A Joint Standard of AASHTO, ITE, and NEMA

NTCIP 2102:2003 v01.09

National Transportation Communications for ITS Protocol

Point to Multi-Point Protocol Using FSK Modem Subnetwork Profile

September 2005

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444 North Capitol Street, N.W., Suite 249
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Institute of Transportation Engineers (ITE)
1099 14th Street, N.W., Suite 300 West
Washington, D.C. 20005-3438

National Electrical Manufacturers Association (NEMA)
1300 North 17th Street, Suite 1752
Rosslyn, Virginia 22209-3806

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At the time that this document was prepared, the following individuals were members of the NTCIP Profiles Working Group:

- Jas Bhullar
- Robert De Roche (Chair)
- Robert Force
- Willard "Bud" Kent
- Amit Misra
- Alex Mousadi
- Joerg "Nu" Rosenbohm
- Sonja Sun
- Kenneth Vaughn
- Hoi Wong

Other individuals providing input to the document include:

- Ken Bare
- Robert Barrett
- Joey Baumgartner
- Blake Christie
- Arthur Felgate
- Michael Forbis
- Wayne Henley
- Joseph Herr
- Earl Hoekman
- David Kingery
- Tom Kurihara
- Gary Meredith
- Bon Ninke
- Brian Paulsmeyer
- Jeff Racz
- Toby Rickman
- Michael Robinson
- James Rose
- Ray Starr
- Dan Vanada

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FOREWORD

This document uses only metric units.

The context of the NTCIP is one part of the Intelligent Transportation Systems standardization activities covering base standards, profiles, and registration mechanisms.

- Base Standards define procedures and rules for providing the fundamental operations associated with communications and information that is exchanged over fixed-point communications links.

- Profiles define subsets or combinations of base standards used to provide specific functions or services. Profiles prescribe particular subsets or options available in base standards necessary for accomplishing a particular function or service. This provides a basis for the development of uniform, nationally recognized conformance.

- Registration Mechanisms provide a means to specify and uniquely identify detailed parameters within the framework of base standards and/or profiles.

This publication provides the definition of an NTCIP Subnetwork Profile. It defines requirements for the data link and physical layers of a communications stack based upon the OSI Basic Reference Model. It also contains optional and conditional clauses that are applicable to specific environments for which they are intended.

This document is an NTCIP Subnetwork Profile document. Subnetwork Profile documents define the requirements of the data link and physical layers of a communications stack based upon the OSI Basic Reference Model.

For more information about NTCIP standards, visit the NTCIP Web Site at http://www.ntcip.org.

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Approvals

This document was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved this standard as the following standard type, as of the date:

AASHTO – Standard Specification; March 2003
ITE – Software Standard; December 2002
NEMA – Standard; October 2002

History

This standard was originally part of NTCIP 2001, *Class B Profile*. In July 1999, the Joint Committee on the NTCIP approved a work item to separate the text into a stand-alone subnetwork profile. NTCIP 2102 was previously referenced as TS 3.SP-PMPP/FSK.

NTCIP 2102 v01.04. May 2000 – Version 01.03 accepted as a User Comment Draft by the Joint Committee on the NTCIP. September 2000 – NTCIP Standards Bulletin B0057 sent version 01.04 for User Comment.

NTCIP 2102 v01.08. June 2001 – Version 01.07 accepted as a Recommended Standard by the Joint Committee on the NTCIP. February 2002 – NTCIP Standards Bulletin B0066 sent version 01.08, with revised front matter, for balloting and approval. Approved by AASHTO in March 2003, approved by ITE in December 2002, and approved by NEMA in October 2002.

NTCIP 2102:2003 v01.09. September 2005 – Prepared document for publication.

Compatibility of Versions

All NTCIP Standards Publications have a major and minor version number for configuration management. The version number syntax is "v00.00a," with the major version number before the period, and the minor version number and edition letter (if any) after the period.

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Compliant systems based on later, or higher, version numbers MAY NOT be compatible with compliant systems based on earlier, or lower, version numbers. Anyone using this document should also consult NTCIP 8004 for specific guidelines on compatibility.

INTRODUCTION

This publication defines a subnetwork profile that is a combination of standards intended to meet specific requirements for data transfers to and from roadside devices in either a networked or direct-connect environment. The purpose of this standard is to provide the information necessary to establish a connection using the Point-to-MultiPoint Protocol (PMPP) via a 1200 bps frequency shift keying (FSK) modem interface. Its scope covers the Data Link and Physical Layers of the OSI Basic Reference Model. It is used to manage connected devices that coexist on a common channel. It supports a variety of upper layer protocols over a common physical implementation. It contains mandatory requirement statements that are applicable to all devices claiming conformance to this standard. It also contains options and conditional requirements, which may be applicable to a specific environment in which a device is used.

Annex A is normative and contains a Profile Requirements List in the form of PICS proforma.

The following keywords apply to this document: AASHTO, ITE, NEMA, NTCIP, Profile, Subnetwork, PMPP, Bell 202, and FSK.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. Under the guidance of the Federal Highway Administration's NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an ITS network.

In September 1996, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standards. In August 1997, the Joint Committee on the NTCIP formed a new working group to develop a method for organizing class profiles. The Profiles WG first met in September 1997.

After research into how national and international standards organizations combine protocols and standards to address all seven layers of the OSI Basic Reference Model, the committee adopted the approach defined in the *NTCIP Profile Framework.* Following that approach, a complete protocol stack was specified by application, transport, and subnetwork profiles. An application profile addresses the application, presentation, and session layers. A transport profile addresses the transport and network layers. A subnetwork profile addresses the data link and physical layers. The *NTCIP - Point to Multi-Point Protocol Using FSK Modem Subnetwork Profile* is a subnetwork profile for use in center-to-field communications.

