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DMS-100 Family

Centrex IP Terminal (NTEX00)

Network Interface Specifcation

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NORTEL NETWORKS™

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Note 2: Significant changes and additions are marked with vertical bars in the outer page margins beside the changed or added information.

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Chapter 1: Introduction

This publication of NIS S228-1, Issue 01.01 is specifically intended as a guide for developers, designers, and users of customer provided terminal equipment which is to be directly, electrically, connected to the Centrex IP Terminal Proxy Server of the DMS-100.

This Specification represents Nortel Networks implementation of an interface to the Centrex IP Terminal Proxy Server based on Nortel Networks Unified Network IP Stimulus Protocol[1] (Unistim).

All pages in this issue of NIS S228–1 are numbered sequentially.

1.1 General

This document is intended as a disclosure document that defines the performance and compatibility requirements for terminal equipment that will be directly connected to the Terminal Proxy Server interface for Centrex IP Services.The document describes the physical, electrical and network protocol aspects of the Centrex IP Terminal (CIPT). It is intended for the use of both customers and manufactures. It is specifically intended for the developers, designers and users of customer provided terminal equipment.

The scope of the document should be sufficient to allow CPE manufacturers to design and build terminal sets that will satisfactorily function with the service. Actual implementations of the required functionality are generally not covered, but rather are left to the ingenuity of the designer. Specific implementations are occasionally suggested, but only where they serve to clarify the meaning.

In addition to meeting the performance and compatibility requirements given in this document, any terminal requirement that is to be connected to this network interface shall be in compliance with the network protection requirements that apply.

Centrex IP Service terminals will also be regulated under any radio frequency interference regulations that are applicable. Terminal equipment must comply with rules established for class B computing equipment.

1. Unified Network IP Stimulus Protocol, Release 1.0 DRAFT, Nortel Networks, R. Joly

1.2 Scope and objective

This document defines the characteristics of the interfaces between IP Terminals and the Centrex IP Terminal Proxy Server providing that service from the DMS-100 switch, the signaling procedures across the interfaces, and the capabilities provided by the DMS-100 switch to support the terminal.

It specifies how the terminals can gain access to the services and features provided by the DMS-100. It also describes the facilities available in the DMS-100 switch to support terminals, and suggests ways in which terminal manufacturers can exploit these facilities to complement the network-provided services.

Chapter 2: Network Interface Overview

2.1 General

The CIPT can use one of two available network interfaces. The choice of network interface is dependent upon the environment the terminal is being used in, LAN or Non-LAN.

2.2 LAN Based Environments

The standard interface of the CIPT can be either 10Base-T or 100Base-T as defined in ISO Standard 8802.3 / IEEE Std. 802.3. This interface is used whenever the terminal is used in a LAN based environment, such as a corporate office environment.

2.3 Non-LAN Based Environments

Residential and small business users who don't have access to LAN facilities can make use of the Nortel Networks 1 Megabit Modem network interface. This interface also provides a POTS failover capability in the event of electrical utility failure.

Chapter 3: Physical Layer Requirements

3.1 Introduction

Physical connection to the Network Interface is through an industry standard RJ-45 connector which supports the IEEE 802.3 (ISO/IEC 8802-3) 10Base-T twisted pair Ethernet standard. Pins 1,2,3, and 6 of the connector are used for transmit and receive. Pins 3&6 must be a pair, and pins 1&2 must be a pair.

3.2 Ethernet Hardware Addressing

Each device using an Ethernet interface requires a unique 48 bit physical address which is fixed in machine readable form on the interface hardware. No two devices have the same Ethernet address. Moving the hardware interface to a new terminal, or replacing a hardware interface that has failed changes the Ethernet address of the terminal.

In addition to recognizing its own physical address, a terminal is also required to recognize a network broadcast address (all 1's) used in transmitting to all stations simultaneously.

3.3 Capacity

Ethernet is a 10 Mbps bus with best effort delivery and distributed access control. While that is the total traffic capacity, it is not the total network throughput or speed due to collisions, retransmissions, and other network errors.

3.3.1 Collision Detection and Recovery

Ethernet access is controlled by Carrier Sense Multiple Access with Collision Detect (CSMA/CD). Transmissions along the ethernet cable travel at 80% of the speed of light, therefore it is possible for two distant transmitters on the same cable to sense the network is idle and begin transmitting, resulting in their signals colliding. When a collision is detected, the sender aborts transmission using a binary backoff policy, and waits for the network to become idle again before transmitting.

3.4 Extensions and Bridging

An Ethernet cable has a maximum length of 100 meters from its transmission source, e.g., its hub. This distance can be extended by a repeater, but only two

repeaters can be placed between any two machines, making the maximum distance 500 meters.

Bridges are superior to repeaters as they do not replicate noise, errors, or bad frames like repeaters do. A bridge relays traffic but isolates one networks from another. Bridges hide the interconnection details of a network, thereby allowing multiple networks to be connected through one bridge.

Chapter 4: Data Link Layer Requirements

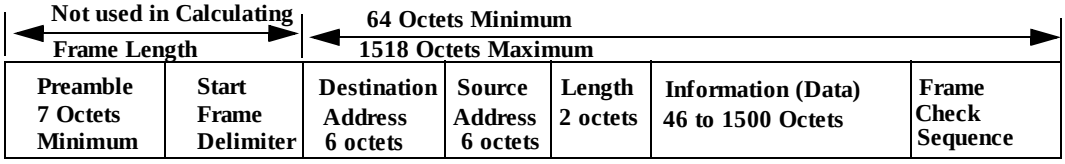
4.1 General

Network signaling is encapsulated within an Ethernet (ISO 8802-3 / IEEE 802.3) frame of variable length. No frame may be smaller than 64 octets, or larger than 1518 octets including header, data and FCS

4.2 Message Envelope Structure

Ethernet is a packet based protocol standard for Local Area Networks employing Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as the access method.

Figure 4.1 IEEE 802.3 Frame Structure



Higher layer protocols such as TCP/IP and Unistim are encapsulated within the Data field of the IEEE 802.3 frame structure. The Frame Check Sequence is a 32 bit Cyclic Redundancy Check used to detect transmission errors.

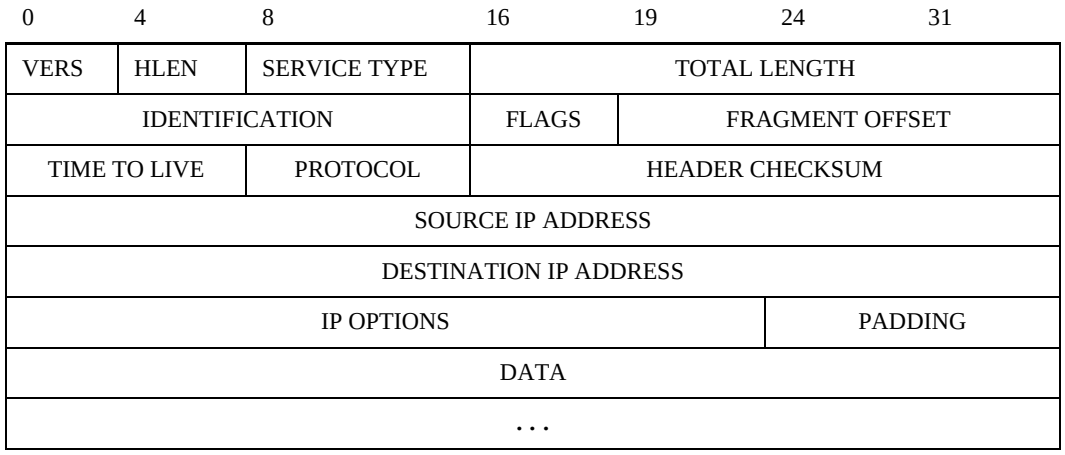
Chapter 5: Network (IP) Layer

5.1 Introduction

5.1.1 General

The Internet Telephony Services of the DMS-100 will support Internet Protocol Version 4 (IPv4 as defined by RFC 791) over a 10Base-T (Ethernet) loop (defined in ISO 8802-3 / IEEE 802.3). Protocols supported over this loop include the Internet Control Message Protocol (ICMP), Dynamic Host Configuration Protocol (DHCP), and User Datagram Protocol(UDP). The format of a generic IP datagram is shown in Figure 2, “IP Datagram Format”.

Figure 2 IP Datagram Format

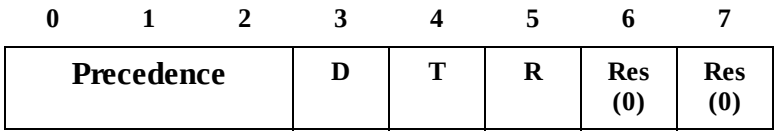


The four bit VERS field defines the version of the IP protocol being used. It is currently set to 4 (0100). Datagrams with an unrecognized version will be rejected.

The Header Length (HLEN) field is also four bits long and specifies the length of the IP header. In the absence of IP OPTIONS this field is normally set to 20 octets long, which gives the field a minimum value of 5 (0101).

The SERVICE TYPE field sets the Quality of Service level. RFC 791 defines the eight bits of this field as defined in Figure 3, “SERVICE TYPE Bit Definition”.

Figure 3 SERVICE TYPE Bit Definition



The Precedence bits specify the priority of the datagram, from 0 being used for routine datagram delivery to 7 being used for network control.

The D, T, and R bits specify the Delay, Throughput, and Reliability, respectively. The table below specifies the exact meaning of the bits.

Table 1 RFC 791 DTR Bit Definitions

D	T	R	Meaning
0			Normal Delay
1			Low Delay
	0		Normal Throughput
	1		High Throughput
		0	Normal Reliability
		1	High Reliability

Bit 6 has been proposed in RFC 1349 to mean “Minimize Monetary Cost”. As this RFC is not yet standard this bit will remain set to 0.

Bit 7 is reserved and is set to 0.

The TOTAL LENGTH field describes the length of the datagram (including both header and data) in octets. All hosts must accept datagrams up to 576 octets while always transmitting datagrams that exceed 576 octets

The IDENTIFICATION field identifies the datagram with a unique 16 bit number in case fragmentation becomes necessary.

The FLAGS field defines three flags used in processing fragments, if any. the first bit is reserved and is set to 0. The second bit controls whether or not fragmentation is allowed, and the third bit is sent when more fragments are to follow the current fragment.

The FRAGMENT OFFSET field defines the relative position of the fragment within the datagram structure.Measurement is done in 8 octet Fragment Blocks.

The TIME TO LIVE field defines the maximum time, in seconds, that the datagram may live on the internet. It is decremented by at least one at every hop (e.g. router) on its way to its destination. When the timer expires the datagram is discarded.

The PROTOCOL field identifies the next higher level protocol contained in the data area of the datagram. A list of well known protocols and their identification numbers is contained in RFC 1700.

The HEADER CHECKSUM field is an integrity check on the datagram header. It must be recalculated at every hop after the TIME TO LIVE field is modified.

The SOURCE IP and DESTINATION IP ADRESS fields have self evident definitions for specifying the transmitting host and final destination host.

The IP OPTIONS field consists of an 8 bit Option Type Octet defined in Figure 4, “Option Type Octet Definitions” below, an 8 bit Option Length octet (including Option Type, Length, and Data bits), and an Option Data octet.

Figure 4 Option Type Octet Definitions

Option Class	Option Number	Option Length	Option Name
0	0	-	End of Option List
0	1	-	No Operation
0	2	11	Security
0	3	Variable	Loose Source Routing
2	4	Variable	Internet Timestamp (round trip delay)
0	7	Variable	Route Record (source to destination)
0	8	4	Stream ID- obsolete
0	9	Variable	Strict Source Routing

The PADDING field ensures that the header ends on a 32 bit boundary.

Chapter 6: Transport Layer (UDP)

6.1 Introduction

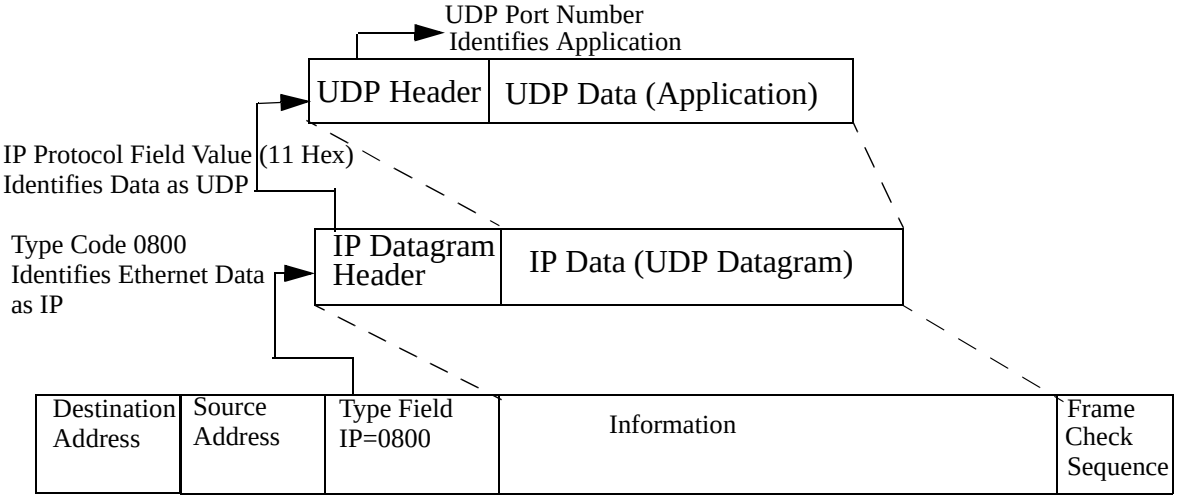
6.1.1 General

The Transport Layer uses the User Datagram Protocol (UDP), as described in RFC 768, to provide connectionless, best effort transmission of datagrams/packets.UDP assumes the underlying protocol is IP but relies on a Reliability layer above UDP to provide more reliability than what is provided by IP. UDP is in effect a queue, distributing datagrams to the desired port identified in the received datagram.

