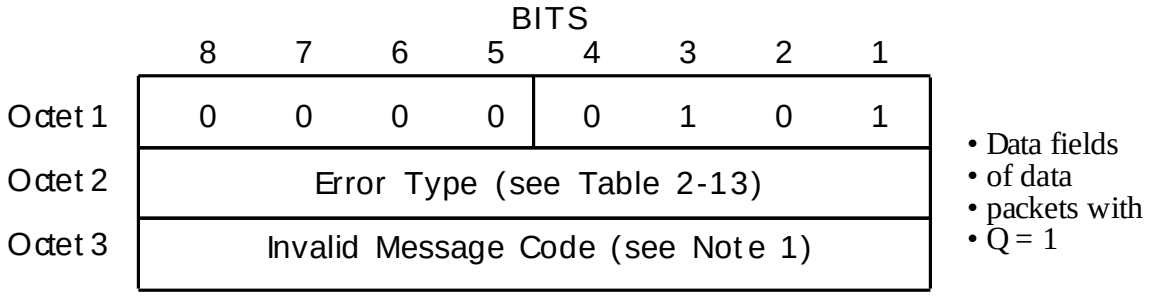


Reference 1988 ITU X.29 Paragraph 4.4.7

Figure 2-4 Indication of Break Pad Message Format

2.6.4.4 Error PAD Message and Procedures

If an error occurs in one of the reference/value sets of the Parameter field in a set, read, or set-and-read PAD message the PSPDN indicates it in the Parameter-indication PAD message by setting bit 8 in the reference field to 1. Possible errors include: referencing a Parameter that does not exist, trying to set a read-only Parameter, and requesting an invalid Parameter value. These errors do not affect the processing of any other valid references to PAD Parameters. When the PSPDN receives an invalid PAD message, it responds by sending an error PAD message (see Figure 2-5). The error PAD message indicates what type of error has occurred and also contains the message code of the invalid PAD message.



Note: Does not occur for error type 00000000
Reference 1988 ITU X.29 Paragraph 4.4.6

Figure 2-5 Error Pad Message Format

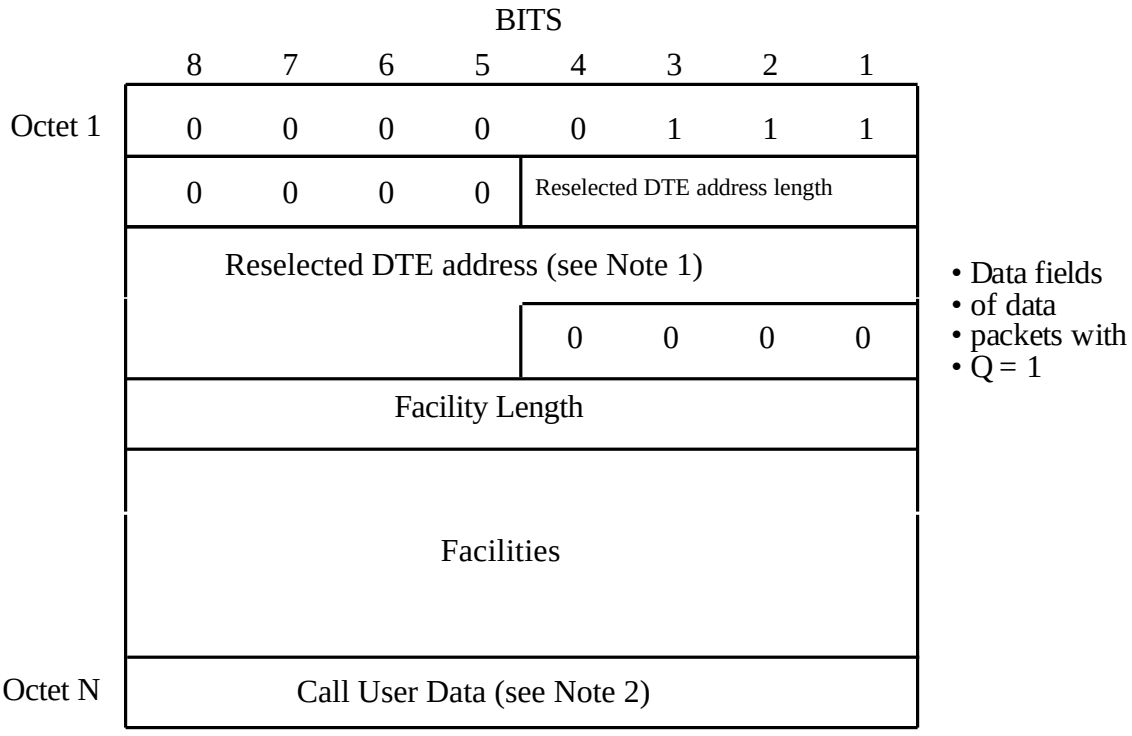
Table 2-13 Coding and Meaning of OCTET 2 of Error Pad Message

Case	Meaning	Coding							
		Bits	8	7	6	5	4	3	2	1
a	Received PAD message contained less than eight bits		0	0	0	0	0	0	0	0
b	Unrecognized message code in received PAD message		0	0	0	0	0	0	0	1
c	Parameter field format of received PAD message was incorrect or incompatible with message code		0	0	0	0	0	0	1	0
d	Received PAD message did not contain an integral number of octets		0	0	0	0	0	0	1	1
e	Received Parameter indication PAD message was unsolicited		0	0	0	0	0	1	0	0
f	Received PAD message was too long		0	0	0	0	0	1	0	1

Ref. 1988 ITU X.29 4.4.6.1

2.6.4.5 Reselection PAD Message Format and Procedures

The format of the Reselection PAD message can be found in Figure 2-6. This is the only format of this message currently supported on the DIGIPAC® network.



Notes:
1. The figure is drawn assuming that the number of semi-octets in the DTE address is odd.
2. A maximum of 12 octets may be present, or 124 octets when used in conjunction with the fast select facility.

Ref. 1988 ITU X.29 4.4.9

Figure 2-6 Reselection Pad Message Format

Upon receipt of the Reselection PAD message, the PAD will:

- transmit to the start-stop mode DTE all previously received data;
- clear the virtual call that is established;
- after having made the appropriate state changes as described in paragraph 3.2.5 of recommendation X.28, establish a virtual call to the reselected DTE. The call request packet sent by the PAD, will contain only the facilities subscribed by the start-stop mode DTE and/or assigned by default. Any other facilities contained in the Reselection PAD message will be ignored. In particular:

Closed User Group Signals - Independently by the CUG indicated in the Reselection PAD message, the PAD will use the same CUG of the original call.