The Profiles Working Group is concerned with the methodology of defining profiles, and the definition and documentation of profiles in Standards Publications. This document is intended to provide a complete subnetwork profile (SP) that specifies the communications over an asynchronous, half-duplex or full-duplex dedicated digital circuit. This SP specifies the requirements for an unbalanced connectionless operation. This subnetwork profile can be used with different transport profiles addressing the network and transport layer requirements. The objective is to facilitate the specification of ITS systems characterized by a high degree of interoperability and interchangeability of its components.

CONTENTS

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Section 1
GENERAL

1.1 SCOPE

This standard is applicable to transportation related devices that must operate in a typical primary/secondary configuration where one device is the designated primary while one or more other devices are connected to one channel acting as secondaries. As a subnetwork profile, it specifies a set of protocols and standards applicable to the data link and physical layers of the OSI Basic Reference Model. The SP-PMPP/FSK is intended to provide an interoperability standard for the Physical and Data Link Layer aspects of communications in transportation related devices. The primary purpose of this standard is to provide a simple data exchange tool that uses a connectionless delivery mechanism.

This subnetwork profile lists the requirements for an implementation using an unbalanced mode of operation for the data link layer that have been derived from the High-Level Data Link Control (HDLC) standard. This subnetwork profile defines not only the definition of the physical and the data link layer protocols but also the interface definition between the data link layer and higher layer protocols.

1.2 PROFILE-PROTOCOL-LAYER RELATIONSHIPS

A profile defines a combination of base standards and/or other profiles that collectively perform the intended function. The definition of Subnetwork Profiles and their functions and responsibilities are defined within NTCIP 8003. This profile references computer communications and transportation protocol standards for the Data Link and Physical Layers of the OSI Basic Reference Model.

The OSI Basic Reference Model defines seven layers, each performing a particular role in the transmission of data over a medium. This subnetwork profile defines the first two layers. The layers, base standards, and profile taxonomy that make up this profile are shown in Figure 1-1.

ISO Layers	Base Standards	Profile
DATA LINK LAYER	ISO/IEC 3309 ISO/IEC 4335 ISO/IEC 7809	SP-PMPP/FSK Subnetwork Profile
PHYSICAL LAYER	Based upon Bell 202T	

Figure 1-1
SP-PMPP/FSK - Subnetwork Profile Relationship

The first layer, the Physical Layer, deals with how the bits of information are transmitted over a communications channel. It deals with the mechanical and electrical interfaces, and the physical transmission medium.

The second layer, the Data Link Layer, has the task of transforming the information that came in over the wire into data that appears to be free of transmission errors. It should incorporate mechanisms to ensure the integrity of the data and provide a method of ensuring that, if need be, no data is lost. An unbalanced configuration provides for only one primary station and one or more secondary stations to operate as point- to-point or point-to-multipoint, half duplex or full duplex, and stop/start (asynchronous) transmission.

An unbalanced configuration is a scenario where a designated primary station is responsible for controlling the interchange of data with each secondary station and for establishing and maintaining the link.

This subnetwork profile requires a Primary/Secondary relationship between devices and controllers (i.e., this profile does not support contention-based communications). The profile will function on low speed communications links that may either be full or half duplex. This SP does not address higher layer functionality such as routing, segmentation and re-transmission of data packets, nor is it concerned with the application(s) residing in the device.

This Subnetwork Profile does not address the organization and definition of the information related to transportation device's end application. Additionally, it does not require a particular Transport Profile or Application Profile. However, it does indicate a particular mechanism to identify higher layer protocols by means of the Initial Protocol Identifier (IPI). The IPI is directly analogous to the Protocol Identifier employed in the Point-to-Point protocol. It provides a mechanism to permit “multiplexing” messages generated by multiple protocols using a single physical channel. The IPI is a number assigned internationally for the Internet community by an organization called IANA.

At the data link layer, the Point to Multi-Point Protocol (PMPP) is used to provide error detection, link activation and deactivation control, and notification. It provides for connectionless delivery and is designed for operation in a primary-secondary environment. A secondary will not transmit unless explicitly allowed to by a primary. This protocol is based on three ISO standards (ISO 3309, ISO 4335, and ISO 7809) and is very similar to the Point to Point Protocol (PPP).

This standard calls for the use of a 1200 bps FSK modem interface at the physical layer. The modem type reflects state-of-practice technology used in traffic signal controller systems. The electrical characteristics and signals are based upon the Bell Telephone 202T Specifications. This type of interface is used multi-drop systems arranged in a primary / multiple secondaries arrangement.

1.3 REFERENCES

For approved revisions, contact:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209-3806
fax: (703) 841-3331
e-mail: ntcip@nema.org

Draft amendments, which are under discussion by the relevant NTCIP Working Group, and amendments recommended by the NTCIP Joint Committee are available on the World Wide Web at http://www.ntcip.org.

1.3.1 Normative References

The following standards (normative references) contain provisions, which, through references in this text, constitute provisions to this Standard. By reference herein, these standards are adopted, in whole or in part as indicated, in this publication. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

Motorola / Universal Data Systems
500 Bradford Drive
Huntsville, AL 35805

Bell 202T *Bell System Data Communications, TECHNICAL REFERENCE, Data sets 202S and 202T Interface Specification*, July 1976

American National Standards Institute (ANSI)
11 West 42nd Street, 13th Floor
New York, NY 10036

ISO/IEC 3309: 1993 *Information technology — Telecommunications and information exchange between systems —High-level data link control (HDLC) procedures—Frame structure*

ISO/IEC 4335: 1993 *Information technology — Telecommunications and information exchange between systems —High-level data link control (HDLC) procedures—Elements of procedures*

ISO/IEC 7809: 1993 *Information technology — Telecommunications and information exchange between systems —High-level data link control (HDLC) procedures —Classes of procedures*

Internet Architecture Board
available via electronic file transfer
use anonymous FTP from
nic.ddn.mil

RFC 1381 *SNMP MIB Extension for the X.25 Packet Layer; D. Throop, F. Baker*

RFC 1317 *Definitions of Managed Objects for RS-232-like Devices, B. Stewart*

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

NTCIP 1201:1996 *National Transportation Communications for Its Protocol (NTCIP) - Global Object Definitions (includes Amendment 1)*

1.3.2 Informative References

The following standard and documents are referenced in this document. They may provide a better understanding of this standard.