6.2 Unreliable Transport (UDP)

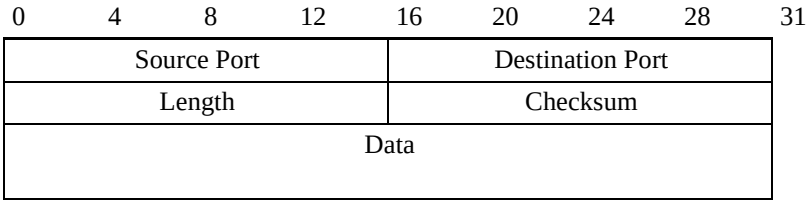
A UDP packet is encapsulated within the data area of an IP packet, which is itself encapsulated within the Information field of an Ethernet frame as shown in Figure 6-5, “UDP Encapsulation”. The UDP Header is depicted in Figure 6-6, “UDP Header Format”.

Figure 6-5 UDP Encapsulation



Ethernet (IEEE 802.3) Frame Structure

Figure 6-6 UDP Header Format



The Source Port field is optional. When used, it is the port to which all replies should be sent. Well Known Ports are defined in Table 6-1, “Well Known UDP Port Numbers”

Table 6-1 Well Known UDP Port Numbers

Port Number Decimal	Port No. Hex	Keyword	Description
7	0007	echo	Echo Protocol
9	0009	discard	Discard Protocol
11	000B	systat	Active Users Protocol
13	000C	daytime	Daytime Protocol
17	0011	qotd	Quote of the Day Protocol
19	0013	chargen	Character Generator Protocol
37	0025	time	Network Time Protocol
42	002A	nameserver	Host Name Server Protocol
43	002B	nicname	Who Is Protocol
53	0035	domain	Domain Name Server
67	0043	bootps	Boostrap Protocol (Server process)
68	0044	bootpc	Bootstrap Protocol (Client Process)
69	0045	tftp	Trivial File Transfer Protocol
161	00A1	snmp	Simple Network Management Protocol
162	00A2	Snmptrap	Simple Network Management Protocol Trap

6.3 Reliable UDP Layer

By definition, the UDP protocol is a “best effort” protocol and is unreliable where guaranteed delivery of packets is required. The network, however, must guarantee that a stimulus terminal receives every command intact and in sequence. A reliable layer on top of UDP is then necessary to transmit reliable data to stimulus terminals.

6.3.1 Go-Back-N

Go-Back-N is a Continuous Repeat Request error control scheme where the transmitter does not have to wait for an acknowledge message(ACK) before sending the next packet. The transmitter is responsible for appending a sequence number to every outgoing packet, and for managing retransmissions based on incoming ACK/NAK’s and time outs. The receiver is responsible for generating ACK for every correctly received packet, and NAK’s for packets received out of sequence. The rules that make up the Go-Back-N error control protocol layer are listed below. Each item in the list will be explained in detail in the following sections.

- Every packet sent contains a sequence number,
- Every packet received in sequence generates an ACK containing the sequence number of the packet,
- Every packet received out-of-sequence generates a NAK containing the sequence number of the packet,
- Every packet that is not acknowledged after a time-out period is re-sent,
- When a NAK is received, the transmitter restarts the transmission at the sequence number contained in the NAK packet,
- An ACK received for packet n automatically acknowledges all packets that have been transmitted before packet n and have not yet been acknowledged.

6.3.1.1 Sequence Number

The transmitter adds a sequence number on every outgoing packet. This sequence number is used at the receiver side to ACK in-sequence packets and NAK out-of-sequence ones. The sequence number is a 16-bit integer that starts at 0x0000. This sequence number occupies the first two bytes of the UDP payload (MSByte first). The data to transmit follows the sequence number.

UDP Byte Position	Byte Contents
Byte 0	MSB of Sequence Number
Byte 1	LSB of Sequence Number
Byte 2 ~ n	Transmit Data

6.3.1.2 Retransmission Mechanism

In Go-Back-N the error control scheme relies on ACK, NAK and time-outs to ensure a reliable data channel. In a perfect network, every packet sent by the transmitter is received by the receiver which sends an ACK containing the sequence number of the packet back to the sender. The following figure illustrates this scenario.

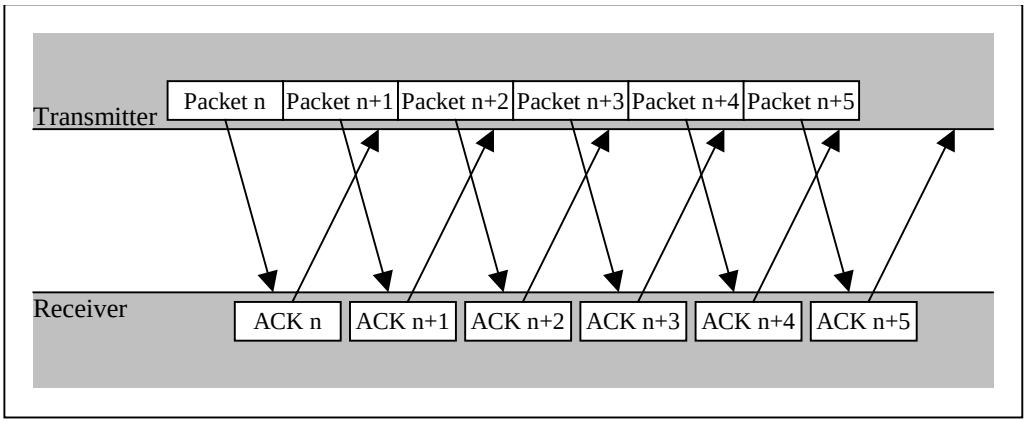


FIGURE 6.3 – PERFECT NETWORK TRANSMISSIONS

In a perfect network every packet sent by the transmitter is received and acknowledged by the receiver with an ACK message containing the sequence number of the transmitted packet. In a real network packets can be lost, corrupted, received out of sequence, or delayed. To allow for these impairments, the transmitter and receiver must implement the rules of the Go-Back-N Retransmission Mechanism to maintain reliable communications.

Rule 1:A received ACK for packet n acknowledges all preceding packets.

Since Go-Back-N generates NAK for every packet received out-of-sequence it can be assumed that when an ACK for packet n is received, all the packets before n were also successfully received. For example: the transmitter doesn't receive ACK n-1 but receives ACK n. The latter ACK indicates that the receiver has successfully received both packets n-1 and n. This assumption is accurate because if packet n-1 wasn't received but packet n was, the response from the receiver would have been NAK n-1 to indicate that packet n was received out-of-sequence as it expected to receive packet n-1.

Rule 2:A received NAK n forces the transmitter to go back to n

A NAK n is generated by the receiver when it expects to receive packet n but receives packet x instead. The NAK message indicates an out-of sequence reception. When the receiver receives a NAK n, it ‘goes back’ (hence the name) and retransmits all frames starting with the one specified in the NAK

message. Once the receiver originates a NAK, it ignores all subsequent frames until it receives the packet that generated the NAK.

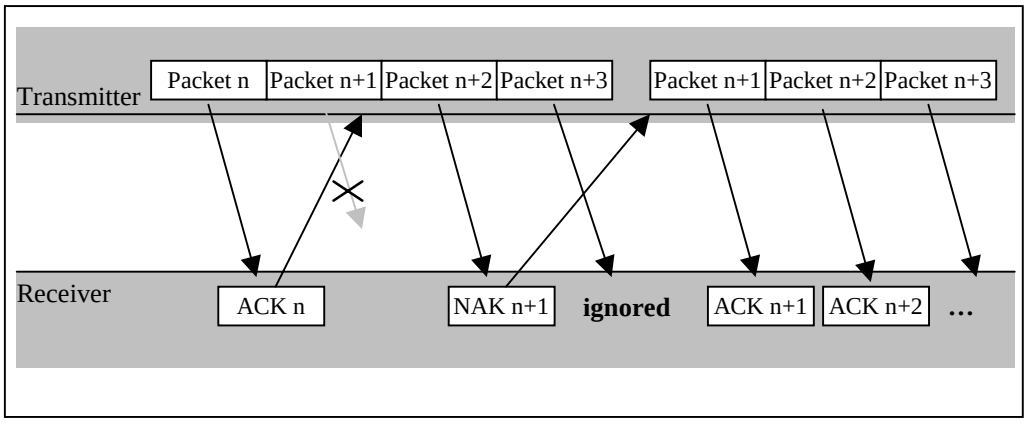


FIGURE 6.4 – OUT-OF-SEQUENCE RECEPTION

Rule 3:Every packet that is not acknowledged after a time out period is retransmitted.

Every packet sent by the transmitter has an associated timer. If packet n isn't ACKed (by receiving an ACK for packet >= n) before its timer expires the transmitter will go back and start retransmiting from packet n.

The Figures 6.5 and 6.6 show the two scenarios in which time-outs can occur. The first is when a NAK frame is lost and the second one is when the last packet or corresponding ACK of a packet stream is lost. It can be seen from Figure 6.6 that it is possible for the receiver to receive duplicate copies of a packet. The receiver must acknowledge the duplicate copy even if it has already received it.

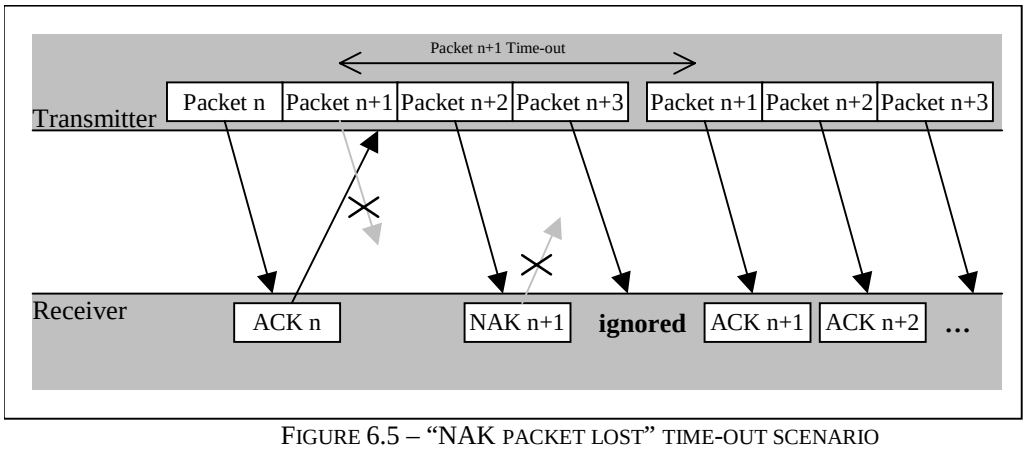


FIGURE 6.5 – "NAK PACKET LOST" TIME-OUT SCENARIO

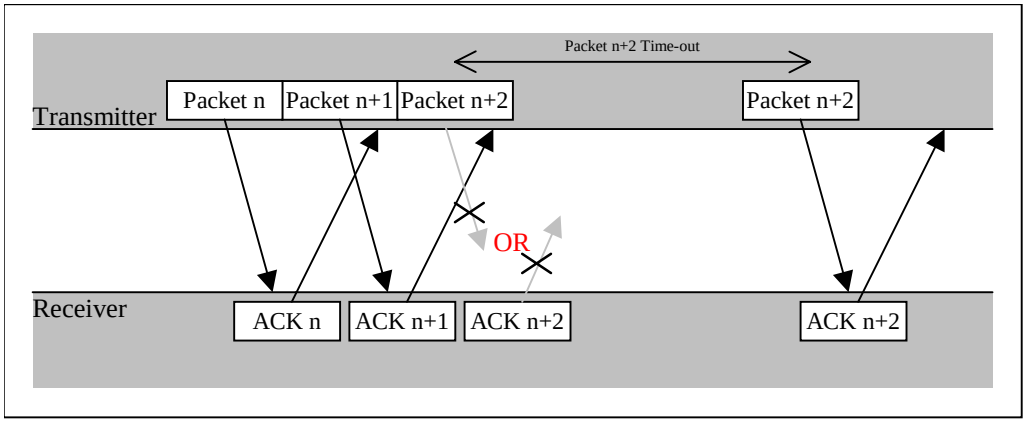


FIGURE 5.6 – "LAST PACKET LOST" TIME-OUT SCENARIO

The time-out interval must be chosen such that it is greater than the estimated round trip time (RTT). The interval must also adapt over time as network conditions are dynamic.A good time-out interval computation scheme must predict network conditions at the time of transmission. The time interval computation method is TBD until more RTT data is collected. In the interim, a fixed 50 ms time-out period will be used.