Reverse Charging - If the start-stop mode DTE was not charged for the original call the reselected call will not be charged to the start-stop mode DTE, independently of the indication in the Reselection PAD message (i.e., the PAD will use the reverse charging facility in the call request packet). If the start-stop mode DTE was charged for the original call, the reselected call will be charged to the reselected DTE if the Reselection PAD message contains the reverse charging facility.

Charging information:

- facility assigned for an agreed contractual period: The information will be sent to the start-stop mode DTE at the clearing of each call (original and reselected), or at the clearing of the last reselected call. If the later procedure was selected, the PAD will send the total charging information, without sending the charge of the individual calls (original and reselected);
- facility on a per call basis: The PAD follows the procedure indicated above, starting from the first charging information facility request (by the start-stop mode DTE or the packet mode DTE).

When the Reselection PAD message is received, the PAD will transmit an error PAD message with an error type unauthorized Reselection PAD message (00000110) under the following conditions:

- the virtual call has been established by the packet-mode DTE;
- the called DTE Reselection prevention facility has been requested by the start-stop mode DTE;
- the Reselection PAD message has been already received more than N times (where N is for further study).

2.7 User Facilities

2.7.1 Incoming Calls Barred

All the incoming calls for a subscriber are barred. This service is offered by the "one way logical channel" facility which blocks the incoming calls on all logical channels. If this service applies to a subscriber, all the incoming calls from the network will be rejected; but it is possible for this subscriber to generate call requests in the network direction. The data transfer can be handled in both directions; this means the logical channels retain their full-duplex capability. **This facility no longer applies to asynchronous lines since dedicated asynchronous access is no longer offered.**

2.7.2 Outgoing Calls Barred

All the outgoing calls for a subscriber are barred. This service is offered by the "one way logical channel" facility which blocks the outgoing calls on all logical channels. If this service applies to a subscriber, all the outgoing calls to the network will be rejected; but, is possible for this subscriber to receive incoming calls. The logical channels retain their full-duplex capability.

2.7.3 Closed User Group Facilities

The Closed User Group (CUG) facilities enables users to form groups with different combinations of restrictions for access from or to users having one or more of these facilities. They are all optional user facilities assigned to the user for an agreed contractual period:

- Closed User Group is a facility in the basic form which enables a user to belong to one or more CUGs.
- Closed User Group with Outgoing Access is a variant to a CUG which also enables the user to make outgoing calls to the open part of the network; other users belonging to the same CUGs do not need the outgoing access possibility.
- Closed User Group with Incoming Access is another variant which allows individual members of a CUG to receive incoming calls either from other CUGs or from other network users.

At the destination node, a validation check about the acceptability of the call is made. The call is forwarded only in the cases when the interlock code received, matches with the interlock codes stored at the destination node associated with the called user, or when a call with outgoing access is to be forwarded to a user which belongs to the open part of the network. In the cases when a call is rejected because of incompatible CUG information, an access barred signal is sent towards the calling user.

Note: A call may be rejected for other reasons not related to the CUG facilities.

A user may belong to one or more CUGs. In the case when a user belongs to more than one CUG, one of these is nominated as the preferential CUG of that user. Each user belonging to at least one CUG, has either the closed use group facility or one or both of the closed use group with outgoing access. The realization of the CUG facilities is based on various validation checks at call set-up; determining whether or not a requested call to or from a user having a CUG facility is allowed. In particular, a validation check is performed by comparison of an interlock code, which is associated with each user belonging to a CUG. Facility registration, including allocation of interlock codes, is controlled by the service order and cannot be controlled by the user.

The DTE/PSPDN interface protocol and the actions at the originating node at call setup from a user belonging to a CUG, depends on whether the user belongs to one or more CUGs and on the combination of CUG facilities that applies. For each CUG that a user belongs to, the interlock code assigned to the CUG is stored, associated with the user at the local node. In the case when a user belongs to more than one CUG, a selection of the CUG concerned and thus of the corresponding interlock code is required at call setup. This selection is made on the following criteria:

- In the case when the calling user makes a facility request including an index identifying a particular CUG, the CUG is selected by the originating node.

- In the case when the calling user makes no facility request identifying a particular CUG, the originating node selects the preferential (or only) CUG.

Thus no facility request concerning CUG facilities is made by the calling user in the case:

- When the user belongs to one CUG only.
- When a user that belongs to more than one CUG makes a call within the preferential CUG.
- When a user having the closed user group with outgoing access facility makes an outgoing access call.

In the case of a call request where the subscriber enters a selected CUG, the indication of outgoing access is not provided in the call request even when subscribed to. The called DTE must match the same interlock code as specified in the call request or the call will be cleared.

In a Call Setup from a user having the CUG with Outgoing Access Facility the call is regarded as an outgoing access call within the preferential (or only) CUG. The call is set up at the originating node. The CALL REQUEST packet forwarded to the next node includes the interlock code of the preferential (or only) CUG together with an indication that the call is a CUG call for which outgoing access is allowed.

Note: With the above procedure, it is not necessary to distinguish at the originating node between a call within a CUG and an outgoing access call.

For Calls to a user having the Closed User Group or the Closed User Group with Outgoing Access Facility, an incoming call is accepted only when it is a CUG call; including the case when outgoing access is allowed and correspondence is found between the interlock code received and an interlock code associated with the called user. If all the above conditions are not met, the call is cleared. For CUG Calls to a User Not Belonging to Any CUG the incoming call is only accepted for a CUG call for which outgoing access is allowed. An incoming call without CUG facility is always allowed. With CUG Calls to a User Having the Closed User Group with Incoming Access Allowed Facility, an incoming CUG call is accepted only when it is a CUG call with outgoing access allowed, or correspondence is found between the interlock code received, and an interlock code associated with the called user. For Calls Without CUG Facility an incoming call is accepted only when the called user has no CUG facility or incoming access is allowed.

2.7.4 Reverse Charging

Reverse charging is an optional user facility that may be requested by the user on a per call basis. This privileges a calling user to request that the call should be charged to the called party. A calling user may request reverse charging by means of a facility request over the DTE/PSPDN interface. The Reverse Charge Option allows for billing of usage charges associated with calls to be billed to another network address.

Customers who select the Reverse Charge Acceptance (Terminating Calls) option will accept the charges for all calls sent to the network address(es) assigned to the customer. In order to receive calls from a dial access customer, this option must be selected.

2.7.5 Fast Select

Fast Select is an optional user facility which may be requested by a DTE for a given virtual call. DTEs can request the fast select facility on a per call basis by means of an appropriate facility request in a call request packet using any logical channel which has been assigned to virtual calls. The Fast Select facility, if requested in a call request packet, allows this packet to contain a call user data field of up to 124 octets. It authorizes the PSPDN to transmit to the DTE, during the DTE waiting state, a call connected or clear indication packet with a called or clear user data field respectively of up to 124 octets.