Internet Architecture Board
http://www.rfc-editor.org/
http://www.ietf.org/rfc/html
http://www.rfc-editor.org/repositories.html

IAB STD 2 (*RFC 1700: Assigned Numbers, Internet Assigned Number Authority (IANA))*

IAB STD 3 *(RFC 1122: Requirements For Internet Hosts - Communication Layers, RFC 1123: Requirements For Internet Hosts - Application and Support)*

IAB STD 15 *(RFC 1157: Simple Network Management Protocol)*

IAB STD 16 *(RFC 1155: Structure and Identification of Management Information for TCP/IP-based Internets, RFC 1212: 1991, Concise MIB Definitions)*

IAB STD 17 *RFC 1213: Management Information Base for Network Management of TCP/IP-based internets: MIB-II, K. McCloghrie*

IAB STD 51 *RFC 1661:The Point-to-Point Protocol (PPP); W. Simpson*

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209

NTCIP 8003:2001 *NTCIP Profile Framework*

NTCIP 1101:1996 *NTCIP - Simple Transportation Management Framework (STMF), v01.12 includes Amendment 1*

NTCIP 2001 *NTCIP - Class B Profile*

NTCIP 2001 Amendment 1 *NTCIP - Class B Profile – Amendment 1*

NTCIP 2201v01.15 *NTCIP - Transportation Transport Profile*

NTCIP 2202 v01.05 *NTCIP – Transportation Transport Profile*

1.4 TERMS

For the purpose of this Standard, the following terms apply.

baud rate	The number of discrete signal events per second occurring on a communications channel. It is often referred to as bits per second (bps), which is technically inaccurate but widely accepted.
bit	Binary Digit. A single basic computer signal consisting of a value of 0 or 1, off or on.
byte	A group of bits acted upon as a group, which may have a readable ASCII value as a letter or number or some other coded meaning to the computer. It is commonly used to refer to 8-bit groups.
data	Information before it is interpreted.
Data Link Layer	That portion of an OSI Basic Reference Model (Layer 2) responsible for flow control, framing, synchronization and error control over a communications link.
datagram	A self-contained unit of data transmitted independently of other datagrams.
Data packet	Another term for “information field” (as used within this standard). This term is mainly used with Network Layer Protocol describing all information that is passed from the Network Layer to the Data Link Layer.
Intelligent Transportation Systems	A major national initiative to improve information, communication and control technologies in order to improve the efficiency of surface transportation.
International Organization for Standardization (ISO)	An international standards organization. ANSI is the primary interface to ISO within the United States. Often thought to be International Standards Organization because of the usage ISO for short.
Internet	A large collection of connected networks, primarily in the United States, running the Internet suite of protocols. Sometimes referred to as the *DARPA Internet, NSF/DARPA, Internet*, or the *Federal Research Internet.*
Internet Protocol (IP)	The network protocol offering a connectionless mode network service in the

	Internet suite of protocols.
Internet Protocol Suite	A collection of computer-communication protocols originally developed under DARPA sponsorship.
internetwork	The ability of devices to communicate across multiple networks.
network	A collection of subnetworks connected by intermediate systems and populated by end systems.
Network Layer	That portion of an OSI Basic Reference Model (Layer 3) responsible for data transfer across the network, independent of both the media comprising the underlying subnetworks and the topology of those subnetworks.
network management	The technology used to manage a network, usually referring to the management of devices that contain information about setup, control, and status of the layers in a communications stack. The term refers to all devices, both intermediate and end systems, that are present on the network or internetwork.
Open Systems Interconnection (OSI)	An international effort to facilitate communications among computers of different manufacture and technology.
OSI Basic Reference Model	A widely accepted structuring technique that provides an abstract representation of the communication process that is divided into seven basic, functional layers.
Physical Layer	That portion of an OSI Basic Reference Model (Layer 1) responsible for the electrical and mechanical interface between communicating systems.
proforma	A guide provided in advance to prescribe form or describe items.
protocol	A system of rules and procedures governing communications between two devices. File transfer protocols in your communications program refer to a set of rules governing how error checking will be performed on blocks of data.
reserved	Reserved for future designation by the standards effort.
Subnetwork	A physical network within a network. All devices on a subnetwork share a common physical medium.
Subnetwork Profile (SP)	A suite of protocols combined in a profile that specifies the lower layers of the OSI Basic Reference Model. The only layers addressed within the SP are the Physical and the Data Link layer.
taxonomy	A classification scheme for referencing profiles or sets of profiles unambiguously.
Transport Layer	That portion of an OSI Basic Reference Model (Layer 4) which attempts to guarantee reliable data transfers between two end-systems, using flow control and error recovery, and may provide multiplexing.