6.3.1.2.1Two Way Communication & Flow Control

Go-Back-N could also be used in two way communications by maintaining two independent one-way communication paths so each side of the call is both transmitter and receiver.

Flow control must be considered since transmitters and receivers have finite buffer space. IP Gateway does not require any flow control capabilities, but terminal endpoint equipment may require flow control due to limited memory. Not acknowledging (NAK) messages when buffers get full provides a simple but effective method.

Chapter 7: Command Level Protocol

7.1 Introduction

The Unified Network IP Stimulus Protocol (Unistim) communicates with the Reliable UDP layer and the CIPT Terminal Control and Management. Unistim provides a command set to enable the DMS-100 Gateway and Terminal Proxy Server (TPS) to control every aspect of the CIPT's operation.

7.2 CIPT Terminal Manager Commands

The following sections describe every command of the Unistim protocol. Each sub-section addresses a different Manager. Each sub-section is also broken into two parts; one describing the command from the TPS to the CIPT, and the other describing the command from the CIPT to the TPS.

7.2.1 TPS to CIPT Broadcast Commands

Logical Icon Update
Time and Date download
Set Default Character Table Configuration

Logical Icon Update

The Logical Icon Update command is used for updating the state of a logical icon. The IT keeps a map of the association between logical and physical icons. When the state or cadence of a logical icon changes, the TPS sends this command to update the corresponding physical icon with the new state and cadence.

Parameters:	Logical Icon ID	specifies logical ID of icon to be updated
	Icon State	specifies desired state of icon
	Icon Cadence	Off
		On
		Flash
		Flicker
		Wink

Twinkle

Blink

Downloadable cadence

Time and Date Download

The Time and Date Download command is used to set the IT's time and date. This new time and date will overwrite the current time and date data stored in the IT. The command contains the year, month, day, hours, minutes and seconds. All numbers are expressed in hexadecimal.

Parameters: Year
Month
Day
Hour
Minute
Second

Set Default Character Table Configuration

This command downloads the default character table configuration that the display manager uses. It specifies the mapping of the character tables to graphics tables and it also specifies which one of the graphics table is to be lock-shifted (code A0 to FF hex).

7.2.2 IT to TPS Broadcast Commands

None

7.2.3 Network Manager

The Network Manager is responsible for configuring and maintaining the network connections between the TPS and the IT.

7.2.3.1 TPS to IT Network Manager Commands

Soft Reset
Hard Reset
Query Network Manager
Network Manager Options
Control Channel QoS Configuration
Reserve UDP Port Block
Server Identification Tag
Set RTCP Source Description Items
Protocol Switch
Download Backup Server Information

Server Switch

Soft Reset

The Soft Reset command is sent by the TPS to reset the IT as well as the accessory ports. This command is intended to reset the IT data structures to their default states.

Hard Reset

The Hard Reset command is sent when the TPS wants to fully re-initialize the IT to its power-up default state.

Query Network Manager

The Query command is used to request the status or information from the Network Manager.

Parameters:	Diagnostic	requests the diagnostic info command to be sent to the TPS.
	Managers	requests the Manager's ID command to be sent to the TPS.
	Attributes	requests the Attributes Info command to be sent to the TPS.
	RTCP	requests the RTCP stats to be sent to the TPS.
	Options	requests the Options status command to be sent to the TPS.
	Copyright	requests the Copyright report containing a copyright string.
	Sanity	requests the IT to reply with a Sanity OK response. This insures that the IT is alive and well.

Network Manager Options

This command updates the programmable options supported at the IT by the Network Manager.

Parameters:	Diagnostics	Enables or disables automatic diagnostic data transmission
	Reliable UDP	Enables or disables reliable UDP layer for control channel

Control Channel QoS Configuration

This command is used tell the IT which QoS features to make use of when communicating with the TPS.

Parameters:	Type Of Service EnableEnables ToS field of command

ToS	Minimize delay
	Maximize throughput
	Maximize reliability
	Minimize monetary cost
	Normal service
Precedence	Routine
	Priority
	Immediate
	Flash
	Flash override
	Critical
	Internetwork control
	Network control

Reserve UDP Port Block

The TPS uses this command to force the IT to reserve a continuous block UDP ports. Once the ports are successfully reserved the TPS can make use of them without fear of interfering with other servers controlling the IT. The command contains the number of ports to reserve and a starting port number. The IT will reply to this command with the **Reserved UDP Ports Report** stating how many ports were successfully reserved and the starting port number. The TPS could use those reserved port numbers to open audio streams for example.

Parameters:

Number of UDP ports to reserve	Number between 1 and 255 which indicates the number of UDP ports that the TPS wants to reserve.
Starting UDP port number	Indicates the number of the first UDP port of the block of ports to reserve. When set to 0x00, the IT chooses the starting UDP port.

Server Identification Tag

This command is used by the TPS to download a character string oriented tag which identifies the server. The IT could place this information on the display to identify the active server for the user.

Set RTCP Source Description Items

This command is used by the TPS to configure the different source description items that are part of the SDES report of the RTCP protocol.

Parameters:	Source Description	Name used to describe the IT e.g. “Homer Doe’s IT”
		E-mail address associated with the IT
		Phone number of the IT
		Geographic location of the IT
		IT software version
		Notice/Status information

Protocol Switch

The TPS sends this command to an IT that supports multiple protocols to force it to change control protocols. The other protocols that the IT supports could have a similar command to enable a switch-back to UNIStim.

Parameters:	Protocol ID	An identifier for different protocols

Download Backup Server Information

This command is used by the TPS to download network-related information regarding backup servers into the IT. Note this command supports the download of info for several backup servers.

Parameters:	Server ID	Server identifier, used to reference a specific backup server per the following parameters:
	Server Port Number	Port number an identified server uses for UNIStim channel.
	Server IP Address	IP address of the identified server.

Server Switch

The TPS sends this command to force the IT to stop accepting UNIStim commands from the current server and start listening to the server specified in the command. This command assumes that the IT has been made aware of the new server's network address in the configuration process or through the **Download Backup Server Information**.

Parameters:	Server ID	Server identifier, used to reference a specific, previously identified server

7.2.3.2 IT to TPS Network Manager Commands

Soft Reset Ack

The Soft Reset Ack command is sent to the TPS after the IT has been reset via the reception of the Soft Reset command. The command will be transmitted only after a successful reset has been performed.

Sanity OK

The Sanity OK command is used in response to a Query Sanity command. It indicates that the IT can still receive and transmit from/to the TPS.

Network Manager Attributes Info

This command is used in response to the **Query Network Manager** (Attributes) command generated from the TPS. The IT replies by sending the Network Manager Attributes.

Parameters:	Supported Protocols	List of protocols supported, by protocol identifier

Network Manager Diagnostic Info

The Diagnostic Info command is sent after it has been requested by the **Query Network Manager** (Diagnostic) command or when an error occurs and the Diagnostic Command transmission has been enabled via the Network Manager Options command.

Parameters:	RXBUFOVF	Rx Buffer Overflow
	TXBUFOVF	Tx Buffer Overflow
	RXBEMPTY	Rx Buffer Empty
	INVALMSG	Invalid Command Received

Manager IDs

This command is sent from the IT after reception of the **Query Network Manager** (managers)

command from the TPS. The IT replies with a list of all managers contained in the IT with the exception of the Network Manager and the Broadcast Manager. A flag, for each manager, indicates if the manager is active or inactive. The format of the command is as follows.

Parameters:	Managers	List of managers supported by the IT
	Active	Active/Inactive indication for each manager

Network Manager Options Report

This command is sent after reception of the **Query Network Manager** (Options) command. It sends the setup of the options to the TPS.

Parameters:	Diagnostics	Automatic diagnostic data transmission enabled or disabled
	Reliable UDP	Reliable UDP layer for control channel enabled or disabled

Copyright Report

This command is used to respond to the **Query Network Manager** (Copyright) request from the TPS. It provides the copyright information as an ASCII string.

Resume Connection With Server

The IT sends this unsolicited command to inform the TPS that it is ready to accept commands from TPS. The transmission of this command can either be triggered by a power-up or by a user choosing to connect to a new TPS after power-up.

Suspend Connection With Server

The IT sends this unsolicited command to inform the TPS that it will disconnect itself from the TPS. The transmission of this command is normally triggered by a user choosing to connect to a different TPS. Typically, this is the last command that the TPS will receive from the IT until the user chooses to switch back to the TPS.

Reserved UDP Ports Report

This command is sent to inform the TPS of the UDP ports that have been reserved as a result of the **Reserve UDP Port Block** command. The command payload reports the number of UDP

ports reserved as well as the number of the first UDP port of the reserved block.

Parameters:	Number reserved UDP ports	Number between 1 and 255 which indicates the number of UDP ports that are reserved by the IT. A '0' in this field means that the command failed.
	First UDP Port of block	Indicates the number of the first UDP port of the reserved block.

7.2.4 Basic Manager

The Basic manager handles the IT maintenance functions.

7.2.4.1 TPS to IT Basic Commands

Start Selftest
Query Basic Manager
Basic Manager Options
General Read/Write
EEprom Write
Encapsulate Command

Start Selftest

The start selftest command is used for running a selftest in the IT. The self tests are device specific. This message requires that the secure code of the IT be set using the **Basic Managers Options** (Secure Code) command.

Query Basic Manager

The Query command is sent by the TPS. It is used to request the status or information from the Basic manager.

Parameters:	Attributes	requests the Attributes Info command to be sent
	Options	requests the Options Status command to be sent
	F/W version	requests the F/W version command to be sent
	H/W ID	requests the IT H/W ID command to be sent (serial number, color and the release number)
	IT Type	requests the IT Type command to be sent
	Selftest	requests the Selftest Result command to be sent
	PEC	requests the Product Engineering Code command to be sent

Basic Manager Options

This command updates the programmable options supported by the IT's Basic manager.

Parameters:	Secure Code	Enables or disables the secure code for critical messages

General Read/Write

This command allows direct read or write access to the devices (EEProm, microprocessor, etc.…) of the IT. For the write operation, the SECURE CODE flag must be set through the **Basic Manager Options** (Secure Code) command. For a read operation, the data bytes must not be present in the command.

Parameters:	Operation	Read or Write
	Device	Hardware device identifier
	Address	address within the requested device
	Data	Data to be written in the case of a Write operation

EEprom Write

This command allows specific EEprom data byte locations to be written by the TPS. In order for this command to succeed, the secure code must be set through the **Basic Manager Options** (Secure Code) command. This command allows access to EEprom data bytes, without having to know the exact location of the data in the EEprom.

Parameters:	Element ID	Dynamic EE Chksm Static EE Chksm
	PEC Index	
	Release Number	
	Color	
	Serial Number	
	Data	Data bytes to be written to Element ID

Encapsulate Command

This command enables the TPS to use UNIStim to encapsulate commands that belong to UNIStim or other protocols. For example, the TPS could force the IT to send out a **Key Event** command by encapsulating it in the **Encapsulate Command**. This command could also be used to directly access resources (such as a DSP, VGA screen etc.) in the IT without using a UNIStim command.

Parameters:	Encapsulated Protocol ID	Identifies protocol ID of encapsulated protocol

Encapsulated Command	Data corresponding to command in identified protocol

7.2.5 IT to TPS Basic Commands

Basic Manager Attributes Info
Basic Manager Options Report
F/W version
IT Type
Selftest result
General Read Response
Hardware ID
Product Engineering Code

Basic Manager Attributes Info

This command is used in response of the **Basic Manager Query** (Attributes) command to inform the TPS of both the EEPROM static and dynamic checksums. Both values are read directly from the EEPROM.

Parameters:	Static Checksum	Static Checksum of EEPROM
	Dynamic Checksum	Dynamic Checksum of EEPROM

Basic Manager Options Report

This command is sent after reception of the **Basic Manager Query** (Options) command. It sends the basic manager's options configuration to the TPS.

Parameters:	Secure Code Status	Enabled or Disabled

F/W Version

This command is used in response to the **Basic Manager Query** (F/W version) command. The F/W version command contains the F/W version code of the IT's code.

Parameters:	F/W Version	7 character ASCII string representing the F/W Version

IT Type

The IT Type command is sent in response to the **Basic Manager Query** (IT Type) command from the TPS. It is used to inform the TPS on the type of IT.

Parameters:	IT Type	IT type identifier

Selftest Result

The result of each test performed during a selftest is given by this command. This command is send after reception of the **Basic Manager Query** (Selftest) command from the TPS.

Parameters:	Test ID	An identifier for each test
	Test Result	A pass/fail indication for each test identified

General Read Response

This command is used in response to the **General Read/Write** command when a read operation is performed.

Parameters:	Device	Hardware device identifier
	Address	address within the requested device
	Data	Data read from the device.

Hardware ID

This command is sent in response to the **Basic Manager Query** (H/W ID) command. It provides the unique number that identifies the IT.

Parameters:	Serial Number	Unique serial number of the IT
	Release Number	HW release number of the IT
	Color	Color code of the IT

Product Engineering Code

This command is sent in response to the **Query Basic Manager** (PEC) command from the TPS. It provides the Product Engineering Code of the IT.

Parameters:	PEC	Product Engineering Code for the IT

7.3 Key/Indicator Manager

The Key/Indicator Manager is the manager responsible for managing parameters associated with keys and the indicators on the IT.