2.8 Asynchronous Interface Attributes

Table 2-14 contains a list of interface attributes that apply to the asynchronous service provided by DIGIPAC®. With the exception of Character Set and Editing Buffer, all are selectable or settable at the time of subscription.

Table 2-14 Summary of Asynchronous PDN Standard Interface Attributes

Dial Access	212A -- Compatible Interface: 300 to 1200 bps
	V.22*bis* Interface 2400 bps
	V.32 Interface 9600 bps
	V.32*bis* Interface 14.4 Kbps and below
	V.34 Interface 28.8 Kbps and below
Character Set	ANSI X3.4
Editing Buffer	At least 128 octets
Signaling	X.28 commands and service signals. User friendly formats
Parameters	ITU X.3 Parameters 1-22
Profiles	ITU simple standard profile
	ITU transparent standard profile
	PSPDN Default Profile

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Table

3. QWEST DIGIPAC® Network Features

3.1 Network Features

Please reference the following Table 3-1.

KEY: S - Supported; NS - Not Supported; NA - Not Applicable

Table 3-1 Network Features
(Page 1 of 2)

FEATURE	ASYNCHRONOUS	X.25	X.75
Extended Packet Sequence Numbering Module 128	NA	S	S
Nonstandard Default Window Sizes	NA	S	S
Default throughput Classes Assignment	S	S	NA
Incoming Calls Barred	S	S	S
Outgoing Calls Barred	S	S	S
One-way Logical Channel Outgoing	S	S	NA
One-way Logical Channel Incoming	S	S	NA
Closed User Group	S	S	S
CUG with Outgoing Access	S	S	S
CUG with Incoming Access	S	S	NA
Incoming Calls Barred Within a CUG	S	S	NA
Outgoing Calls Barred Within a CUG	S	S	NA
Reverse Charging	S	S	S
Reverse Charging Acceptance	S	S	S
RPOA Selection	S	S	S
Nonstandard Default Packet Sizes	S	S	S
Multiple Circuits to the same DTE	NA	S	NA
Flow Control Parameter Negotiation	S	S	S
Throughput Class Negotiation	S	S	S
Fast Select	S	S	S
Fast Select Acceptance	S	S	NA
Closed User Group Selection	S	S	S
Local Charging Prevention	S	S	NA
Network User Identification	S	S	NS
Charging Information	S	S	NA
Multi-Line Hunt Group	S	S	NA
Call Redirection	S	S	NA
Call Line Address Modification Notification	S	S	NS
Call Redirection Notification	S	S	NA
Direct Call	S	NA	NA
Packet Retransmission	NS	NS	NS
Bilateral Closed User Group	NS	NS	NS

Table 3-1 Network Features
(Page 2 of 2)

FEATURE	ASYNCHRONOUS	X.25	X.75
Window Size Indication	NA	NA	S
Utility Marker	NA	NA	S
Bilateral CUG with Outgoing Access	NS	NS	NS
On-line Facility Registration	NS	NS	NS
Multiple Trunks with the Same Address	S	S	S
Abbreviated Address Calling	S	NA	NA
Setting Values of PAD Parameters	S	NA	NA
Reading Values of PAD Parameters	S	NA	NA
Automatic Detection of: Data Rate Code and Operational Characteristics	S	NA	NA
PAD Recall	S	NA	NA
Echo	S	NA	NA
Selection of Data Forwarding Signal	S	NA	NA
Selection of Idle Time Delay	S	NA	NA
Ancillary Device Control	S	NA	NA
Suppression of PAD Service Signals	S	NA	NA
Selection of Operation of PAD on Receipt of Break	S	NA	NA
Discard Output	S	NA	NA
Padding After Carriage Return	S	NA	NA
Line Folding	S	NA	NA
Binary Speed (Read Only)	S	NA	NA
Flow Control of PAD by Start-Stop Mode DTE	S	NA	NA
Linefeed Insertion	S	NA	NA
Linefeed Padding	S	NA	NA
Editing Functions	S	NA	NA
Parity Functions	S	S	NA
Standard Profile Selections	S	S	S
Permanent Virtual Circuits	NS	S	NS
D-bit Modification	NS	S	NS
Transmit Delay Selection and Notification	NS	NS	NS
Bilateral CUG Selection	NA	NA	S
Transit Network Identification	NA	NA	S
Call Identifier			

Note: Network features supported may change with updated tariff filings.

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Tables

4. QWEST DIGIPAC® Physical Interface

4.1 Overview

This Chapter describes the physical interface with the DIGIPAC® Network. Descriptions for the Line, Modem, Data Service Unit (DSU) and DIGIPAC® Network port are addressed. In this document, Modem is used generically to identify either an analog data Modem or a digital data DSU. Modems attached to the DIGIPAC® Network must be compatible with the description shown for each type of service. If not compatible, the customer provided modem will not be able to communicate with the associated DIGIPAC® modem located in the Central Office (CO).

Tables 4-1 through 4-5 specify the options for the modem types required to accommodate the DIGIPAC® asynchronous dial services. These tables provide a description of each selected option and whether the option is required or recommended for the customer. The options are intended to be generic to a given modem. The customer provided modem may have different technology or text to describe each option; with fewer or more options than addressed. Table 4-6 list compatible Network Channel (NC) and Network Channel Interface (NCI) code combinations to assist the customer with NC and NCI selections.

A glossary section is provided Chapter 5 to assist the customer in understanding the terminology used in this section. Your QWEST Marketing Representative may be contacted for assistance with questions and for further clarification.

4.2 Dial Access

DIGIPAC® supports dial access ports that provide a full duplex interface, from 300 up to 28000 bits/s. However, even though the modems used for DIGIPAC® dial access can support speeds up to 28000 bits/s, the transmission speed on each connection will likely be lower than 28000 bits/s due to factors such as customer line limitations. DIGIPAC® Public dial access ports are configured as auto reverse charge.

The DIGIPAC® Network modem and customer provided modem use and autobaud procedure to detect and implement the channel data rate. This procedure is specified in Chapter 1 of this Technical Publication.

After a disconnect in the physical level by either the user or the network, the network modem prevents subsequent connections to dial port until after the user's session is cleared. This requirement prevents another user from being connected to this port and thus, being connected to the previous session.

4.3 Direct Access

DIGIPAC® no longer supports direct access (dedicated access) for asynchronous services.