1.5 ABBREVIATIONS AND ACRONYMS

The abbreviations and acronyms used in this Standard Publication are defined as follows:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASN.1	Abstract Syntax Notation One
bps	Bits per Second
BCC	Balanced operation Connectionless-mode Class

CCITT	Formerly Consultative Committee on International Telegraph and Telephone [Now ITU-Telecommunications Sector (ITU-T)]
DARPA	Defense Advanced Research Projects Agency
DLSDU	Data Link Service Data Unit
FCS	Frame Check Sequence
FHWA	Federal Highway Administration
FSK	Frequency Shift Keying
HDLC	High-level Data Link Control
IAB STD	Internet Architecture Board Standard
IANA	Internet Assigned Number Authority
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPI	Initial Protocol Identifier
ISO	International Organization for Standardization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
ITU	International Telecommunications Union
NEMA	National Electrical Manufacturers Association
NTCIP	National Transportation Communications for ITS Protocol
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PMPP	Point to Multi-Point Protocol
PPP	Point-to-Point Protocol
PRL	Profile Requirements List
RFC	Request for Comments
SNMP	Simple Network Management Protocol
SP	Subnetwork Profile
STMF	Simple Transportation Management Framework
STMP	Simple Transportation Management Protocol
TCP	Transmission Control Protocol
TP	Transport Profile
UCC	Unbalanced Connectionless Class
UDP	User Datagram Protocol
UI	HDLC Unnumbered Information
UP	HDLC Unnumbered Poll

Section 2
CONFORMANCE

2.1 GENERAL REQUIREMENTS

Implementations claiming conformance to the SP-PMPP/FSK shall support the following elements as stated.

a. All requirements in the remainder of Section 2 of this profile.
b. All of the constraints specified in Annex A (normative) of this profile.
c. All requirements of the standards referenced by this profile.

2.2 DATA LINK LAYER REQUIREMENTS

The data link channel shall be asynchronous (start/stop) as specified in the HDLC standards (ISO 3309: 1993; ISO 4335: 1993; ISO 7809: 1993). The HDLC requirements must be implemented except if specified otherwise in the following paragraphs.

2.2.1 Protocol Parameters

There shall be four timers normally associated with the Data Link Layer, T1 through T4. They shall be settable in the range of 1 to 2147483647 milliseconds, by 1. Their context only applies to the Data Link Layer; not other layers.

a. T1—This specifies the maximum time a primary station shall wait for a UI frame. T1 is only activated for a command frame with the poll bit set.
b. T2—This specifies the maximum time a secondary station can delay before sending an UI frame. This timer ensures that secondary starts a response so that it is received by a primary before T1 times out (T2 < T1). T2 is only activated when the receiving station accepts a frame with the poll bit set.

To ensure that data is transmitted as rapidly as possible, the maximum total byte-to-byte delay time in a frame shall be one bit time (e.g., 0.83 ms for 1200 bps). In full duplex operation at a primary station, the transmission of the closing flag may exceed the byte-to-byte delay.

2.2.1.1 Primary Station Timers

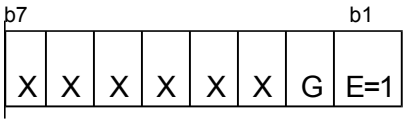
If the device is acting as a primary station, the T1 timer shall be supported.

2.2.1.2 Secondary Station Timers

If device is acting as a secondary station, the T2 timer shall be supported.

2.2.2 Addressing

The address field of data link layer frames shall use single or extended byte addressing, as provided for in clause 5.1 of ISO/IEC 3309, and shall incorporate support for group addressing. The low order bit of the first byte of an address shall be set to zero (0) to indicate that the next byte is part of the address field. When extended addressing is used, then the address values are a concatenation of the six higher-ordered bits of the first octet, and the seven higher-ordered bits from the second octet. Examples of 1-byte and 2-byte addressing are shown in the following figures.



G=1 if Group Address
E=1 for Non-extended Address

Figure 2.2.2-1: Single Byte Address Field

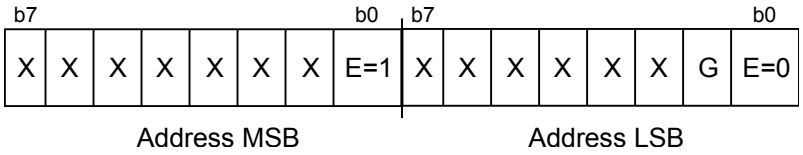


Figure 2.2.2-2: Two Byte Address Field

NOTE—The LSB of the address filed is transmitted first and is referred to as "the first byte" within this text.

The second low order bit of the first byte can be set to one (1) to indicate that the frame is intended only for a selected group of addresses. The G-Bit is set for all group addresses. With bit 0 and bit 1 set to 1 and 0 respectively, the upper 6 bits can be used to address stations 1 to 63. If the second low order bit is set to 1, the upper 6 bits shall indicate that the frame is intended for a group of secondary addresses. Group address 63 (0xFF) is reserved for the "all stations address" and this shall always be transmitted as a single byte. The support of the Group address (0xFF) is mandatory.

Address 0x00 (0 in decimal) shall be never assigned and address 0x3F (63 in decimal) is reserved.

The UI response frame shall always contain its own address in the address field.

UP frames shall not be sent to the all-station address or to a group address.

Support for 1-byte addressing is mandatory, recognition of 2-byte addresses is mandatory and support for creating 2-byte addressing is optional.

2.2.3 Control Field

The control field shall be one octet in length; it shall not be extended.

2.2.3.1 P/F Bit in Control Field

The supported settings of the P/F bit are as specified in ISO 4335, Clause 6.3, 7.3.1.9, and 7.3.1.10 with the following limitations:

a. UP Command shall be '33' (Poll Bit = 1).
b. UI Command to a group or all-station address shall be '03' (Poll Bit = 0).
c. UI Command to a single station address shall be '03' (Poll Bit = 0) or '13' (Poll Bit = 1).
d. UI Response shall be '13' (Final Bit = 1).
e. TEST Command to a single station address shall be 'F3' (Poll Bit = 1).
f. TEST Response shall be 'F3' (Final Bit = 1).

All other control field / address combinations shall be considered invalid frames and shall be discarded (see 2.2.8.1).

An unnumbered poll shall never be used with a broadcast or group address. An unnumbered poll shall never contain a data field.

2.2.4 Initial Protocol Identifiers (IPI)

The purpose of an IPI is to identify the protocol used at the next higher layer. The IPI is the first field of the information field within an HDLC frame. The IPI field value must be at least one byte in length. A receiving device must be able to recognize a 2-byte IPI field. The support for creating a 2-byte IPI value is optional. A description of the use of the Protocol Field (referred to as IPI in this standard) can be found in RFC 1661, the Point to Point Protocol.