7.3.1 TPS to IT Key/Indicator Commands

LED Update
Query Hookswitch
User Activity Timer
Downloadable Free Form Icon Access
Query Key/Indicator Manager
Key/Indicator Manager Options
Logical Icon Mapping
Key Repeat Timer Download
Query LED State
Query IT Icon State
Indicator Cadence Download
User Activity Timer Download
Free Form Icon Download
IT Icon Update

LED Update

The LED Update command is used to update the state and cadence of LEDs on the IT.

Parameters	LED ID	LED identifier
	LED State	Off
		On
		Flash
		Flicker
		Wink
		Twinkle
		Blink
		Downloadable cadence

Note that cadence should be downloaded using **Indicator Cadence Download** before selecting Downloadable cadence as the LED State.

Query Hookswitch

The Query Hookswitch command is used to query the state of hookswitch on the IT. The IT

must send back the **Hookswitch State** command in reply.

User Activity Timer

The User Activity Timer can be turned on and off using this command. The time-out value of the timer is defined using the User Activity Timer Download command. When the User Activity timer starts, if no key event happens (depression, repeat or release) in the IT before the timer times-out, the IT will send the User Activity Timer Expired command back to the TPS. If at least one key event happens then the timer will reset and start the count down again until the User Activity timer is stopped.

Parameters:	Start/Stop	Starts or stops the timer

Downloadable Free Form Icon Access

The Downloadable Free Form Icon Access command is used to enable or disable the download Icon RAM bit map. This command allows ‘overloading’ the existing Free Form Icon ROM bit maps.

Parameters:	Free Form Icon Source	Hard coded Free Form ROM bit map or downloaded Free Form RAM bit map

Query Key/Indicator Manager

The Query Key/Indicator manager command is used to request information about various states or information handled by the Key/Indicator manager.

Parameters:	Options	Requests the status of the option setting
	Attributes	Requests the information of the Key/Indicator Manager's Attributes.

Key/Indicator Manager Options

This TPS uses this command to set the Key/Indicator manager options.

Parameters:	Key Release Message	Enable/Disable the transmission of Key Event message with Key Release flag set when a valid key release occurs
	Volume Key Message	Enable/Disable the transmission of Volume Key Event messages
	Local Dial Pad Feedback	No Feedback
		Key Click

DTMF

Logical Icon Mapping

The Logical Icon Mapping command is used to define the relationship between physical and logical icons in the IT.

Parameters:	Command	Global NIL mapping One-to-one mapping Single mapping
	Physical Icon ID	Same as defined in the IT Icon Update command
	Logical Icon ID	Logical ID to be assigned to the specified Physical Icon

Notes:

The Global NIL mapping command removes all the mapping between the logical icons and the physical icons.

1) The one-to-one mapping command is used to map the physical icon 0 with the logical icon 0, physical icon 1 with the logical icon 1 and so on.
2) The single mapping command maps a single physical icon to a logical icon ID
3) The Physical and Logical Icon ID fields are not required when the Administration command is the Global NIL mapping or the one-to-one mapping

Key Repeat Timer Download

The Key repeat Timer Download is used by the TPS to specify the time (first timer) before sending the key repeat command when the key remains depressed and also for specifying the time (second timer) to wait before sending all subsequent key repeat commands if the same key remains depressed.

Parameters:	Key Repeat Initial Time	Duration key must be pressed prior to sending key repeat command
	Key Auto Repeat Interval	Time interval between successive key repeat commands while key remains depressed

Notes:

1) The key repeat function may not be supported on all keys

Query LED State

The Query LED State command is used by the TPS to extract LED state information from the IT.

Parameters:	LED ID	Specifies LED to be queried

Query IT Icon State

The Query IT Icon State command is used by the TPS to extract IT icon state information from the IT.

Parameters:	Physical Icon ID	Specifies the physical icon to be queried

Indicator Cadence Download

The Indicator Cadence Download command is used to specify a new custom cadence that can be used to flash the icons and LEDs when using the downloadable cadence option in the **LED Update** and **IT Icon Update** commands.

Parameters:	Cycle 1 On Time	On duration for first cycle
	Cycle 1 Off Time	Off duration for first cycle
	Cycle 2 On Time	On duration for second cycle
	Cycle 2 Off Time	Off duration for second cycle
	Cycle 3 On Time	On duration for third cycle
	Cycle 3 Off Time	Off duration for third cycle
	Cycle 4 On Time	On duration for fourth cycle
	Cycle 4 Off Time	Off duration for fourth cycle

Notes:

1) A maximum of four on-off cycles can be specified.
2) Not all four cycles have to be used.

User Activity Timer Download

The User Activity User Download command is used to download the time-out value used by the User Activity timer. This time-out value will be used when the user Activity is started by the **User Activity Timer** command. Upon receipt of the command the IT will restart the timer with the new time-out value.

Parameters:	User Activity Timeout Value	Duration of user activity timeout.

Free Form Icon Download

This command is used to download a free form icon representation that is not already hard

coded in the IT ROM. The command contains the ID of the downloadable icon, and the bitmap that represents the free form icon.

Parameters:	Free Form Icon ID	Identifier of downloaded icon
	Icon Bitmap Data	Bitmap data of icon representation

IT Icon Update

This command is used to change the current state and cadence of an IT icon. The IT icon will be updated with the new state and cadence only if the physical icon IS NOT mapped to a logical icon.

Parameters:	Physical Icon ID	specifies physical ID of icon to be updated
	Icon State	specifies desired state of icon
	Icon Cadence	Off
		On
		Flash
		Flicker
		Wink
		Twinkle
		Blink
		Downloadable cadence

7.3.2 IT to TPS Key/Indicator Commands

Key Event
LED Status Report
On hook
Off hook
User Activity Timer Expired
Hookswitch State
Key/Indicator Manager Attributes info
Key/Indicator Manager Options Report
IT Icon Status Report

Key Event

This command is used to report an event related to the keys. The event can be a key depression, key repeat or a key released.

Parameters:	Key ID	dial pad 0
		dial pad 1

		dial pad 2
		dial pad 3
		dial pad 4
		dial pad 5
		dial pad 6
		dial pad 7
		dial pad 8
		dial pad 9
		dial pad *
		dial pad #
		Navigation Up
		Navigation Down
		Navigation Right
		Navigation Left
		Quit
		Copy
		Volume Up
		Volume Down
		Hold
		Release
		Mute
		Headset
		Handsfree
		Programmable Key 1 to N
	Key Event	Key released
		Key depressed
		Key Repeated

Notes:

1) A number (N) of non specific “programmable” keys are supported

LED Status Report

This command is sent to the TPS in response to the **Query LED State**. It informs the TPS on the state and cadence of LEDs.

Parameters	LED ID	LED identifier
	LED State	Off
		On
		Flash
		Flicker
		Wink
		Twinkle

		Blink
		Downloadable cadence

On Hook

The On Hook command is sent to the TPS when the IT detects an Off hook to On hook transition.

Off Hook

The Off Hook command is sent to the TPS when the IT detects an On hook to Off hook transition.

User Activity Timer Expired

This command is sent to the TPS when the User Activity timer times out. The actual time-out value for the User Activity Timer is specified by the **User Activity Timer Download** command.

Hookswitch State

This command is sent to the TPS in response to the **Query Key/Indicator Manager (Hookswitch)** command.

Parameters:	Hookswitch State	On hook
		Off hook

Key/Indicator Manager Attributes Info

This command is sent to the TPS in response to the **Query Key/Indicator Manager** (Attributes) command and informs it of the attributes of the Key/Indicator manager. The format of the command is as follows.

Parameters:	Programmable keys	contains the number of programmable keys on the IT
	Soft Keys	contains the number of soft keys on the IT
	Headset Key	indicates existence of a Headset Key on the IT
	Mute Key	indicates existence of a Mute Key on the IT
	Quit	indicates existence of a Quit Key on the IT
	Copy	indicates existence of a Copy Key on the IT
	Message Waiting Indicator	indicates existence of a Message Waiting Indicator on the IT
	Navigation keys	none
		two
		four

Key/Indicator Manager Options Report

This command is sent to the TPS in response to a **Query Key/Indicator Manager** (Options) command. It sends the Key/Indicator Manager's options configuration to the TPS.

Parameters:	Key Release Message	Enabled/Disabled
	Volume Key Message	Enabled/Disabled
	Local Dial Pad Feedback	No Feedback
		Key Click
		DTMF

The options are set via the **Key/Indicator Manager Options** command.

IT Icon Status Report

This command is used in response of the **Query Key/Indicator Manager** (Icon State) command. It informs the TPS of the state of icons.

Parameters:	Physical Icon ID	specifies physical ID of icon to be queried
	Icon State	specifies state of icon
	Icon Cadence	Off
		On
		Flash
		Flicker
		Wink
		Twinkle
		Blink
		Downloadable cadence

7.5 Audio Manager

The Audio manager is the entity that manages every aspect of the audio configuration of the IT. The main tasks of the manager are to configure the loss plan and tones, setup voice paths and establish end-to-end voice connections.

7.5.1 TPS to IT Audio Commands

Query Audio Manager
Query Supervisor Headset Status
Audio Manager Options
Mute/unmute
Transducer Based Tone On
Transducer Based Tone Off
Alerting Tone Configuration
Special Tone Configuration
Paging Tone Configuration

Alerting Tone Cadence Download
Special Tone Cadence Download
Paging Tone Cadence Download
Transducer Based Tone Volume Level
Alerting Tone Test
Visual Transducer Based Tones Enable
Stream Based Tone On
Stream Based Tone Off
Stream Based Tone Configuration
Stream Based Tone Frequency Component List Download
Stream Based Tone Cadence Download
Select Adjustable Rx Volume
Set APB's Rx Volume Levels
Change Adjustable Rx Volume
Adjust Default Rx Volume
Adjust APB's Tx and/or STMR Volume Level
Query APB's Tx and/or STMR Volume Level
ABP Download
Open Audio Stream
Close Audio Stream
Connect Transducer
Frequency Response Specification
Biquad Download
Voice Switching Configuration
Query RTCP Statistics
Configure Vocoder Parameters
Jitter Buffer Configuration

Query Audio Manager

The Query Audio Manager command is used to request various status or information from the Audio manager.

Parameters:	Attributes	requests the Attributes of the Audio manager
	Options	request the option setting of the Audio manager
	Alerting	requests the Alerting selection (warbler rate and cadence)
	Adjustable Rx Volume	requests the IT to send the Adjustable Rx Volume Information command.
	APB Default Rx Volume	requests the IT to send the Default Rx Volume of the specified APB

	Handset	requests the handset status
	Headset	requests the headset status
	APB number	specifies the APB for the APB Default Rx Volume query

Query Supervisor Headset Status

This command is used to query the connection status of the supervisor headset.

Audio Manager Options

This command updates the programmable options supported by the Audio manager.

Parameters:	Volume Adjustment	Remote: volume adjusted by the NI Local: volume adjusted by IT
	Volume Adjustment Reports	Enable/Disable the transmission of volume adjustment reports when volume keys are depressed
	Headset Rfeature Key Message	Enable/Disable the transmission of Headset Rfeature Key message when key event is detected on headset interface.

Mute/unmute

This command is used to mute/unmute Rx and Tx streams.

Parameters	Stream ID	Identifies stream to mute/unmute
	Direction	Rx Tx
	Mute Function	Mute Unmute

Notes:

1) A single command can be used to change the mute setting of many streams at once by replicating the parameters of the command as many times as required.

Transducer Based Tone On

This command is used to turn on one of the transducer based tone (alerter, paging or special tone). The association between a transducer based tone and a transducer is done using the **Alerter Tone Setup**, **Paging Tone Setup** and **Special Tone Setup** commands of the audio manager. Some of these tones may be mutually exclusive.

Parameters:	Transducer based Tone ID	Alerting Special Tones Paging Tones
	Attenuation	Downloaded tone volume level

		Downloaded tone volume level - 2

Transducer Based Tone Off

This command is used disconnect a transducer based tone from its associated transducer.

Parameters:	Transducer Based Tone ID	Alerting Special Tones Paging Tones

Alerting Tone Configuration

This command is used to configure the various parameters that are associated with the Alerting tone. Through this command the alerter tone's volume range, warbler effect, cadence and transducer routing can be configured.

Parameters:	Warble Select	Specifies the warble to use with the alerting tone
	Tone Volume Range	Number of steps from the maximum tone volume value, which is set by hardware.
	Transducer Routing	Handset Speaker=
	Headset Speaker	
	Handsfree Speaker	
	Cadence Select	cadence 0 cadence 1 cadence 2 cadence 3 cadence 4 cadence 5 cadence 6 downloadable alerter tone cadence

Special Tone Configuration

This command is used to configure the various parameters that are associated with the special tone. Through this command the special tone's volume range, cadence and transducer routing can be configured.

Parameters:	Tone Volume Range	Number of steps from the maximum tone volume value, which is set by hardware.
	Transducer Routing	Transducer to which the special tone will be routed when turned on. Handset speaker Headset speaker Handsfree speaker

	Cadence Select	cadence 0 cadence 1 cadence 2 cadence 3 cadence 4 cadence 5 cadence 6 downloadable special tone cadence
	Special Tone Content	Selects the frequencies that make up the special tone

Paging Tone Configuration

This command is used to configure the various parameters that are associated with the paging tone. Through this command the paging tone's volume range, cadence and transducer routing can be configured.