4.4 Physical Interface Description

4.4.1 Dial Access - Asynchronous Analog - 300/1200 bit/s

Line: 2-Wire; Business/Residence; 1 party

Modem: 212A compatible; Full duplex operation

Interface specifications and operation in accordance with United States Telephone Association (USTA) document TA20, "Compatibility Criteria for Data Set 212A", September 1977.

See Table 4-1 for options

Port: EIA RS-232-C; recommended EIA-232-D

4.4.2 Dial Access - Asynchronous - 2400/1200 bit/s

Line: 2-Wire; Business/Residence; 1 party

Modem: CCITT V.22 bis/212A compatible; Full duplex operation

Interface specifications and operation in accordance with CCITT Recommendation V.22 bis - 1988 "2400 Bit/s Per Second Duplex Modem Using The Frequency Division Technique Standardized For Use On The General Switched Telephone Network and On Point-To-Point 2-Wire Leased Telephone-Type Circuits".

Optional ITU-T V.42 error correction

Error correction procedures in compliance with ITU-T Recommendation V.42 - 1994 "Error Correction Procedures For DCEs Using Asynchronous To Synchronous Conversion" specifications for LAPM.

See Table 4-2 for options

Port: EIA RS-232-C; recommended EIA-232-D

4.4.3 Dial Access - Asynchronous - 9600 bit/s

Line: 2-Wire; Business/Residence; 1 party

Modem: ITU-T V.32 compatible using Trellis Coded Modulation scheme

Interface specifications and operation in accordance with ITU-T Recommendation V.32 - 1994 "A Family Of 2-Wire Modems Operating At Data Signaling Rates Of Up To 9600 bit/s For Use On The General Switched Telephone Network and On Leased Telephone-Type Circuits".

Optional ITU-T V.42 error correction

Error correction procedures in compliance with ITU-T Recommendation V.42 - 1994 "Error Correction Procedures For DCEs Using Asynchronous To Synchronous Conversion" specifications for LAPM.

See Table 4-3 for options

Port: EIA RS-232-D; (CCITT V.24/V.28/V.54)

4.4.4 Dial Access - Asynchronous - 14400 bit/s

Line: 2-Wire; Business/Residence; 1 party

Modem: ITU-T V.32*bis* compatible using Trellis Coded Modulation scheme

Interface specifications and operation in accordance with ITU-T Recommendation V.32*bis* - 1992 "A Duplex Modems Operating At Data Signaling Rates Of Up To 14400 bit/s For Use On The General Switched Telephone Network and On Leased Point-To-Point 2-Wire Telephone-Type Circuits".

Optional ITU-T V.42 error correction

Error correction procedures in compliance with ITU-T Recommendation V.42 - 1994 "Error Correction Procedures For DCEs Using Asynchronous To Synchronous Conversion" specifications for LAPM.

Optional ITU-T V.42*bis* data compression

Data compression procedures in compliance with ITU-T Recommendation V.42*bis* - 1992 "Data Compression Procedures for Data Circuit Teminating Equipment (DCE) Using Error Correction Procedures".

See Table 4-4 for options

Port: EIA RS-232-D; (CCITT V.24/V.28/V.54)

4.4.5 Dial Access - Asynchronous - 28000 bit/s

Line: 2-Wire; Business/Residence; 1 party

Modem: ITU-T V.34 compatible using Trellis Coded Modulation scheme

Interface specifications and operation in accordance with ITU-T Recommendation V.34 - 1994 "A Modem Operating At Data Signaling Rates Of Up To 28000 bit/s For Use On The General Switched Telephone Network and On Leased Point-To-Point 2-Wire Telephone-Type Circuits".

Optional ITU-T V.42 error correction

Error correction procedures in compliance with ITU-T Recommendation V.42 - 1994 "Error Correction Procedures For DCEs Using Asynchronous To Synchronous Conversion" specifications for LAPM.

Optional ITU-T V.42*bis* data compression

Data compression procedures in compliance with ITU-T Recommendation V.42*bis* - 1992 "Data Compression Procedures for Data Circuit Teminating Equipment (DCE) Using Error Correction Procedures".

See Table 4-5 for options

Port: EIA RS-232-D; (CCITT V.24/V.28/V.54)

Table 4-1 Dial Access - Asynchronous - 300/1200 bit/s 212A Compatible - (2-Wire)
(Page 1 of 2)

REQUIRED MODEM OPTIONS (DIGIPAC® AND CUSTOMER)	
1.	Switched network operation.
2.	Communication protocol: 212A recommendations for 1200 bit/s operation.
3.	Asynchronous operation.
4.	Data rate: 1200 bit/s/300 bit/s (Dual/Autobaud operation).
5.	Character length: 10 bit/s per character including start and stop bit/s.
6.	Transmit signal level: -9.0 dBm (Permissive).
7.	Line impedance: 600 ohms.
8.	Controlled transmit carrier; dependent on the ON and OFF transition of DTE interface signal Request To Send.
9.	Received Line Signal Detector (CF) functions normally, that is, turns on and off in response to the on and off transition of received carrier.
10.	Data Terminal Ready (CD) is transitive. An OFF transition causes the modem to disconnect the data connection (go on-hook) and disable auto answer.
11.	Loss of carrier disconnect, enabled. Modem will terminate data connection when loss of received carrier is detected for more than approximately 350 ms.
12.	DTE control of data rate via the CH lead (pin 23), disabled. Terminal cannot control modem data rate.
13.	Send space disconnect, enabled. Transmits approximately 4 seconds of spaces at end of call to disconnect remote modem.
14.	Receive space disconnect, enabled. Modem disconnects upon receiving approximately 1.6 seconds of space signal from remote modem.

Table 4-1 Dial Access - Asynchronous - 300/1200 bit/s 212A Compatible - (2-Wire)
(Page 2 of 2)

	DIGIPAC® MODEM OPTIONS
1.	Clear To Send lead (CB) forced OFF when Received Line Signal Detector (CF) goes OFF. CB lead is common to CF lead.
2.	Ring indicator lead (CE), pin 22, is on during ringing only.
3.	Automatic answering, enabled. Calls are answered by modem.
4.	Operates as an Answer/Originate modem.
5.	Data rate indicator to DTE via the CI lead (pin 12), disabled. CI lead (pin 12) not a functional DIGIPAC® port interface lead.
6.	Data Set Ready (CC lead, pin 6) forced ON during Analog Loopback test, or continuously.
7.	DTE control of Analog Loopback via the LL lead, enabled and assigned to pin 18.
8.	Modem goes off-hook (busy) when an Analog Loopback test is invoked.
9.	DTE control of Remote Digital Loopback via pin 21, enabled.
10.	Enable modem's ability to respond to Remote Digital Loopback (RDL) signal from remote modem. The modem responds to a digital loopback signal generated by the far end modem.
	Test mode indication to DTE via the TM lead (pin 25), enabled.
11.	Signal quality abort, disabled. Modem does not disconnect and hang up when the received signal quality deteriorates.
12.	Frame and signal grounds separated by 100 ohms.
13.	