Support for at least one of the following IPI or Protocol Field values is mandatory:

- NTCIP 2202 - Internet Transport Profile (IPI =0x21)
- NTCIP 2201 - Transportation Transport Profile (IPI = 0xC1)

2.2.5 Information Field Length

The maximum DLSDU length shall be at least the size of the maximum upper layer PDUs (Network Layer PDU) plus 2 octets for the IPI.

2.2.6 FCS Field

The 16-bit FCS procedure defined in clause 4.6.2 of ISO/IEC 3309 shall be used.

2.2.7 Modes of Operation

The HDLC protocol shall provide for an unbalanced data link operating in two-way alternate transmission mode. In an unbalanced data link, a primary station assumes responsibility for managing the communications line to the connected secondary devices.

In terms of HDLC, the NTCIP Data Link Layer protocol shall be the Unbalanced Connectionless Class (UCC) of procedures defined in ISO/IEC 7809 with HDLC optional functions number 7 applied for multi-octet addressing and number 15.1 for start/stop transmission with basic transparency. This is designated as UCC-7,15.1.

Those clauses of ISO/IEC 3309, 4335, and 7809 dealing with the following shall not apply to NTCIP:

a. synchronous transmission
b. classes and associated modes other than UCC
c. HDLC optional functions other than 7 and 15.1

2.2.8 Frame Types

Primary and secondary NTCIP stations shall make use of the following HDLC frame types as defined in ISO/IEC 4335 and in ISO/IEC 7809 for use with the UCC procedures. Additionally, primary or secondary NTCIP stations may support TEST frames to perform a basic test of the data link layer (ISO/IEC 7809 with HDLC optional function number 12).

Command:	Response:
Unnumbered Information (UI)	Unnumbered Information (UI)
Unnumbered Poll (UP)	Unnumbered Information (UI)
TEST Command (TEST)	TEST Response (TEST)

2.2.8.1 Invalid Frames

ISO 3309, Subclause 4.9.2 and ISO 4335, Clause 8.3 define what constitutes an invalid frame.

Additionally, the following conditions shall also lead to an invalid frame:

a. unsupported address within the HDLC address field,

b. unsupported control value within the HDLC control field,
c. UP Command '23' to any address (Poll Bit = 0),
d. UP Command '33' to a group or all-station address,
e. UI Command '13' to a group or all-station address,
f. TEST Command 'E3' to any address (Poll Bit = 0), or
g. TEST Command 'F3' to a group or all-station address.

All invalid frames shall be discarded without further actions being required.

2.2.9 Procedures

Transmission of frames on the link shall be in Unbalanced mode as described in the Introduction of ISO/IEC 4335 and clause 6 of ISO/IEC 7809. That is, transmission shall be controlled by the Data Link layer of the station designated as the Primary station (referred to as the "control" station in ISO/IEC 7809) on that link and shall be responded to by the addressed Secondary station (referred to as the "tributary" station in ISO/IEC 7809).

A Secondary station shall transmit only one UI response frame per respond opportunity. The response of the secondary shall contain its address in the address field, not the primary's (recipient's) address. Clause 6.4.2.2 of ISO/IEC 7809, which states that the last UI response frame (F-bit=1) must have an information field length of zero, shall be ignored.

The data link layer shall allow buffering for at least one outstanding data frame.

2.3 PHYSICAL LAYER REQUIREMENTS

A device conforming to this part of this SP shall satisfy the mandatory requirements for the 1200 bps FSK modem interface and other characteristics as specified in this profile.

The requirements for the physical layer shall be in accordance with the following.

2.3.1 Modem Electrical Characteristics

The FSK modem interface shall provide support for two or four-wire communications over an unconditioned Type 3002 voice grade private line channel or equivalent customer owned cable. The nominal impedance of the line or cable shall be 600 ohms. Communications over the system interface shall utilize time division multiplex techniques. Transmissions shall use phase coherent frequency shift keying (FSK) modulation at a data rate of 1200 bps. Data format shall be asynchronous, bit serial. The receiver portion of the system interface shall be an FSK to digital demodulator. Receiver sensitivity shall be a minimum of -34dBm, with in band signal-to-noise ratio of 10dB or better.

Support of the following parameters shall be provided:

Data Rate	1200 Baud
Modulation	FSK, Asynchronous
Frequencies	Mark=1200 Hz, Space=2200 Hz
Transmit Output Range	+6, 0, -2,-4, -6, -8, -10 dBm
Receiver Input Level	0 to -34 dBm
Line Impedance	600 Ohms
Clear-To-Send Delay	8 +/- .3 ms
Carrier Detect	6.9 +/- .4 On and 5 +/- .5 Off
Carrier Turn-Off	8 +/- .4 ms Soft / < 1 ms Quick
Receive Squelch	8.7 +/- .3 or 0

2.3.2 Modem Mechanical Characteristics

The unit connector shall be a 9 pin, metal shell "D" subminiature type connector. The connector shall

utilize male contacts and be equipped with latching blocks. The connector shall mate with a 9 pin, female, "D" type connector, AMP Inc. part number 205203-1 or equivalent, which is equipped with spring latches, AMP Inc. part number 745011-1 or equivalent. The pin connections and the use shall be as follows:

Pin	Function	Two-wire Configuration	Four-wire Configuration
1	Transmit 1	input/output	output
2	Transmit 2	input/output	output
3	Reserved	reserved	reserved
4	Receive 1	reserved	input
5	Receive 2	reserved	input
6	Earth Ground	See Note	See Note
7	Reserved	reserved	reserved
8	Reserved	reserved	reserved
9	Earth Ground	See Note	See Note

NOTE — Pins 6 and 9 are provided for termination of an external cable shield, if appropriate. There shall be no internal connection of pin 6 or pin 9 to earth ground.