Parameters:	Tone Volume Range	Number of steps from the maximum tone volume value, which is set by hardware.
	Transducer Routing	Transducer to which the special tone will be routed when turned on. Handset speaker Headset speaker Handsfree speaker
	Cadence Select	cadence 0 cadence 1 cadence 2 cadence 3 cadence 4 cadence 5 cadence 6 downloadable paging tone cadence

Alerting Tone Cadence Download

The Alerting Cadence Download command is used by the TPS to download an alerting cadence in the IT. This new Alerting Tone cadence will be used the next time the IT receives the Tone On (Alerting Tone) command if this tone is set to use the downloadable cadence (see Tone Cadence Select command).

Parameters:	Cycle 1 On Time	On duration for first cycle
	Cycle 1 Off Time	Off duration for first cycle
	Cycle 2 On Time	On duration for second cycle
	Cycle 2 Off Time	Off duration for second cycle

Cycle 3 On Time	On duration for third cycle
Cycle 3 Off Time	Off duration for third cycle
Cycle 4 On Time	On duration for fourth cycle
Cycle 4 Off Time	Off duration for fourth cycle

Notes:

1) A maximum of four on-off cycles can be specified.
2) Not all four cycles have to be used.

Special Tone Cadence Download

The Special Tone Cadence Download command is used to download a Special Tone cadence in the IT. This new Special Tone cadence will be used the next time the IT receives the Tone On (Special Tone) command if this tone is set to use the downloadable cadence (see Tone Cadence Select command).

Parameters:		
	Cycle 1 On Time	On duration for first cycle
	Cycle 1 Off Time	Off duration for first cycle
	Cycle 2 On Time	On duration for second cycle
	Cycle 2 Off Time	Off duration for second cycle

Notes:

1) A maximum of two on-off cycles can be specified.
2) Not all two cycles have to be used.

Paging Tone Cadence Download

The Paging Tone Cadence Download command is used to download the configuration for the paging tone. The command is used to specify the tone frequency and On/Off duration of all the tones that make up the paging tone. This new Paging Tone cadence will be used the next time the IT receives the Tone On (Paging Tone) command if this tone is set to use the downloadable cadence (see Tone Cadence Select command).

Parameters:		
	Cycle 1 Paging Tone Content	Specifies the tone frequencies to be used in the first cycle
	Cycle 1 On Time	On duration for first cycle
	Cycle 1 Off Time	Off duration for first cycle
	Cycle 2 Paging Tone Content	Specifies the tone frequencies to be used in the second cycle
	Cycle 2 On Time	On duration for second cycle
	Cycle 2 Off Time	Off duration for second cycle
	Cycle 3 Paging Tone Content	Specifies the tone frequencies to be used in the third cycle
	Cycle 3 On Time	On duration for third cycle

	Cycle 3 Off Time	Off duration for third cycle

Notes:
1) A maximum of three paging tone cycles can be specified.
2) Not all three cycles have to be used.
3) The paging tone frequency content is specified for each cycle

Transducer Based Tone Volume Level

The Transducer Based Tone Volume Level command is used to specify the volume level for different transducer based tones. The volume is defined in steps from the lowest level of the volume range. If the volume level specified in the command is outside the volume range, the upper boundary of the range will be used as the new volume level.

Parameters:	Transducer Based Tone ID	Alerting Special Tones Paging Tones
	Tone Volume	Specifies tone volume from lowest level of volume range

Alerting Tone Test

The Alerting Tone Test command is used to start the alerting tone on the IT without changing the current selection of alerting. This command is usually used when the user selects the type of alerting. Only the warbler can be selected.

Parameters:	Warble Select	Specifies the warble to use with the alerting tone

Visual Transducer Based Tones Enable

This command is used to configure the IT with respect to providing visual tones feedback when it receives the **Transducer Based Tone On** command.

Parameters:	Visual Tones	Enable/Disable Visual Tones

Stream Based Tone On

This command is used to inject a stream based tone into an audio stream. The actual parameters that define the stream based tone specified in the command can be set using the **Stream Based Tone Configuration** command which is used to bind a cadence and a frequency component list with the tone.

Parameters:	Stream Based Tone ID	Identifies the stream based tone to be injected in audio stream
	Stream ID	Identifies the stream in which to inject the stream based tone

	Direction	Rx Tx
	Tone Level	Volume level at which the tone should be played out, in steps from minimum.

Stream Based Tone Off

This command to stop the injection of the specified stream based tone in the specified audio stream.

Parameters:	Stream Based Tone ID	Identifies the stream based tone to be stopped in audio stream
	Stream ID	Identifies the stream in which to inject the stream based tone should be stopped
	Direction	Rx Tx

Stream Based Tone Configuration

This command is used to bind one of the 32 stream based tone cadences and one of the 32 frequency component lists with a stream based tone. The next time the stream based tone referred to in the command is turned on through the **Stream Based Tone On** command, it will use the cadence and frequency component list specified in this command. The actual cadences and frequency component lists can be modified through the **Stream Based Tone Cadence Download** and the **Stream Based Tone Frequency Component List Download.**

Parameters:	Stream based Tone ID	Stream based tone to bind with cadence in frequency component list specified in the command.
	Stream based Tone Cadence ID	Cadence to use next time stream based tone specified in command is turned on.
	Stream based Tone Freq. Component List	Frequency components to use next time stream based tone specified in command is turned on.

Stream Based Tone Frequency Component List Download

This command is used to reconfigure one of the 32 frequency component lists available for stream based tones.

Parameters:	Frequency Component 1	Specifies the frequency of the first component
	Frequency Component 2	Specifies the frequency of the second component
	Frequency Component 3	Specifies the frequency of the third component
	Frequency Component 4	Specifies the frequency of the fourth component

Notes:

1) A maximum of four frequency components can be specified.
2) Not all four components have to be used.

Stream Based Tone Cadence Download

This command is used to reconfigure one of the 32 cadences available for stream based tones. The command specifies up to four On/Off duration pairs.

Parameters:	Stream based Tone Cadence ID	Cadence to use next time stream based tone specified in command is turned on.
	Cycle 1 On Time	On duration for first cycle
	Cycle 1 Off Time	Off duration for first cycle
	Cycle 2 On Time	On duration for second cycle
	Cycle 2 Off Time	Off duration for second cycle
	Cycle 3 On Time	On duration for third cycle
	Cycle 3 Off Time	Off duration for third cycle
	Cycle 4 On Time	On duration for fourth cycle
	Cycle 4 Off Time	Off duration for fourth cycle

Notes:

1) A maximum of four cycles can be specified.
2) Not all four components have to be used.
3) If the off time of cycle 1 is not specified, the stream based tone will be played until it is turned off through the Stream Based Tone Off command.

Select Adjustable Rx Volume

This command is used to select the Rx volume that will be affected by the **Change Adjustable Rx Volume** command.

Parameters:	Adjustable Rx Volume	none
		Audio Parameters Bank 1
		Audio Parameters Bank 2
		Audio Parameters Bank 3
		Audio Parameters Bank 4
		Audio Parameters Bank 5
		Audio Parameters Bank 6
		Audio Parameters Bank 7
		Alerting
		Special Tones
		Paging Tones

Set APB's Rx Volume Levels

The Set APB's Rx Volume Level command is used to specify the new Current Rx Volume for the specified APB. The command can also force the Default Rx Volume to be changed to the specified Current Rx Volume by setting the Default flag. The volume level is specified as an offset in number of steps from the system RLR for the path specified APB. This command will override volume control adjustments done by the user. This command is intended to be used by the system to convey volume control adjustments made by the user in list based option controls.

Parameters:	APB number	none Audio Parameters Bank 1 Audio Parameters Bank 2 Audio Parameters Bank 3 Audio Parameters Bank 4 Audio Parameters Bank 5 Audio Parameters Bank 6 Audio Parameters Bank 7
	RLR Offset Direction	Indicates whether the offset is a positive or a negative offset with respect to the APB's system RLR.
	Update Default	Specifies whether the default volume for the APB should be updated
	Rx Volume Level Offset	Specifies the volume offset in steps to be applied to the APB's system RLR.

Change Adjustable Rx Volume

This command is used to increase or the decrease the receive volume selected through the **Select Adjustable Rx Volume** command by one step within the limits of its loss plan. This command is used when the volume adjustments are performed by the TPS instead of locally in the IT.

Parameters:	Down	One step quieter
	Up	One step louder

Adjust Default Rx Volume

This command is used to increase or decrease the Default Rx Volume value of the specified Audio Parameters Bank (APB) or transducer based tone by one step within the limits of its loss plan. This command should be used when the user increases or decreases the default Rx volume from an option list. Also notice that this command will only change the default Rx volume and not the system default value which is the RLR (downloaded via the Receive Loudness Rating command) so the loss plan will not

be changed with this command.

Where	Down	One step quieter
	Up	One step louder
	Default Rx Volume to Change	none
		Audio Parameters Bank 1
		Audio Parameters Bank 2
		Audio Parameters Bank 3
		Audio Parameters Bank 4
		Audio Parameters Bank 5
		Audio Parameters Bank 6
		Audio Parameters Bank 7
		Alerting
		Special Tones
		Paging Tones

Adjust APB's Tx and/or STMR Volume Level

The Adjust APB's Tx and/or STMR command is sent by the TPS to allow Tx and STMR volume adjustments for different transducer types. It is used to adjust the APB's Tx or STMR volume level, either increasing or decreasing it by one step. The adjustment enable bits allow the TPS to adjust both Tx and STMR volumes with a single command. Alternatively, either the STMR or Tx volumes can be adjusted individually. This command is intended to be used for multi-vendor headset configuration.

Parameter	APB number	none
		Audio Parameters Bank 1
		Audio Parameters Bank 2
		Audio Parameters Bank 3
		Audio Parameters Bank 4
		Audio Parameters Bank 5
		Audio Parameters Bank 6
		Audio Parameters Bank 7
	STMR Volume Increment Direction	STMR volume increase/decrease by one increment
	STMR Volume Adjust Enable	Enables/Disables volume adjustments to be made to the STMR path
	Tx Volume Increment Direction	Tx volume increase/decrease by one increment
	Tx Volume Adjust. Enable	Enables/Disables adjustments to be made to the Tx path

Query APB's Tx and/or STMR Volume Level

The Query APB's Tx and/or STMR command is sent by the TPS to query the current STMR and/or Tx volume level settings. This command is intended to be used for multi-vendor headset configuration.

Parameters:	APB number	none Audio Parameters Bank 1 Audio Parameters Bank 2 Audio Parameters Bank 3 Audio Parameters Bank 4 Audio Parameters Bank 5 Audio Parameters Bank 6 Audio Parameters Bank 7
	STMR Volume Level Request	requests STMR volume level information from audio manager
	Tx Volume Level Request	requests Tx volume level information from audio manager

ABP Download

This command is used to download all the audio parameters (such as loss plan) associated with a specific audio parameter bank. The new parameters will be used the next time a voice call involving the ABP is set up. This command uses flags to indicate the presence (or absence) of each audio parameter.

Parameters:	APB number	Audio Parameters Bank 1 Audio Parameters Bank 2 Audio Parameters Bank 3 Audio Parameters Bank 4 Audio Parameters Bank 5 Audio Parameters Bank 6 Audio Parameters Bank 7
	Switched Loss	Amount of Switched Loss used by the Switching algorithm
	Step Size	The volume step size
	Minimum Volume	Minimum Volume relative to the RLR
	Automatic Gain Control	Specifies if AGC is implemented for this APB.
	Maximum Volume	Maximum Volume Relative to the RLR
	Receive Loudness Rating	The RLR to use for this APB
	Return to Default	Specifies if the volume control for this APB is to operation in return to default mode
	Send Loudness Rating	The SLR to use for this APB
	SideTone Masking Rating	The STMR to use for this APB

Open Audio Stream

This command is used to set up full or half-duplex end-to-end RTP voice sessions between the IT and an IP connected far-end. This command is also used to specify RTCP ports and DTMF support for the specified voice session.

Parameters:	Rx Stream ID	Tells the IT which stream it must use as the destination of voice data originating from the far end.
	Tx Stream ID	Tells the IT which stream it must use as the source of voice data destined to the far-end.
	Rx Vocoder Type	Specifies to type of vocoder to use to decode the Rx Stream.
	Tx Vocoder Type	Specifies to type of vocoder to use to encode the Tx Stream.
	Frames per Packet	Specifies how many audio frames are contained in a single UDP packet
	ToS	Minimize delay Maximize throughput Maximize reliability Minimize monetary cost Normal service
	Precedence	Routine Priority Immediate Flash Flash override Critical Internetwork control Network control
	Tx DTMF	This bit is used to indicate whether or not DTMF key pressed information will be transmitted as part of the voice session.
	Rx DTMF	This bit is used to indicate whether or not DTMF key pressed information will be received as part of the voice session.
	IT RTP Port	Local UDP port to use for transmitting and receiving voice data.
	IT RTCP Port	Local UDP port to use for transmitting and receiving RTCP control messages. An RTCP port of “zero” means that the audio stream does not have an RTCP channel and that the Far-End RTCP port field is a “don’t care”.
	Far-End RTP Port	Far-end UDP port to/from which the voice data should be sent/received.