Table 4-2 Dial Access - Asynchronous - 2400/1200 bit/s CCITT Recommendation V.22 bis/212A Compatible - (2-Wire)
(Page 1 of 2)

REQUIRED MODEM OPTIONS (DIGIPAC® AND CUSTOMER)	
1.	Switched network operation.
2.	Communication protocol compatibility: CCITT for 2400 bit/s, 212A for 1200 bit/s
3.	Asynchronous operation.
4.	Data rate 2400 bit/s; Autobaud: 2400 bit/s/1200 bit/s.
5.	Character length: 10 bit/s per character including start and stop bit/s.
6.	Transmit signal level: -9.0 dBm (Permissive).
7.	Line impedance: 600 ohms.
8.	Controlled transmit carrier; dependent on the ON and OFF transition of DTE interface signal Request To Send.
9.	Received Line Signal Detector (CF) functions normally, that is, turns on and off in response to the on and off transition of received carrier.
10.	Data Terminal Ready (CD) is transitive. An OFF transition causes the modem to disconnect the data connection (go on-hook) and disable auto answer.
11.	Loss of carrier disconnect, enabled. Modem will terminate data connection when loss of received carrier is detected for more than approximately 350 ms.
12.	DTE control of data rate via the CH lead (pin 23), disabled. Terminal cannot control modem data rate.
13.	Send space disconnect, enabled. Transmits approximately 4 seconds of spaces at end of call to disconnect remote modem.
14.	Receive space disconnect, enabled. Modem disconnects upon receiving approximately 1.6 seconds of space signal from remote modem.
15.	Optional Error Correction Procedures per CCITT Recommendation V.42, enabled according to service requested.

Table 4-2 Dial Access - Asynchronous - 2400/1200 bit/s CCITT Recommendation V.22 bis/212A Compatible - (2-Wire)
(Page 2 of 2)

	DIGIPAC® MODEM OPTIONS
1.	Clear To Send lead (CB) forced OFF when Received Line Signal Detector (CF) goes OFF. CB lead is common to CF lead.
2.	Ring indicator lead (CE), pin 22, is on during ringing only.
3.	Automatic answering, enabled. Calls are answered by modem.
4.	Operates an Answer/Originate modem.
5.	Data rate indicator to DTE via the CI lead (pin 12), disabled. CI lead (pin 12) not a functional DIGIPAC® port interface lead.
6.	Data Set Ready (CC lead, pin 6) forced ON during Analog Loopback test, or continuously.
7.	DTE control of Analog Loopback via the LL lead, enabled and assigned to pin 18.
8.	Modem goes off-hood (busy) when a Analog Loopback test is invoked.
9.	DTE control of Remote Digital Loopback via pin 21, enabled.
10.	Enable modem's ability to respond to Remote Digital Loopback (RDL) signal from remote modem. The modem responds to a digital loopback signal generated by the far end modem.
	Test mode indication to DTE via the TM lead (pin 25), enabled.
11.	Signal quality abort, disabled. Modem does not disconnect and hang up when the received signal quality deteriorates.
12.	Frame and signal grounds separated by 100 ohms.
13.	

Table 4-3 Dial Access - Asynchronous - 9600 bit/s CCITT Recommendation V.32 Compatible - (2-Wire) Using Trellis Coded Modulation
(Page 1 of 2)

REQUIRED MODEM OPTIONS (DIGIPAC® AND CUSTOMER)	
1.	Communication Protocol Compatibility: CCITT
2.	Switched Network Operation.
3.	Data Transmission: Asynchronous Operation.
4.	Trellis Coded Modulation, Enabled.
5.	Data Rate: 9600 Bit/s
6.	Character Length: 10 Bit/s Per Character Including Start and Stop Bit/s
7.	Transmit Signal Level: -9.0 dBm - Permissive.
8.	Constant Transmit Carrier. Carrier Stays On Independent Of RTS From The DTE.
9.	Line Independence: 600 Ohms.
10.	Send Space Disconnect, Enabled. Transmits 2 To 4 Seconds Of Spaces At End Of Call To Disconnect Remote Modem.
11.	Receive Space Disconnect, Enabled. Modem Disconnects Upon Receiving Approximately 2 Seconds Of Space Signal From Remote Modem.
12.	Loss Of Carrier Disconnect, Enabled. Modem will terminate data connection when loss of received carrier is detected for more than approximately 350 ms.
13.	Optional Error Correction Procedures Per CCITT Recommendation V.42, Enabled According To Service Requested.

Table 4-3 Dial Access - Asynchronous - 9600 bit/s CCITT Recommendation V.32 Compatible - (2-Wire) Using Trellis Coded Modulation
(Page 2 of 2)

	DIGIPAC® MODEM OPTIONS
1.	Dialing mode is Duel Tone Multiple Frequency (DTMF).
2.	Asynchronous overspeed/underspeed correction limit: 2.5%
3.	Request To Send (CA/105) To Clear To Send (CB/106) delay: within 2 ms.
4.	Received Line Signal Detector, circuit CF/l09 (pin 8) turns OFF and ON in response to the OFF and ON transitions of received carrier, not forced ON.
5.	Data Terminal Ready (CD) is transitive. An OFF transition causes the modem to terminate the connection (go on-hook), then return to the command mode.
6.	DTE control of data rate via circuit CH/111 (pin 23), disabled. Terminal cannot control modem data rate.
7.	Ring indicator circuit CE/125 (pin 22), is on during ringing only.
8.	Automatic answering, enabled. Modem automatically answers calls and switches to data mode.
9.	Data Set Ready (circuit CC/107) normal, indicates when modem is ready to exchange control signals with the DTE to initiate transfer of data.
10.	Data Set Ready (circuit CC/107) forced ON during Analog Loopback test.
11.	DTE control of Analog Loopback via circuit LL/141, enabled and assigned to pin 18.
12.	Modem goes off-hood (busy) when an Analog Loopback test is invoked.
13.	DTE control of Remote Digital Loopback via circuit RL/140 (pin 21), enabled.
14.	Enable modem's ability to respond to Remote Digital Loopback (RDL) signal from remote modem. The modem responds to a digital loopback signal generated by the far end modem. Test mode indication to DTE via circuit TM/142, (pin 25), enabled.
15.	Signal quality abort, enabled. Modem will initiate retrain procedures upon detection of unsatisfactory signal reception or loss or equalization.
16.	Frame and signal grounds separated by 100 ohms.
17.	