2.3.3 Modem Terms

The following terms are critical to any throughput timing analysis. They are included here to avoid any ambiguity in their meanings.

a. Clear-to-Send Delay Time—When there is data to send (RTS goes true), this is the minimum time a transmitter is held in the MARK condition (carrier) before sending data so that a receiver is given enough time to recognize a valid carrier signal.

b. Carrier Detect Time—This is the maximum time for a receiver to recognize the presence of a carrier signal.

c. Soft Carrier Turn Off Time—After sending data (RTS goes false), this is the time during which the transmitter should transmit the soft carrier frequency (900hz). This is done because at the end of a message transients may occur and this could cause spurious space signals to be received at a remote modem.

d. Receiver Squelch Time—After transmitting (RTS goes false), this is the maximum time for receiver carrier detect to be clamped off so that line transients are not demodulated. After this time, the receiver can search for carrier. This is also known as the turn around time.

2.3.4 Duplexing

A conformant device shall support full duplex operation at the physical layer. Optionally, it may support half duplex. The implementation of both transmission formats are allowed; however, since they are exclusive, it needs to be predefined which one is used on a particular link. The specification or setup must be done before communications are established.

2.3.5 Buffering (Frame Size)

Each device conforming to this standard shall provide sufficient buffering space to store the maximum transmission unit. The maximum transmission unit (MTU) is defined as the size of the upper layer PDUs (=DLPDU) of at least 515 octets plus header and footer information. Additionally, the implementation must allow for byte stuffing. A device supporting lengths greater than this value shall also state what lengths are supported in the PICS.

2.4 DATA LINK LAYER / INTERNET PROTOCOL INTERFACE

If the Internet Protocol (IP) is being used as the Network Layer Protocol, then the following paragraph shall apply.

Support for the Type of Service (TOS) parameter as specified in the IP protocol, shall not be implemented within this profile.

2.5 MIB REQUIREMENTS

Devices claiming conformance to this standard AND to the NTCIP 2301 (AP-STMF) shall support the following objects as specified in RFC 1381, RFC 1317 and TS 3.4. All other object definitions listed within these base standards are optional.

2.5.1 The HDLC Group

If the semantics of the HDLC Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in RFC 1381, Section 4.

- lapbAdmnTable,
  - lapbAdmnEntry,
    - lapbAdmnIndex,
    - lapbAdmnT1AckTimer,
    - lapbAdmnT2AckDelayTimer

- lapbOperTable,
  - lapbOperEntry,
    - lapbOperIndex,
    - lapbOperTransmitN1FrameSize,
    - lapbOperReceiveN1FrameSize,
    - lapbOperPortId

2.5.2 The RS232 Group

If the semantics of the RS232 Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in RFC 1317, Section 5.

- rs232Number,
- rs232PortTable,
  - rs232PortEntry,
    - rs232PortIndex,
    - rs232PortType,

NOTE—rs232PortType shall use "other(1)" to indicate FSK Modem.

2.5.3 The RS232 Asynchronous Group

If the semantics of the RS232 Asynchronous Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in RFC 1317, Section 5.

- rs232AsyncPortTable,
  - rs232AsyncPortEntry,
    - rs232AsyncPortIndex,
    - rs232AsyncPortFramingErrs,

- rs232AsyncPortOverrunErrs

2.5.4 The HDLC Group Address Group

If the semantics of the HDLC Group Address Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in TS 3.4-1996, Global Object Definitions, Clause 2.7.

- maxGroupAddresses,
- hdlcGroupAddressTable,
  - hdlcGroupAddressEntry,
    - hdlcGroupAddressIndex,
    - hdlcGroupAddress

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Annex A
PMPP SUBNETWORK PROFILE REQUIREMENTS LIST

(Normative)

A.1 INTRODUCTION

This annex provides the Profile Requirements List (PRL) for implementations of the PMPP and FSK Modem – Subnetwork Profile in the form of proforma. A Profile Implementation Conformance Specification (PICS) for an implementation is generated by an implementer or supplier by indicating the appropriate level of support provided by an implementation.

To claim conformance with this profile, an implementation shall satisfy the mandatory conformance *requirements of this profile.

An implementation's completed PRL is called the PICS. The PICS states which capabilities and options of the protocol have been implemented. The following can use the PICS:

a. The protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight.

b. The supplier and user, as a detailed indication of the capabilities of the implementation.

c. The user, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to do so can often be predicted from incompatible PICSs).

d. A user, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.1.1 Notation

The following notations and symbols are used to indicate status and conditional status in the PRL and PICS within all NTCIP standards. Not all of these notations and symbols may be used within this standard.

A.1.1.1 Status Symbols

The following symbols are used to indicate base standard and profile status:

m	mandatory
m.<n>	support of every item of the group labeled by the same numeral <n> required, but only one is active at a time.
o	optional
o.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required
c	conditional
n/a	non-applicable (i.e., logically impossible in the scope of the profile)
x	excluded or prohibited

The o.<n> notation is used to show a set of selectable options (i.e., one or more of the set must be

implemented) with the same identifier <n>. Two character combinations are used for dynamic conformance requirements. In this case, the first character refers to the static (implementation) status, and the second refers to the dynamic (use); thus "mo" means "mandatory to be implemented, optional to be used." Base standard requirements are shown using the equivalent notations in upper case (e.g., M, O, X).

The classification of the requirements and options in Internet RFCs does not correspond to the convention described in above, and shall be mapped into the profile as follows:

RFC	Profile
MUST	Mandatory[1]
SHOULD	Mandatory[1]
MAY	Optional
SHOULD NOT	Prohibited
MUST NOT	Prohibited

A.1.1.2 Conditional Status Notation

The following predicate notations are used:

<predicate>:	This notation introduces a single item that is conditional on the <predicate>.
<predicate>::	This notation introduces a table or a group of tables, all of which are conditional on the <predicate>.