	Far-End RTCP Port	Far-end UDP port to/from which the RTCP control messages should be sent/received.
	Far-End IP Address	Specifies the IP address of the end point that is at the other end of the RTP connection.

Close Audio Stream

This command is used to kill audio voice sessions associated with the stream Ids specified in the payload of the command.

Parameters:	Rx Stream ID	Tells the IT which Rx stream it must terminate
	Tx Stream ID	Tells the IT which Tx stream it must terminate

Connect Transducer

This command is used to cross-connect the transducers specified in the command with a quantity of streams in an uni-directional or bi-directional fashion. The actual streams referred to in this command are created through the **Open Audio Stream** command. This command can also be used to assign an Audio Parameters Bank (APB) to the transducer pair designated in the command.

Parameters:	Transducer Pair ID	Handset Headset Handsfree Speaker/Microphone All Transducer Pairs
	Stream ID	ID of the stream to connect to the transducer specified in the command.
	Tx Enable	Streams specified in the command are connected the microphone of the designated transducer pair.
	Rx Enable	Streams specified in the command are connected the speaker of the designated transducer pair.
	APB	Specifies if an APB is to be used in conjunction with the specified transducer pair
	Sidetone	Specifies if sidetone is enabled for transducer pair specified in command
	Destructive /Additive	Specifies whether this command should augment or replace transducers that were connected to the streams listed in the command prior to its reception.
	APB number	none Audio Parameters Bank 1 Audio Parameters Bank 2 Audio Parameters Bank 3 Audio Parameters Bank 4

Audio Parameters Bank 5
Audio Parameters Bank 6
Audio Parameters Bank 7

Frequency Response Specification

The Frequency Response Specification command specifies the filter building blocks to be used to implement the desired frequency response for a given transducer. The command is used by the IT to fill in a frequency response specification table, specifying which filters need to be set up for a given transducer. The Frequency Response Specification command contains a list of filter numbers which correspond to predefined filter building blocks in the IT. Each filter ID will program a predefined number of biquadratic sections (biquads). The biquad ID field specifies the first biquad to be used for implementing the filter.

The Filter Gain Compensation is sent as part of the Frequency Response Specification. The Filter Gain Compensation specifies a gain adjustment to compensate for any deviation from the Loudness Rating (LR) caused by the filter shape specified by the frequency response specification. Both the Rx and Tx FGC values **must** be provided each and every time this command is sent.

Parameters:	Transducer ID	Handset Headset Handsfree Speaker/Microphone
	Rx Filter Count	number of new filter in the Rx direction
	Tx Filter Count	number of new filter in the Tx
	Starting BQ ID	ID of the first biquad to use for implementing the filter.
	Rx/Tx Filter ID	Filter Id as specified in the functional description.

Notes:

1) The number of Rx and Tx Filter ID bytes must match the filter count provided in the first data byte.
2) Each filter occupies a certain number of biquads. The TPS should know exactly the number of biquads each filter occupies in order to fill up the biquads in the IT correctly.

Biquad Download

The Biquad Download command is used to adjust the IT frequency response by downloading new set of coefficients for a specific biquad. The next time the IT will program the biquads, it will use the new set of coefficients. The downloaded biquad can be selected using the **Frequency Response Specification** command. Each biquad takes

five coefficients, B0, B1, B2, A1 and A2.

Parameters:	Biquad ID	Biquad Identifier
	B0	Coefficient B0
	B1	Coefficient B1
	B2	Coefficient B2
	A1	Coefficient A1
	A2	Coefficient A2

Voice Switching Configuration

This command is used to download the voice switching parameters associated with a specific transducer. These parameters will be used the next time the voice switching is enabled.

Note that unlike the **Connect Transducer** command, there is no need for the Transducer Direction bit since the command specifies frequency responses for both the receive and transmit transducers. For each receive transducer specified in the Transducer ID field, the command will also be used to configure its transmit-side counterpart.

Parameters:	Transducer ID	Handset
		Headset
		Handsfree Speaker/Microphone
	AGC Threshold	Input threshold for application of AGC
	Rx Virtual Pad	Tx blocking margin of the switching algorithm
	Dialtone threshold	Input threshold for considering a dialtone
	Tx Virtual Pad	Rx blocking margin of the switching algorithm
	Echo Mute Enable	Enable/Disable talker echo muting
	Dynamic Sidetone Enable	Enable/Disable sidetone variation based on noise floor

Query RTCP Statistics

This command is used by the TPS to request RTCP data gathered in the media session associated with the stream ID specified.

Parameters:	Stream ID	ID of the stream to be queried
	Stream Direction	Rx
		Tx
	IT Packet Count	Requests the total number of packets sent by the IT in the session up to this point
	IT Octet Count	Requests the total number of octets sent by the IT in the session up to this point
	Interarrival Jitter	Requests an estimate of the statistical variance of the delay between each received media packets

	Fraction Lost	Requests the fraction of media packets lost as reported in the last RTCP packet
	Total Packet Loss	Requests the total number of lost packets since the beginning of the media session

Configure Vocoder Parameters

This command is used to configure parameters that are associated with the vocoder specified in the command. The command contains a field that identifies the vocoder to modify followed by a list of new parameter settings. Note that not all vocoders support the entire list configurable parameters.

Parameters:	Vocoder Type	Specifies the vocoder on which to apply the parameter settings
	Direction	Rx Tx Both
	Voice Activity Detection	Enable/Disable
	Bad Frame Interpolation Algorithm	Enable/Disable
	Post Filter	Enable/Disable
	High Pass Filter	Enable/Disable
	Frame Size	Specifies number of bytes per frame

Jitter Buffer Configuration

This command is used to configure parameters that are associated with the jitter buffer of the specified stream.

Parameters:	Stream ID	ID of the stream to associated with the jitter buffer to be configured.
	Jitter Buffer Maximum Size	Maximum number of frames in jitter buffer beyond which uncontrolled frame loss will occur.
	Desired Jitter	Desired number of frames in jitter buffer. When controlled frame deletion occurs, enough frames will be deleted to reach this number.
	High Water Mark	Threshold number of frames in jitter buffer at which point controlled frame deletion will occur.

7.5.2 IT to TPS Audio Commands

Handset connected
Handset disconnected
Headset connected
Headset disconnected

Supervisor Headset connected
Supervisor Headset disconnected
Headset Rfeature Key Pressed
Audio Manager Attributes info
Audio Manager Options Report
Adjustable Rx Volume Report
Adjustable Rx Volume Information
APB's Default Rx Volume Value
Alerting Tone Select
APB's Tx and/or STMR Response
RTCP Statistics Report
Open Audio Stream Report

Handset Connected

The Handset Connected command is sent to the TPS when a handset is detected in the handset port of the IT.

Parameters: Handset Type Specifies the type of handset detected

Handset Disconnected

The Handset Disconnected command is sent to the TPS when the handset is disconnected from the handset port of the IT.

Headset Connected

The Headset Connected command is sent to the TPS when a headset is detected in the headset port of a so equipped IT

Headset Disconnected

The Headset Disconnected command is sent to the TPS when the headset is disconnected from the headset port.

Supervisor Headset Connected

The Supervisor Headset Connected command is sent to the TPS when the supervisor headset is detected on the supervisor headset port of a so equipped IT.

Supervisor Headset Disconnected

The Supervisor Headset Disconnected command is sent to the TPS when the supervisor headset is disconnected from the supervisor headset port.

Headset Rfeature Key Pressed

The Headset Rfeature Key Pressed command is sent to the TPS in response to the IT

receiving the predefined headset based feature key event on the headset port. The transmission of this message is enabled by the **Audio Manager Options** (Headset Rfeature Key Message) command.

Audio Manager Attributes Info

This command is used in response of the **Query Attributes** command to inform the TPS of all the attributes that the Audio manager has.

Parameters:	Handsfree	Handsfree supported
	Supported Vocoders	List of all vocoders supported by the IT.

Audio Manager Options Report

This command is sent after reception of the **Audio Manager Query** (Options) command. It informs the TPS of the Audio manager's option setup.

Parameters:	Volume Adjustment	Remote: volume adjusted by the NI Local: volume adjusted by IT
	Volume Adjustment Reports	Enable/Disable the transmission of volume adjustment reports when volume keys are depressed
	Headset Rfeature Key Message	Enable/Disable the transmission of Headset Rfeature Key message when key event is detected on headset interface.

Adjustable Rx Volume Report

This command is sent to the TPS after a volume key has been depressed and the “Volume Adjustment Reports” option has been enabled via the **Audio Manager Options** command. The command shows which volume key has been depressed and if it caused the rx volume reach its “floor” or “ceiling”. The TPS could use this information to display a visual representation of the volume adjustment to the user.

Parameters:	Volume ID	none
		Audio Parameters Bank 1
		Audio Parameters Bank 2
		Audio Parameters Bank 3
		Audio Parameters Bank 4
		Audio Parameters Bank 5
		Audio Parameters Bank 6
		Audio Parameters Bank 7
		Alerting
		Special Tones
		Paging Tones

	Stream Based Tones
Vol. Down	Indicates that the volume down key has been depressed.
Vol. Up	Indicates that the volume up key has been depressed.
Floor	Indicates that the volume setting of the specified volume register has decreased to the 'floor'
Ceiling	Indicates that the volume setting of the specified volume register has increased to the "ceiling"

Adjustable Rx Volume Information

This command is used to inform the TPS of the active Rx volume register in the IT. It contains the APB or transducer based tone number, its current Rx volume setting and volume range as well as the floor ceiling indications. This command is sent generally after reception of the **Query Audio Manager** (Adjustable Rx Volume) command

Parameters:	Active Volume ID	none Audio Parameters Bank 1 Audio Parameters Bank 2 Audio Parameters Bank 3 Audio Parameters Bank 4 Audio Parameters Bank Audio Parameters Bank 6 Audio Parameters Bank 7 Alerting Special Tones Paging Tones Stream Based Tones
	Floor	Indicates that the volume setting of the specified volume register is at its 'floor'.
	Ceiling	Indicates that the volume setting of the specified volume register is at its "ceiling".
	Rx Volume Level	Current setting of the specified volume register.
	Rx Volume Range	Range of the specified volume register.

APB Default Rx Volume Value

The Audio Parameters Bank Default Rx Volume Value command is used in response to the **Query Audio Manager** (APB Default Rx Volume) command. It gives the default Rx volume level of the specified APB. It contains the APB number, the default volume setting of the APB, the floor ceiling indicators.

Parameters:	APB Identifier	none

		Audio Parameters Bank 1
		Audio Parameters Bank 2
		Audio Parameters Bank 3
		Audio Parameters Bank 4
		Audio Parameters Bank 5
		Audio Parameters Bank 6
		Audio Parameters Bank 7
		Alerting
		Special Tones
		Paging Tones
		Stream Based Tones
	Floor	Indicates that the volume setting of the specified volume register is at its "'floor'.
	Ceiling	Indicates that the volume setting of the specified volume register is at its "ceiling".
	Default Volume Level	Default volume of the specified volume register.
	Volume Range	Range of the specified volume register.

Alerting Tone Select

This command is used in response to the **Query Audio Manager** (Alerting) command. The alerting information as well as the warble rate selection are sent as part of this command. The format of the command as follows.

Parameters:	Alerting Cadence Selection	cadence 0
		cadence 1
		cadence 2
		cadence 3
		cadence 4
		cadence 5
		cadence 6
		downloadable cadence
	Warbler Select	Specifies warble selected

APB's Tx and/or STMR Response

The Query APB's Tx and/or STMR response is sent by the IT in response to the corresponding query command. The response sent by the IT indicates the current STMR and/or Tx volume level setting for the specified APB number.

Parameters:	APB number	none
		Audio Parameters Bank 1
		Audio Parameters Bank 2
		Audio Parameters Bank 3
		Audio Parameters Bank 4

		Audio Parameters Bank 5
		Audio Parameters Bank 6
		Audio Parameters Bank 7
	Tx Vol Level	current Tx volume level for the specified APB
	STMR Vol. Level	current STMR volume level for the specified APB

RTCP Statistics Report

This command is sent in response to the **Query RTCP Statistics** command sent by the TPS.

Parameters:	IT Packet Count	Total number of packets sent by the IT in the session up to this point.
	IT Octet Count	Total number of octets sent by the IT in the session up to this point.
	Interarrival Jitter	Estimate of the statistical variance of the delay between each received media packet.
	Fraction Lost	Fraction of media packets lost as reported in the last RTCP packet.
	Total Packet Lost	Total number of lost packets since the beginning of the media session.

Open Audio Stream Report

The IT automatically sends this command to the TPS after it receives an **Open Audio Stream** command. The command reports on the status of the stream created by the Open Audio Stream command.

Parameters:	Status Code	Stream opened successfully
		Operation failed – RTP port not available
		Operation failed – RTCP port not available

7.6 Display Manager

The main task of the display manager is to present the information sent by the TPS on the LCD. The TPS does not have to know the physical location of where the information is presented. Another big task of the display manager is to maintain the configuration tables for the multi-language character tables.