Table 4-4 Dial Access - Asynchronous - 14400 bit/s ITU-T Recommendation V.32 *bis* Compatible - (2-Wire) Using Trellis Coded Modulation
(Page 1 of 2)

REQUIRED MODEM OPTIONS (DIGIPAC® AND CUSTOMER)	
1.	Communication Protocol Compatibility: ITU-T
2.	Switched Network Operation.
3.	Data Transmission: Asynchronous Operation.
4.	Trellis Coded Modulation, Enabled.
5.	Data Rate: 14400 Bit/s
6.	Character Length: 10 Bit/s Per Character Including Start and Stop Bit/s
7.	Transmit Signal Level: -9.0 dBm - Permissive.
8.	Constant Transmit Carrier. Carrier Stays On Independent Of RTS From The DTE.
9.	Line Independence: 600 Ohms.
10.	Send Space Disconnect, Enabled. Transmits 2 To 4 Seconds Of Spaces At End Of Call To Disconnect Remote Modem.
11.	Receive Space Disconnect, Enabled. Modem Disconnects Upon Receiving Approximately 2 Seconds Of Space Signal From Remote Modem.
12.	Loss Of Carrier Disconnect, Enabled. Modem will terminate data connection when loss of received carrier is detected for more than approximately 350 ms.
13.	Optional Error Correction Procedures Per CCITT Recommendation V.42, Enabled According To Service Requested.
14.	Optional Data Compression Procedures Per ITU-T Recommendation V.42*bis*. Enabled According To Service Requested and 13 above is enabled as well.

Table 4-4 Dial Access - Asynchronous - 14400 bit/s ITU-T Recommendation V.32 *bis* Compatible - (2-Wire) Using Trellis Coded Modulation
(Page 2 of 2)

	DIGIPAC® MODEM OPTIONS
1.	Dialing mode is Duel Tone Multiple Frequency (DTMF).
2.	Asynchronous overspeed/underspeed correction limit: 2.5%
3.	Request To Send (CA/105) To Clear To Send (CB/106) delay: within 2 ms.
4.	Received Line Signal Detector, circuit CF/l09 (pin 8) turns OFF and ON in response to the OFF and ON transitions of received carrier, not forced ON.
5.	Data Terminal Ready (CD) is transitive. An OFF transition causes the modem to terminate the connection (go on-hook), then return to the command mode.
6.	DTE control of data rate via circuit CH/111 (pin 23), disabled. Terminal cannot control modem data rate.
7.	Ring indicator circuit CE/125 (pin 22), is on during ringing only.
8.	Automatic answering, enabled. Modem automatically answers calls and switches to data mode.
9.	Data Set Ready (circuit CC/107) normal, indicates when modem is ready to exchange control signals with the DTE to initiate transfer of data.
10.	Data Set Ready (circuit CC/107) forced ON during Analog Loopback test.
11.	DTE control of Analog Loopback via circuit LL/141, enabled and assigned to pin 18.
12.	Modem goes off-hood (busy) when an Analog Loopback test is invoked.
13.	DTE control of Remote Digital Loopback via circuit RL/140 (pin 21), enabled.
14.	Enable modem's ability to respond to Remote Digital Loopback (RDL) signal from remote modem. The modem responds to a digital loopback signal generated by the far end modem. Test mode indication to DTE via circuit TM/142, (pin 25), enabled.
15.	Signal quality abort, enabled. Modem will initiate retrain procedures upon detection of unsatisfactory signal reception or loss or equalization.
16.	Frame and signal grounds separated by 100 ohms.
17.	

Table 4-5 Dial Access - Asynchronous - 28800 bit/s ITU-T Recommendation V.34 Compatible - (2-Wire) Using Trellis Coded Modulation
(Page 1 of 2)

REQUIRED MODEM OPTIONS (DIGIPAC® AND CUSTOMER)	
1.	Communication Protocol Compatibility: CCITT
2.	Switched Network Operation.
3.	Data Transmission: Asynchronous Operation.
4.	Trellis Coded Modulation, Enabled.
5.	Data Rate: 28800 Bit/s (Actual data rate per call will, more than likely, be less than 28800 Bit/s due factors in the network such as impairments on customer line.)
6.	Character Length: 10 Bit/s Per Character Including Start and Stop Bit/s
7.	Transmit Signal Level: -9.0 dBm - Permissive.
8.	Constant Transmit Carrier. Carrier Stays On Independent Of RTS From The DTE.
9.	Line Independence: 600 Ohms.
10.	Send Space Disconnect, Enabled. Transmits 2 To 4 Seconds Of Spaces At End Of Call To Disconnect Remote Modem.
11.	Receive Space Disconnect, Enabled. Modem Disconnects Upon Receiving Approximately 2 Seconds Of Space Signal From Remote Modem.
12.	Loss Of Carrier Disconnect, Enabled. Modem will terminate data connection when loss of received carrier is detected for more than approximately 350 ms.
13.	Optional Error Correction Procedures Per CCITT Recommendation V.42, Enabled According To Service Requested.
14.	Optional Data Compression Procedures Per ITU-T Recommendation V.42*bis*. Enabled According To Service Requested and 13 above is enabled as well.

Table 4-5 Dial Access - Asynchronous - 28800 bit/s ITU-T Recommendation V.34 Compatible - (2-Wire) Using Trellis Coded Modulation
(Page 2 of 2)

	DIGIPAC® MODEM OPTIONS
1.	Dialing mode is Duel Tone Multiple Frequency (DTMF).
2.	Asynchronous overspeed/underspeed correction limit: 2.5%
3.	Request To Send (CA/105) To Clear To Send (CB/106) delay: within 2 ms.
4.	Received Line Signal Detector, circuit CF/l09 (pin 8) turns OFF and ON in response to the OFF and ON transitions of received carrier, not forced ON.
5.	Data Terminal Ready (CD) is transitive. An OFF transition causes the modem to terminate the connection (go on-hook), then return to the command mode.
6.	DTE control of data rate via circuit CH/111 (pin 23), disabled. Terminal cannot control modem data rate.
7.	Ring indicator circuit CE/125 (pin 22), is on during ringing only.
8.	Automatic answering, enabled. Modem automatically answers calls and switches to data mode.
9.	Data Set Ready (circuit CC/107) normal, indicates when modem is ready to exchange control signals with the DTE to initiate transfer of data.
10.	Data Set Ready (circuit CC/107) forced ON during Analog Loopback test.
11.	DTE control of Analog Loopback via circuit LL/141, enabled and assigned to pin 18.
12.	Modem goes off-hood (busy) when an Analog Loopback test is invoked.
13.	DTE control of Remote Digital Loopback via circuit RL/140 (pin 21), enabled.
14.	Enable modem's ability to respond to Remote Digital Loopback (RDL) signal from remote modem. The modem responds to a digital loopback signal generated by the far end modem. Test mode indication to DTE via circuit TM/142, (pin 25), enabled.
15.	Signal quality abort, enabled. Modem will initiate retrain procedures upon detection of unsatisfactory signal reception or loss or equalization.
16.	Frame and signal grounds separated by 100 ohms.
17.	