The <predicate>: notation means that the status following it applies only when the PRL or PICS states that the feature or features identified by the predicate are supported. In the simplest case, <predicate> is the identifying tag of a single PICS item. The <predicate>:: notation may precede a table or group of tables in a clause or subclause. When the group predicate is true then the associated clause shall be completed. The symbol <predicate> also may be a Boolean expression composed of several indices. "AND," "OR," and "NOT" shall be used to indicate the Boolean logical operations.

A.1.1.3 Support Column Symbols

This profile is in the form of a PICS and, therefore, includes a support column. An implementer claims support of an item by circling the appropriate answer (Yes, No, or N/A) in the support column:

Yes	Supported by the implementation.
No	Not supported by the implementation.
N/A	Not applicable

A.1.1.4 Footnotes

Footnotes to the proforma are indicated by superscript numerals. The footnote appears on the page of the first occurrence of the numeral. Subsequent occurrences of a numeral refer to the footnote of the first occurrence.

[1] In the course of adapting communications industry standards to the transportation industry, there may be exceptions where specific mandatory requirements are not applicable to the new environment. Where these exceptions are made, a justification shall be provided.

A.1.1.5 Instructions for Completing the PRL

A Profile implementer shows the extent of compliance to a Profile by completing the PRL. The implementer indicates whether mandatory requirements are complied with, and whether optional functions are supported. The resulting completed PRL is called a PICS. Where this profile refines the features of the base standards, the requirements expressed in this PRL shall be applied (as indicated in PRL items with no "Profile Support" column) to constrain the allowable responses in the base standard PICS proforma. When this profile makes additional requirements, the "Support" column for such PRLs shall be completed. In this column, each response shall be selected either from the indicated set of responses, or it shall comprise one or more parameter values as requested. If a conditional requirement is inapplicable, use the Not Applicable (NA) choice. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference Xi, where i is a unique identifier, to an accompanying rationale for the noncompliance. When the profile requirement is expressed as a two-character combination (as defined in A.1.1 above), the response shall address each element of the requirement; e.g., for the requirement "mo," the possible compliant responses are "yy" or "yn."

A.2 STANDARDS REFERENCED

This profile specifies the provision for data transport over point-to-multipoint links. It also specifies the provision for physical transportation, and basic datagram creation and analysis taking place in a connection-less environment. It references the following standards:

ISO/IEC 3309: 1993	*Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Frame structure*.
ISO/IEC 4335: 1993	*Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures*
ISO/IEC 7809: 1993	*Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Classes of procedures*
RFC 1381	*SNMP MIB Extension for the X.25 Packet Layer; D. Throop, F. Baker*
RFC 1317	*Definitions of Managed Objects for RS-232-like Hardware Devices, B. Stewart*
TS3.4-1996	*NTCIP - Global Object Definitions*
Bell 202T	*Bell System Data Communications, Technical Reference, Data Sets 202S and 202T Interface Specification,* July 1976

A.3 PICS REQUIREMENTS LIST

A.3.1 Implementation Identification

Ref	Question	Response
1	Supplier	
2	Contact point for queries about the profile	
3	Implementation Name(s) and Version(s)	
4	Date of statement	
5	Other Information: Machine Name, Operating Systems, System Name	
6	Amendments or revisions to the base standards or profiles that are applicable.	

A.3.2 Global Statement of Conformance

Are all mandatory requirements met for:

Ref	Question	Response
1	Bell 202T Electrical and Signaling Characteristics	
2	DB 9 Mechanical Interface Characteristics	
3	ISO 3309	
4	ISO 4335	
5	ISO 7809	
6	RFC 1381(X.25 MIB), Section 4 (LAPB group)	
7	RFC 1317 (RS232 like devices MIB), Section 5 (rs232, rs232Async groups)	
8	TS 3.4 - NTCIP Global Object Definitions (hdlcGroupAddress group)	
9	Exceptions as stated in this Standard	

A.4 BASIC REQUIREMENTS

The following table lists the basic requirements for a Point to MultiPoint over FSK Modem – Subnetwork Profile implementation, and asks if the listed protocols or standards have been implemented. Additionally, questions regarding supported higher layer protocols are asked, since the different layer protocols interact and because this interaction has an effect on items that must be supported on the data link layer if these higher layer protocols are implemented.

Index	Protocol/Element	Clause of Profile	Profile Status	Support
pmpp	ISO 3309, ISO 4335, ISO 7809 and the exceptions stated in Section 2 of this document implemented?	2.2	m	Yes
fsk	1200 bps FSK modem interface as stated in Section 2.3 of this Standard implemented?	2.3	m	Yes
ip	IAB STD 5 (RFC 791), IP, and IAB STD 3, RFC 1122, Section 3, IP, implemented?	2.2.4	o.1	Yes No
ip.1	Interface requirements per clause 2.4 implemented?	2.4	ip:m	Yes
tt	Transportation Transport Profile implemented?	2.2.4	o.1	Yes No
snmp	IAB STD 15 (RFC 1157), SNMP, implemented?		o	Yes No
snmp.1	MIB requirements per clause 2.5 implemented?	2.5	snmp:m	Yes