7.5.3 TPS to IT Display Commands

Page Scroll
Restore Default Character Table Configuration
Display Backlight Control
Arrow
Query Status Bar Icon
Highlight On/Off
Restore Time and Date
Clear Time and Date
Call Duration Timer
Query Display Manager
Download Call Duration Timer Delay
Disable Display Field
Clear Field
Cursor Control
Page Download
Display Scroll with Data
Status Bar Icon Update
Month Label Download
Call Timer Label Download
Time and Date Format
Display Data Write
Context Info Bar Format
Set Default Character Table Configuration
Set Current Character Table Configuration
Special Character Download
Highlighted Field Definition
Contrast
Caller Log Download

Page Scroll

This command is used to scroll up or down one page of display. This command assumes that the information of the page to scroll to is already downloaded in the IT.

Restore Default Character Table Configuration

This command is used to restore the character table configuration of the display to the one downloaded through the **Set Default Character Table Configuration** command. The G1, G2 and G3 tables will contain the character sets specified by the default configuration and one of the G table will be lock-shifted (code A0 to FF hex).

Display Backlight Control

This command is used to turn on and off the display backlight. This could be used in power saving mode when back lighting is supported by the IT.

Parameters:	Backlight	Turn Backlight on or off

Arrow

This command turns on or off the dedicated arrow fields on the display.

Parameters:	Left	Turn Left arrow on or off
	Right	Turn Right arrow on or off
	Up	Turn Up arrow on or off
	Down	Turn Down arrow on or off

Query Status Bar Icon

This command is used to query the state of a specific icon in the status bar. The IT will reply with the Status Bar Icon State command specifying the state of the queried icon.

Parameters:	Status Bar Icon ID	Specifies the status bar icon to be queried

Highlight On/Off

This command is used to turn on or off the highlight on the display. When the highlight is turned on, the field that is specified by the **Highlighted Field Definition** command will be highlighted.

Parameters:	Highlight	Turn Highlight on or off

Restore Time and Date

This command is used to revert the effect of the **Clear Time and Date** and **Caller Log Download** commands by restoring the time and date in the time & date fields of the IT. The time and

date or the call duration information, whichever was the last one active prior to receipt of a **Clear Time and Date** command or the **Caller Log Download** command, will be shown in the time and date field.

Clear Time and Date

This command clears the time and date fields and inhibits the update of the fields with the time and date information. The time and date information is still kept in the IT in case it is restored with a **Restore Time & Date** command.

Call Duration Timer

This command is used to configure the call duration timer. Through this command, the call duration timer can be started or stopped, reset, shown or hidden, with or without a delay.

Parameters:	Function	Start	
		Stop	
		Reset	Resets the Timer
		Display	Show
			Hide
		Delay	None

Action specified by Display bit executed after Call Duration Timer Delay

Query Display Manager

The Query Display Manager command is sent by the TPS to request various status information from the Display manager. The format of the command is as follows.

Parameters:		
	Attributes	requests the **Attributes Info** command to be sent.
	TAD	requests the **Time and Date Format** command to be sent.
	Cursor	requests the **Cursor Location** command to be sent.
	Contrast	requests the **Contrast Level** command to be sent.
	Backlight	requests the **Backlight Status Info** command to be sent.
	Highlight	requests the **Highlight Status** command to be sent.
	Current Character Table	requests the **Current Character Table Configuration Status** command to be sent.
	Default Character Table	requests the **Default Character Table Configuration Status** command to be sent.

Download Call Duration Timer Delay

The Download Call Duration Timer Delay command is used to specify the delay to be used by the Call Duration Timer command when the Delay option is selected in the **Call Duration Timer** command.

Parameters: Call Duration Timer Delay specifies the delay duration of call duration timer.

Disable Display Field

The Disable Display Field command is used to enable and disable fields of the LCD. When a field is disabled it becomes blank until it is re-enabled. However, if the TPS writes data to a disabled field, the data will be stored in the IT and will become visible on the LCD once it is re-enabled. All fields that have their corresponding bit set will be disabled and all others with their bit cleared will be enabled.

Parameters:	Numeric	Enable/Disable Numeric Index Field in the Info Bar
	Context	Enable/Disable Context Field in the Info Bar
	Date	Enable/Disable Date Field
	Time	Enable/Disable Time Field
	Line X	Enable/Disable Line X
	Softkey Y	Enable/Disable Softkey Y
	All	Enable/Disable all fields

Clear Field

This command is used to erase fields of the LCD. Many portion of the display can be cleared at the same time. Once a field is cleared, the data it contained is lost and cannot be re-displayed on the field unless re-downloaded by the IT.

Parameters:	Numeric	Clear Numeric Index Field in the Info Bar
	Context	Clear Context Field in the Info Bar
	Date	Clear Date Field
	Time	Clear Time Field
	Line X	Clear Line X
	Softkey Y	Clear Softkey Y
	All	Clear all fields

Cursor Control

This command is used to activate, configure and move the cursor on the display.

Parameters:	Cursor Movement	Set cursor at home (first character on the first text line) Set cursor at the specified position within the specified field Move the cursor by one to the left Move the cursor by one to the right Move the cursor a specified number of positions to the left Move the cursor a specified number of positions to the right
	Cursor State	ON OFF Blink
	Field	Numeric Line SoftKey
	Softkey ID	The Softkey ID when field specifies softkey
	Line Number	Line number when field specifies line.
	Character Position	Position of the cursor in the specified field (zero being the first position within the field)
	Position Delta	Specifies number of positions left or right to move cursor

Page Download

This command downloads portions of next up or next down page in the IT. A portion can be any field that characterizes the display, i.e., line, softkey, etc.

Parameters:	Field	Softkey Line
	Line Number	Specifies line number when Line field is specified
	Softkey ID	Specifies softkey when Softkey field is specified
	Character Position	Specifies starting character position when Line field is specified
	Display Data	Data to be written to specified field and position

Display Scroll with Data

This command is used to download a new line of text and to scroll the others up or down. This command only affects the line fields of the display. This command cannot download more than

one new line of text at the time.

Parameters:	Scroll Direction	Down: Place text data on first line and scroll others down Up: Place text data on last line scroll others up
	Display Data	Data to be written

Status Bar Icon Update

This command is used to change to current state and cadence of a status bar icon.

Parameters:	Status Bar Icon ID	specifies the status bar icon to be updated
	Icon State	specifies desired state of icon
	Icon Cadence	Off On Flash Flicker Wink Twinkle Blink Downloadable cadence

Month Labels Download

This command is used to download the label for the current and next months. These labels are used in the date field and enable the date to roll over to next month.

Parameters:	Current Month Label	Text string representing current month
	Next Month Label	Text string representing next month

Call Duration Timer Label Download

This command is used to download the call duration timer label which will be displayed on the IT's display when the call duration timer is activated.

Parameters:	Call Duration Timer Label	Text string representing call duration timer label

Time and Date Format

This command is used to specify the format that the Display manager will use to present the time and the date information to the user.

Parameters:	Time Format	12-hour clock (e.g. 10:34pm) French clock (e.g. 22h34) 24-hour clock (e.g. 22:34)
	Date Format	day first (e.g. 16Sep) month first (e.g. Sep16) numeric standard (e.g. 09/16) numeric inverse (e.g. 16/09)

Notes:

1) For the day-first and for the month-first formats, the month label has to be downloaded, via the **Month Label Download** command.

Display Data Write

This command is used as a generic command for writing to the display. It is composed of four parts: the address, the control, the tag and the data. Three of these parts, the address, the control, and the tag, are optional. The display data part is mandatory. The address byte is used to specify where the text to write starts. If no address is specified, the data will start at the current cursor position. The tag field is used to give a meaning to the attached text (directory, CLID, etc.). The control field is used to control characteristics of the display. If the control field is not present, the default control setup will be used.

Parameters:

Address	Field	Numeric Context Line SoftLabelKey Softkey
	Line Number	Specifies line number when Line field is specified
	SoftLabelKey ID	Specifies soft labelled key when Soft Labeled Key field is specified
	Softkey ID	Specifies softkey when Softkey field is specified
	Character Position	Specifies starting character position when Line field is specified
	Control	Cursor MovementNone Cursor moves to end of new text
	Clear Left	Clears the text at the left of the active position before writing the new text.
	Clear Right	Clears the text at the right of the active position before writing the new text.
	Shift Left	Shifts text at the specified position to the left when writing new text.

	Shift Right	Shifts text at the specified position to the right when writing new text.
	Highlight	Highlights new text
	Extended Height	Displays new text in extended height format
Tag	Tag Data	Non displayed data indicating purpose of data
Data	Display Data	Data to be displayed per command

Context Info Bar Format

This command is used to specify the format of the Context Info bar field. The supported formats are the ones specified in the functional description of the IT in question.

Parameters:	Format	none
		Underline
		Overline
		Marquee
		Border
		Reverse-video
		Reverse-video with border
	Field	Numeric
		Context
		Date
		Time

Set Default Character Table Configuration

This command downloads the default character map configuration that the display manager must use. It specifies the mapping of the character table to the graphics tables and it also specifies which one of the graphics table is to be lock-shifted (code A0 to FF hex).

Parameters:	Default Character Table Configuration	Data representing Default character table configuration

Set Current Character Table Configuration

This command downloads the current character map configuration that the display manager must use. It specifies the mapping of the character table to the graphics tables and it also specifies which one of the graphics table is to be lock-shifted (code A0 to FF hex).

Parameters:	Default Character Table Configuration	Data representing Default character table configuration

Special Character Download

This command is used to download special characters that are not specified in the character ROM tables of the IT. In the command, the special character address is specified as well as bit-map.

Parameters:	Character ID	identifies character to be downloaded
	Bitmap Data	data defining the character

Highlighted Field Definition

This command is used to highlight a portion of the display.

Parameters:	Field	Numeric Context Line SoftKey
	Line Number	Line number when field specifies line.
	Softkey ID	The Softkey ID when field specifies softkey
	Starting Position	Starting character position of the highlighted portion.
	Ending Position	Ending character position of the highlighted portion.

Contrast

This command sets the contrast level.

Parameters:	Contrast	Specifies contrast level to be set

Caller Log Download

This command is used to update the time and date fields with a downloaded time and text label instead of the usual time and date information.

Parameters:	Hour	Specifies hour
	Minutes	Specifies minutes
	Text Label	Text data to be written to the Date field

7.5.4 IT to TPS Display Commands

Display Manager Attributes Info
Contrast Level Report
Cursor Location Report

Highlight Status On
Current Character Table Configuration Status
Default Character Table Configuration Status
Time and Date Format Report
Status Bar Icon State Report
Backlight Status
Highlight Status Off

Display Manager Attributes Info

This command is used in response to the **Query Display Manager** (Attributes) command.

Parameters:		
	Line Width	The width of the text area lines expressed in characters
	Lines	Number of lines in the text area
	Line Icon	When set, it indicates that an icon is associated with each line in the text area of the display
	Softkey Width	The width of the softkeys expressed in characters.
	Softkeys	Number of softkeys
	Soft Labeled Key Width	The width of the Soft-Labeled key area expressed in characters.
	Soft Labeled Keys	Number of soft labeled keys
	Context Field Width	The width of the context field expressed in characters.
	Numeric Width	Number of digit supported in the numeric index field.
	Time Width	Number of Character supported in the time field.
	Date Width	Number of Character supported in the date field.
	Character Download	Number of downloadable characters.
	Free Form Icon Download	Number of downloadable free form icons
	Character sets	List of supported character sets

Contrast Level Report

This command is used in response to the **Query Display Manager** (Contrast) command. It gives the current display contrast level. The level is set by the TPS with the **Contrast** command.

Parameters:		
	Contrast Level	Current setting of display contrast

Cursor Location Report

This command is used in response to the **Query Display Manager** (Cursor) command. It gives the position of the cursor on the display.

Parameters	Field	Numeric Line SoftKey
	Softkey ID	The Softkey ID when field specifies softkey
	Line Number	Line number when field specifies line.
	Character Position	Position of the cursor in the specified field (zero being the first position within the field)

Highlight Status On

This command is used in response to the **Query Display Manager** (Highlight) command when the highlight feature is on. The command defines the display area that is currently highlighted.

Parameters:	Field	Numeric Context Line SoftKey
	Line Number	Line number when field specifies line.
	Softkey ID	The Softkey ID when field specifies softkey
	Starting Position	Starting character position of the highlighted portion.
	Ending Position	Ending character position of the highlighted portion.

Current Character Table Configuration Status

The Current Character Table Configuration Status command is used in response to the **Query Display Manager** (Current Config) command. It informs the TPS about the current character table configuration of the display manager.

Parameters:	Contrast Level	Current contrast setting
	Current Character Table Configuration	Data representing current character table configuration

Default Character Table Configuration Status

The Default Character Table Configuration Status command is used in response to the **Query Display Manager** (Default Config) command. It informs the TPS about the default character

table configuration of the display manager.

Parameters:	Contrast Level	Current contrast setting
	Default Character Table Configuration	Data representing default character table configuration

Time and Date Format Report

The Time and Date Format command is used in response to the **Query Display Manager** (TAD) command. It reports on the format that the IT uses to present the time and date information to the user.

Parameters:	Time Format	12-hour clock (e.g. 10:34pm)
		French clock (e.g. 22h34)
		24-hour clock (e.g. 22:34)
	Date Format	day first (e.g. 16Sep)
		month first (e.g. Sep16)
		numeric standard (e.g. 09/16)
		numeric inverse (e.g. 16/09)

Status Bar Icon State Report

This command is used in response to the **Query Display Manager** (Icon) command. It gives the current state and cadence of the selected status bar icon.