Table 4-6 NC and NCI Code Combinations - Private Dial

SPEED (bit/s)	SERVICE	MODEM OPERATION	CHANNEL TYPE	NC CODE	NCI CODE CKL1-PS	NCI CODE CKL2-CS
2400	Async	CCITT V.22 bis	VG32	UC- -	02DM2.8PA.NW	02LO3..SS
	Async	CCITT V.22 bis & V.42	VG32	UC- -	02DM2.8PB.NW	02LO3..SS
9600	Async	CCITT V.32	VG32	UC- -	02DM2.9PA.NW	02LO3..SS
	Async	CCITT V.32 & V.42	VG32	UC- -	02DM2.9PB.NW	02LO3..SS
	Synch	CCITT V.32	VG32	UC- -	02DM2.9PS.NW	02LO3..SS
14400	Async	ITU-T V.32bis & V.42	VG32	UC- -	02DM2.BPB.NW	02LO3..SS
	Async	ITU-T V.32bis, V.42 & V.42bis	VG32	UC- -	02DM2.BPC.NW	02LO3..SS
28800	Async	ITU-T V.34 & V.42	VG32	UC- -	02DM2.CPB.NW	02LO3..SS
	Async	ITU-T V.34, V.42 & V.42bis	VG32	UC- -	02DM2.CPC.NW	02LO3..SS

CONTENTS

Chapter and Section **Page**

5. Definitions

5.1 Acronyms

AC	Access Concentrator
AMA	Automatic Message Accounting
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
BCD	Binary Coded Decimal
BOC	Bell Operating Company
bps	Bits per Second
CCA	Credit Card Association (CCA)
CCITT	International Telegraph and Telephone Consultative Committee
CO	Central Office
CPE	Customer Provided Equipment
CSU	Channel Service Unit
CUD	Call User Data
CUG	Closed User Group
DCE	Data Circuit-Terminating Equipment
DDD	Direct Distance Dialing
DDS	Digital Data System
DISC	Disconnect
DM	Disconnect Mode
DNIC	Data Network Identification Code
DNPA	Data Numbering Plan Area
DOV	Data Over Voice
DSU	Data Service Unit
DSP	Display System Protocol
DTE	Data Terminal Equipment
DVM	Data/Voice Multiplexer
EIA	Electronic Industries Association
F	Final bit

FCS	Frame Checking Sequence
FRMR	Frame Reject
HDLC	High Level Data Link Control
I	Information
IA5	International Alphabet No. 5
IC	Interexchange Carrier
INIC	ISDN Network Identifier Code
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISP	Information Service Provider
Kbps	Kilobits per second
LAPB	Link Access Procedure Balanced
LATA	Local Access and Transport Area
LC	Logical Channel
LCN	Logical Channel Number
LRC	Logical Channel Number
MLHG	Multi-line Hunt Group
MNP®	Microcom Networking Protocol
MTCE	Maintenance
NPA	Numbering Plan Area
N(R)	Receive Sequence Number
N(S)	Send Sequence Number
NTN	Network Terminal Number
NUI	Network User Identification
OOS	Out of Service
OSI	Open Systems Interconnection
OTC	Operating Telephone Company
P	Poll
PAD	Packet Assembler/Disassembler
PDN	Public Data Network
PHF	Packet Handler Function

POS	Point-Of-Sale
PPSN	Public Packet Switching Network
PPSNGR	Public Packet Switching Network Generic Requirement
PS	Packet Switch
PSDN	Packet Switched Data Network
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
PVC	Permanent Virtual Circuit
RC	Recent Change
RCVS	Recent Change and Verify Subsystem
REJ	Reject
RES	Reset
RNR	Receive Not Ready
RPOA	Recognized Private Operating Agency
RR	Receive Ready (packets or frames)
SABM	Set Asynchronous Balanced Mode
SABME	Set Asynchronous Balanced Mode Extended
STE	Signaling Terminal Equipment
SVC	Switched Virtual Calls
UA	Unnumbered Acknowledgment
USTA	United States Telephone Association
VC	Virtual Call
V(R)	Receive State Variable
V(S)	Send State Variable
XID	Exchange Identification

5.2 Glossary

Asynchronous Transmission

Data transmission in which the time of occurrence of a specified significant instant in each byte, character, word, block or other unit of data (usually the leading edge of a start signal) is arbitrary, and occurs without necessarily being dependent on preceding signals on the channel.

Baud

Denotes a unit of signaling speed. It is the reciprocal of the time duration in seconds of the shortest signal element (mark or space) within a code signal. The rates specified are the number of signal elements per second.

Bit

An abbreviation of binary digit; one of the members of a set of two in the binary numeration system, e.g., either of the digits 0 or 1. Also, a unit of information; one bit of information is sufficient to specify one of two equally like possibilities, usually meaning yes or no.

Bits Per Second (BPS)

Unit of data transmission rate (see baud).

Carrier Detect (DCD)

See Received Line Signal Detector.

Character

Letter, numeral, punctuation, control figure or any other symbol contained in a message.

Clear To Send (CTS)

An EIA-232 interface control signal that indicates to the DTE whether or not the modem is ready to transmit data.

Conditioning

Denotes an enhancement to the transmission performance of a voiceband channel. Parameter(s) affected are attenuation distortion, envelope delay, distortion and noise.

Consultative Committee International Telephone and Telegraph (CCITT)

An international association that sets international telecommunications standards.

Data Communications Equipment (DCE)

The equipment that provides the functions required to establish, maintain and terminate data transmission connection; e.g., a modem, as well as the signal conversion, and coding required for communications between data terminal equipment and data circuit.

Data Set Ready (DSR)

An EIA-232 interface control signal that indicates to the DTE the status of the local modem; e.g., modem is connected to communications channel and is not in the test or dial mode.

Data Terminal Equipment (DTE)

Customer owned equipment used to transmit and receive data.

Data Terminal Ready (DTR)

An EIA-232 interface control signal that indicates to the modem the DTE is ready to transmit or receive data.

Dial Access

Access to the packet switch is via the voice Public Switched Network.

Digital Service Unit (DSU)

A DCE device that converts EIA-232-D or CCITT V.35 signals (from the packet switch) to baseband bipolar line signals suitable for transmission over a telephone channel.

Direct Access

Access to the packet switch is via a dedicated channel between the End-User and the packet switch.

Full Duplex

Simultaneous transmission in both directions between two points.

Half Duplex

Data transmission in either direction, but not simultaneously.

Line

The transport facility (cable pair or carrier) between the Central Office and Network Channel Interface.

Link Access Procedure For Modems (LAP-M)

An error correction procedure defined in CCITT Recommendation V.42-1988.

Loopback

A test procedure that causes a received signal to be returned to the source.

Modem

A DCE device that converts EIA-232-D or CCITT V.35 signals (from the packet switch) to voiceband signals suitable for transmission over a telephone channel.

Port

An EIA-232 or CCITT V.35 I/O interface of a packet switch, computer or modem.

Received Line Signal Detector

An EIA-232 interface control signal that indicates to an attached DTE device that the modem is receiving a signal from a remote modem.

Request to Send (RTS)

An EIA-232 interface control signal that indicates the DTE has data to transmit and conditions the modem for data transmission.

Ring Indicator

An EIA-232 control interface signal, which indicates to the DTE that a ringing signal is being received on the communications channel.

Start Bit

In asynchronous transmission, the first bit in each character, normally a space, which prepares the receiving equipment for the reception and registration of the character.

Stop Bit

In asynchronous transmission, the last bit, used to indicate the end of a character, normally a mark condition, which serves to return the line to its idle or rest state.

Switch Network

Data transmission and access to DIGIPAC® is via the voice Public Switched Network.

Synchronous Transmission

Transmission in which the occurrence of a specified event (e.g., byte, character, word, block or other unit of data, such as the leading edge of a start signal), occurs in a specified time relationship with a preceding signal in the channel, in accordance with a specified timing pulse, or in accordance with a specified time frame.

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6. References

6.1 American National Standards Institute

ANSI X3.4 Denotes the code character set to be used for the general interchange of information among information-processing systems, communications systems and associated equipment.

6.2 AT&T Publication

PUB 62310 *"Digital Data System Channel Interface Specification"*, September 1983.

6.3 Telcordia Publications

TR-NPL-000011 Bellcore, *Asynchronous Terminal and Host Interface Reference,* Issue 1

TR-TSY-000301 Bellcore, *Public Packet Switched Network Generic Requirements* , Issue 2

TR-TSY-000448 Bellcore, *ISDN Routing and Digit Analysis* , Issue 1, Revision 1

6.4 Consultative Committee International Telephone And Telegraph

CCITT Recommendation V.3 International Alphabet No. 5

CCITT Recommendation V.22*bis* 2400 Bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-Wire leased telephone-type circuits.

CCITT Recommendation V.24 Defines physical and electrical connection between data terminal equipment and data communications equipment.

CCITT Recommendation V.26 2400 BPS modem standardized for use on 4-Wire leased telephone-type circuits.

CCITT Recommendation V.27 4800 BPS with manual equalizer standardized for use on leased telephone-type circuits.

CCITT Recommendation V.29 9600 BPS modem standardized for use on leased telephone-type circuits.

CCITT Recommendation V.32	A family of 2-Wire duplex modems operating at data signaling rates of up to 9600 bit/s for use on the general switched telephone network and on leased telephone-type circuits.
CCITT Recommendation V.32*bis*	A family of 2-Wire duplex modems operating at data signaling rates of up to 14400 bit/s for use on the general switched telephone network and on leased telephone-type circuits.
CCITT Recommendation V.34	A family of 2-Wire duplex modems operating at data signaling rates of up to 28800 bit/s for use on the general switched telephone network and on leased telephone-type circuits.
CCITT Recommendation V.35	Modems for Synchronous Data Transmission using 60-108 Khz Group Band Circuits (Replaced by V.36)
CCITT Recommendation V.36	Data Transmission at 48 Kilobits per second using 60-108 Khz Group Band Circuits
CCITT Recommendation V.42	Error-correction procedures for DCEs using Asynchronous-Synchronous conversion.
CCITT Recommendation V.54	Loop back interface option associated with V.24.
CCITT Recommendation X.1	International user classes of service in Public Data Networks.
CCITT Recommendation X.2	International user services and facilities in Public Data Networks.
CCITT Recommendation X.3	Packet Assembly/Disassembly (PAD) facility in a Public Data Network.
CCITT Recommendation X.4	General Structure of Signals of International Alphabet. 5 Code for data transmission over Public Data Networks.
CCITT Recommendation X.21	Use on Public Data Networks of DTEs which are designed for interfacing to synchronous CCITT series V. recommendation modems.
CCITT Recommendation X.25	Interface between DTE and DCE for terminals operating in the packet mode on Public Data Networks.

CCITT Recommendation X.28	DTE/DEC Interface for start-stop mode data terminal equipment accessing the PAD facility in a Public Data Network situated in the same country.
CCITT Recommendation X.29	Procedures for the exchange of control information and user data between a PAD facility and a packet mode DTE or another PAD.
CCITT Recommendation X.32	Interface between data terminal equipment and data circuit terminating equipment for terminals operating in the Packet mode and accessing a packet switch Public Data Network through a public switched telephone network or an Integrated Services Digital Network or a circuit switch Public Data Network.
CCITT Recommendation X.75	Terminal and transit call control procedures and data transfer system on international circuits between packet switched data networks.
CCITT Recommendation X.87	Principles and procedures for realization of international facilities and network utilities in Public Data Networks.
CCITT Recommendation X.92	Hypothetical reference connections for public synchronous data networks.
CCITT Recommendation X.96	Call progress signals in Public Data Networks
CCITT Recommendation X.110	Routing principles for international public data services through Switched Public Data Networks of the same type.
CCITT Recommendation X.121	International numbering plan for Public Data Networks.

6.5 Electronic Industries Association

EIA RS-232-C	Defines physical and electrical connection between data terminal equipment and data communications equipment.

6.6 Pre-Divestiture Publication

PUB 41021	*"Digital Data System - Channel Interface Specifications"*, March 1973 and Addendum, October 1981

6.7 United States Telephone Association

USTA document TA20	*Compatibility Criteria for Data Set 212A,* September 1977

6.8 QWEST Communications, Inc. Technical Publications

PUB 77331 *"Digital Data Over Voice Digital Access Arrangements, Network Interface Specifications"*, Issue E, September 2001.

6.9 Ordering Information

All documents are subject to change and their citation in this document reflects the most current information available at the time of printing. Readers are advised to check status and availability of all documents.

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