Parameters:	Status Bar Icon ID	specifies the status bar icon to be updated
	Icon State	specifies desired state of icon
	Icon Cadence	Off
		On
		Flash
		Flicker
		Wink
		Twinkle
		Blink
		Downloadable cadence

Backlight Status

This command is used in response to the **Query Display Manager** (Backlight) command. It gives the current state of the backlight. The backlight is controlled by the TPS with the **Display Backlight Control** command.

Parameters:	Backlight Status	On
		Off

Highlight Status Off

This command is used to respond to the **Query Display Manager** (Highlight) command when the status of the highlight is off.

7.6 Command Summary

Table 1:Broadcast Manager Commands

TPS to IT	IT to TPS
Logical Icon Update	
Time and Date Download	
Set Default Character Table Configuration	

Table 2:Network Manager Commands

TPS to IT	IT to TPS
Soft Reset	Soft Reset Ack
Hard Reset	Sanity OK
Query Network Manager	Network Manager Attributes info
Network Manager Options	Network Manager Diagnostic Info
Control Channel QoS Configuration	Manager Ids
Reserve UDP Port Block	Network Manager Options Report
Server Identification Tag	Resume Connection With Server
Set RTCP Source Description Items	Suspend Connection With Server
Protocol Switch	Reserved UDP Ports Report
Download Backup Server Information	Copyright Text
Server Switch	
Server Alarm	

Table 3:Basic Manager Commands

TPS to IT	IT to TPS
Start Selftest	Basic Manager Attributes Info
Query Basic Manager	Basic Manager Options Report
Basic Manager Options	F/W version
General Read/Write	IT Type
Eeprom Write	Selftest result
Encapsulate Command	General Read Response
	Hardware ID
	Product Engineering Code

Table 4:Key/Indicator Manager Commands

TPS to IT	IT to TPS
LED Update	Key Event
Query Hookswitch	LED Status Report
User Activity Timer	On hook
Downloadable Free Form Icon Access	Off hook
Query Key/Indicator Manager	User Activity Timer Expired
Key/Indicator Manager Options	Hookswitch State
Logical Icon Mapping	Key/Indicator Manager Attributes info
Key Repeat Timer Download	Key/Indicator Manager Options Report
Query LED State	IT Icon Status Report
Query IT Icon State	
Indicator Cadence Download	
User Activity Timer Download	
Free Form Icon Download	
IT Icon Update	

Table 5:Audio Manager Commands

TPS to IT	IT to TPS
Query Audio Manager	Handset connected
Query Supervisor Headset Status	Handset disconnected
Audio Manager Options	Headset connected
Mute/unmute	Headset disconnected
Transducer Based Tone On	Supervisor Headset connected
Transducer Based Tone Off	Supervisor Headset disconnected
Alerting Tone Configuration	Headset Feature Key Pressed
Special Tone Configuration	Audio Manager Attributes info
Paging Tone Configuration	Audio Manager Options Report
Alerting Tone Cadence Download	Adjustable Rx Volume Report
Special Tone Cadence Download	Adjustable Rx Volume Information
Paging Tone Cadence Download	APB's Default Rx Volume Value
Transducer Based Tone Volume Level	Alerting Tone Select
Alerting Tone Test	APB's Tx and/or STMR Response
Visual Transducer Based Tones Enable	RTCP Statistics Report
Stream Based Tone On	Open Audio Stream Report
Stream Based Tone Off	
Stream Based Tone Configuration	
Stream Based Tone Frequency Component List Download	
Stream Based Tone Cadence Download	
Select Adjustable Rx Volume	
Set APB's Rx Volume Levels	
Change Adjustable Rx Volume	
Adjust Default Rx Volume	
Adjust APB's Tx and/or STMR Volume Level	
Query APB's Tx and/or STMR Volume Level	
ABP Download	
Open Audio Stream	
Close Audio Stream	
Connect Transducer	
Frequency Response Specification	
Biquad Download	
Voice Switching Configuration	
Query RTCP Statistics	
Configure Vocoder Parameters	
Jitter Buffer Configuration	

Table 6:Display Manager Commands

TPS TPS to IT	IT to TPS
Page Scroll	Display Manager Attributes Info
Restore Default Character Table Configuration	Contrast Level Report
Display Backlight Control	Cursor Location Report
Arrow	Highlight Status On
Query Status Bar Icon	Current Character Table Configuration Status
Highlight On/Off	Default Character Table Configuration Status
Restore Time and Date	Time and Date Format Report
Clear Time and Date	Status Bar Icon State Report
Call Duration Timer	Backlight Status
Query Display Manager	Highlight Status Off
Download Call Duration Timer Delay	
Disable Display Field	
Clear Field	
Cursor Control	
Page Download	
Display Scroll with Data	
Status Bar Icon Update	
Month Label Download	
Call Timer Label Download	
Time and Date Format	
Display Data Write	
Context Info Bar Format	
Set Default Character Table Configuration	
Set Current Character Table Configuration	
Special Character Download	
Highlighted Field Definition	
Contrast	
Caller Log Download	

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List of terms

Abbreviations	Acronyms
ABCE	Automatic Bridged Call Exclusion
AC	Attendant Console
ACB	Automatic Call Back
ACBAR	Automatic Callback/Automatic Return
ACD	Automatic Call Distribution
ACO	Additional Call Offering
ACOU	Additional Call Offering-Unrestricted
ACR	Anonymous Call Rejection
AE	Application Entity
AFC	Additional Function Call
Ai	Action indicator
AMA	Automatic Message Accounting
ANI	Automatic Number Identification
AR	Automatic Recall
ASN.1	Abstract Syntax Notation One
ASP	Assignment Source Point
AT	Abstract Terminal
AUD	Automatic Dial
AUL	Automatic Line
BBG	Basic Business Group
BC	Bearer Capability
BCE	Bridged Call Exclusion
BRI	Basic Rate Interface
BS	Bearer Service
CA	Call Appearance
CACH	Call Appearance Call Handling
CAR	Call Appearance Reservation
CBQ	Call Back Queuing
CCITT	International Telegraph and Telephone Consultative Committee
CCR	Customized Code Restriction
CDN	Called Party Number
CES	Connection Endpoint Suffix
CF	Call Forward
CFAC	Call Forward All Calls
CFB	Call Forward Busy
CFC	Call Forward Cancel
CFD	Call Forward Don't Answer
CDS	Called Party Subaddress
CFF	Cal l Forward Fixed
CFI	Call Forward Intergroup
CFX	
CFI	Call Forward Intragroup
CFP	Call Forward Programming

CFRA	Call Forward Remote Access
CFU	Call Forward Universal
CFV	Call Forwarding Variable
CFWVAL	Call Forward Validation
CGN	Calling Party Number
CGS	Calling Party Subaddress
CHG	Charge Number
CID	Channel identification
CIDCW	Caller Identity Delivery On Call Waiting
CIDS	Calling Identify Delivery and Suppression
CLID	Caller ID
CLASS	Custom Local Area Signalling Services
CM	Computing Module
CMD	Circuit-Mode Data
CN	Connected number
CNAMD	Calling Name Delivery
CND	Calling Number Delivery
CNDA	Calling Number Delivery Activation
CNDB	Calling Number Delivery Blocking
CNDD	Calling Number Delivery Deactivation
CNI	Calling Number Identification
CNIS	Calling Number Identification Services
CNP	Calling Number Privacy
COT	Customer Originated Trace
CPE	Customer Premises Equipment
CPS	Calling Party Subaddress
CPU	Call PickUp
CR	Call Reference
CRA	Call Request Activation
CRB	Call Reference Busy
CRBL	Call Reference Busy Limit
CRd	Call Reference dummy or null
CT	Call Type
CUG	Closed User Group
CWD	
CWI	
CWO	
CWT	Call Waiting
DC	Direct Call
DCA	Dialed Access Codes
DCPK	Directed Call Park
DDD	Direct Distance Dialing
DDO	Direct Dialing Overseas
DIN	Denied Incoming
DISA	Direct Inward System Access
DISC	Disconnect
DLH	Distributed Line Hunt

DM	Disconnected Mode
DN	Directory Number
DND	Directory Number Dependent
DND	Do Not Disturb
DNH	Directory Number Hunt
DOR	Denied Origination
DPN	
DRCW	Distinctive Ringing Call Waiting
DSL	Digital Subscriber Line
DT	Display Text
DTE	Data Terminal Equipment
EBO	Executive Busy Override
EBX	Executive Busy Override - Exempt
EID	Endpoint IDentifier
EKTS	Electronic Key Telephone Service
ERWT	Expensive Route Warning Tone
ESB	Emergency Service Bureau
EXB	Extension Bridging
FA	Feature Activation
FA	Feature Activator
FC	Feature Code
FC	Flexible Calling
FCA	Feature Code Access
FCM	Functional Call Management
FCS	Frame Check Sequence
FFM	Functional Feature Management
FI	Feature Indication
FI	Feature Indicator
FIT	Fully Initializing ISDN Terminal
FKA	Feature Key Access
FKM	Feature Key Management
FPE	Feature Processing Environment
FRMR	Frame Reject
FTM	Functional Terminal Management
GIC	Group Intercom
HLC	High Layer Compatibility
HMI	Human-Machine Interface
I	Information
I-CF	ISDN Call Forwarding
I-CND	ISDN Called Number Delivery
IBN	Integrated Business Network
ICM	Intercom
IE	Information Element
IRQ	Information Request
ISDN	Integrated Services Digital Network

ITU-T	International Telecommunication Union -Telecommunication Standardization Sector
KP	KeyPad
KSH	Keyset Short Hunt
LAPB	Link Access Procedure - Balanced
LCC	Line Class Code
LDN	Listed Directory Number
LLC	Low-Layer Compatibility
LNR	Last Number Redial
LNRA	Last Number Redial Associated
LPIC	Preferred intraLATA Carrier
LS	Locking Shift
LSB	Least Significant Bit
LTID	Logical Terminal IDentifier
LVM	Leave Message
MADN	Multiple Appearance Directory Number
MBCE	Manual Bridged Call Exclusion
MBS	Meridian Business Set
MCA	Multiple Call Arrangement
MCH	Malicious Call Hold
MDC	Meridian Digital Centrex
MLH	Multi-Line Hunt
MRFM	MADN Ring Forward Manual
MSB	Make Set Busy
MSB	Most Significant Bit
MWT	Message Waiting
NBL	Notification Busy Limit
NCOS	Network Class of Service
NCP	Network Control Program
NDM	Normal Disconnect Mode
NI	Notification Indicator
NIT	Non-Initializing Terminal
NOAMA	No Automatic Message Accounting
NPI	Number Plan Identification
NPSI	Network Control Packet Switching Interface
NRM	Normal Response Mode
NRS	Network Resource Selector
NT	Network Termination
NT1	Network Termination Equipment
NTMFT	Nortel Meridian Feature Transparency
NTTRF	Nortel Bellcore TR-compliant Functional
OM	Operation Measurement
OSA	Operator System Access
PBX	Private Branch Exchange
PCA	Privacy Change Allowed
PCM	Pulse Code Modulation

PD	Parameter Downloading
PDN	Primary DN
PH	Packet Handler
PI	Progress Indicator
PIC	Preferred interLATA Carrier
PMD	Packet Mode Data
PPSN	Public Packet Switched Network
PRK	Call Park
PS	Packet Switched
PSDS	Public Switched Digital Service
PVC	Protocol Version Control
QLLC	Qualified Logical Link Control
RAG	Ring Again
REJ	Reject
RES	Residential Enhanced Services
RF	Ring Forward
RGN	Redirecting Number
Ri	Reference number
RLS	Release
RN	Redirecting Number
RND	Redirecting Number Display
RNN	Redirection Number
RNR	Receive Not Ready
RO	Remote Operations
ROSE	Remote Operations Service Element
RR	Receive Ready
RU	Remote Unit
S	Supervisory
SABME	Set Asynchronous Balanced Mode Extended
SAP	Service Access Point
SAPI	Service Access Point Identifier
SC	Speed Call
SCA	Selective Call Acceptance
SCA	Single Call Arrangement
SCF	Selective Call Forwarding
SCL	Speed Call - Long list
SCP	Signalling Control Protocol
SCR	Selective Call Rejection
SCS	Speed Call - Short list
SCU	Speed Call User
SDLC	Synchronous Data Link Control
SDN	Secondary DN
SERVORD	Service Orders
SIG	Signal
SLE	Screen List Editing
SLU	Subscriber Line Usage
SNA	System Network Architecture

SPID	Service Profile Identifier
SPM	Service Profile Management
SSRT	Station Ringing Transfer
SVC	Switched Virtual Circuit
TCA	Terminal Call Appearance
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier
TID	Terminal IDentifier
TN/NPI	Type of Number/Numbering Plan Indicator
TNS	Transit Network Selection
TON	Type Of Number
TRC	Terminating Restriction Code
TSP	Terminal Service Profile
UA	Universal Access
UA	Unnumbered Acknowledgment
UCD	Uniform Call Distribution
UI	Unnumbered Information
UP	User Provided
USID	User Service Identifier
VI	Voiceband Information
WML	Warm Line
XID	Exchange Identification
XPM	Extended Peripheral Module
3WC	Three-Way Calling

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