A.5 DATA LINK LAYER

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
classPro	***Class of Procedures***					
unc	Unbalanced operation Normal response mode Class (UNC)	ISO 7809 3.2, 4	O.1	2.2.7	x	No
uac	Unbalanced operation Asynchronous response mode Class (UAC)	ISO 7809 3.2, 4	O.1		x	No
bac	Balanced operation Asynchronous balanced mode Class (BAC)	ISO 7809 3.2, 5	O.1		x	No
ucc	Unbalanced operation Connectionless-mode Class (UCC)	ISO 7809 3.2, 6	O.1		m	Yes
bcc	Balanced operation Connectionless-mode Class (BCC)	ISO 7809 3.2, 7	O.1		x	No
trans	***Form of Transmission***					
sync	Synchronous Transmission	ISO 3309-4.5.1	O.2	2.2.7	x	No
async	Start/Stop (Asynchronous) Transmission	ISO 3309-4.5.2	O.2		m	Yes
async Basic	with basic transparency	ISO 3309-4.5.2	O.3		m	Yes
async Sbdpt	with SBDPT transparency	ISO 3309-4.5.2.1	O.3		x	No
async Octet	with Control-octet transparency	ISO 3309-4.5.2.2	O.3		x	No
startStop	Start/Stop (Asynchronous) Transmission - extended transparency	ISO 3309-4.5.3	O		x	No
comm	***Form of Communication***					
commTwa	Two Way Alternate (half duplex)	ISO 7809-6.4.5	O.2	2.2.9	o.1	Yes No
commTws	Two Way Simultaneous (full duplex)	ISO 7809.6.4.6	O.2	2.2.9	o.1	Yes No
FrameInfo	***Frame Information***					
Modulo8	Basic (Modulo 8)	ISO 4335-6.2.1	O.3	2.2.3	m	Yes
Modulo 128	Extended (Modulo 128)	ISO 4335-6.2.1	O.3		x	No
non Alligned	Capable of sending Non-Octet Aligned Frames	ISO 3309-4.4	O	2.2.7	x	No
discNon Alligned	Discharge Non-Octet Aligned Frames	ISO 3309-3.4	O		m	Yes
FrmSetup	***Frame Setup***					
Oflag	Opening Flag	ISO 3309-4.1	M	2.2	m	Yes

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
FrmAddr	Address field	ISO 3309-4.2	M		m	Yes
frmCtrl	Control field	ISO 3309-4.3	M		m	Yes
frmInfo	Information field	ISO 3309-4.4	M		o	Yes
frmIpi	Protocol Field (IPI)	RFC 1661	M	2.2.4	frmInfo:m	Yes
frmFcs	FCS	ISO 3309-4.6	M	2.2.6	m	Yes
cFlag	Closing Flag	ISO 3309-4.1	M	2.2	m	Yes
frmAddrL	Address Field Length	ISO 3309-5.1, -6		2.2.2	m	Yes
single BGen	Single Byte Generation and Recognition	ISO 3309-5.1	M		m	Yes
twoBRec	Two Byte Address Recognition	ISO 3309-5.1	M		m	Yes
twoBGen	Two Byte Address Generation	ISO 3309-5.1	O		o	Yes No
noStation	No-Station Address (Address 0)	ISO 3309-6.3	M		x	No
allStation	All-Station Address (Group Address 63) support	ISO 3309-6.2	M		m	Yes
otherAddr	Support of other group addresses	ISO 3309-6.4	M		o	Yes No
allStation Poll	All-Station Polling support	ISO 3309-6.2	O		x	No
groupPoll	Group Polling support	ISO 3309-6.4	O		x	No
SecName	Secondaries insert their address in the address field when responding	ISO 3309-4.2	M		m	Yes
CrtlLenght	Control Field Length			2.2.3	m	M
ctrlNorm	Normal	ISO 3309-4.3	M		m	Yes
ctrlExt	Extended	ISO 3309-5.2	O		x	No
pfBit	P/F Bit settings	ISO 4335-6.3, -7.3.1.9, -7.3.1.10		2.2.3.1		
pfUp	P bit always set in UP frames		M		m	Yes
PfUi Single	P bit always set in UI frames to single addresses		O		o	Yes No
pfUi Group	P bit always not set to all-station or group station addresses in UI frames		M		m	Yes
pbFBit	F bit is always set to 1		M		m	Yes
pbFBit-0	Support of clause 6.4.2.2 of ISO 7809 stating that only the last frame of a UI response frame (F-bit = 1) must have an information field length of zero	ISO 7809-6.4.2.2	M	2.2.9	x	No
ipi	Initial Protocol Identifier Length	IAB STD 51, 2		2.2.4		

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
ipiNorm	Normal		O.4		m	Yes
ipiExt	Extended		O.4		m o	Yes Yes No
upFrm	No data in UP frames	ISO 4335-7.3.1.9	M	2.2.8	m	Yes
fcs	***FCS Length***					
fcs16	16 Bits	ISO 3309 4.6.2	O.5	2.2.6	m	Yes
fcs32	32 Bits	ISO 3309 4.6.3	O.5		x	No
singleOC flag	Ability to create a Single Flag that is used for both, as Closing Flag of one Frame and as the Opening Flag of the next	ISO 3309-4.1	O	-	x	No
oneFrm	One command or response frame per command / response opportunity	ISO 3309-4.1	M	2.2.9	m	Yes
frmSize	***Frame size***					
minMtu	What is the maximum MTU transmitted (in bytes) ?					
maxMtu	What is the maximum frame size received (in bytes) ?					
invalFrm	***Invalid Frames result from***					
invalFlag	Frames not bound by two flags	ISO 3309 - 4.9.2	M	2.2.8.1	m	Yes
InvalFrm	Frame not long enough	ISO 3309 - 4.9.2	M		m	Yes
InvalFcs	Invalid FCS	ISO 4335-8.3	M		m	Yes
InvalAddr	Unsupported Address				m	Yes
invalCrtl	Unsupported Control Field				m	Yes
InvalDisc	All invalid frames discarded and No action taken as a result				m	Yes
FrmTypes	***Frame Types***					
Test1	Support of TEST Frames and all associated mandatory functions?	ISO 7809-8.12	O	2.2.8	o	Yes No
Test2	Support of TEST Frames	ISO 4335-7.3.1.13, -7.3.2.8	O		o	Yes No
TestCmd	Primary capable of sending TEST command frames	ISO 4335-7.3.1.13	O		o	Yes No
TestInfo	Information field present	ISO 4335-7.3.1.13	O		o	Yes No
testOpp	Secondary capable of sending TEST response frames at first opportunity	ISO 4335-7.3.1.13	TestCmd: M		TestCmd: m	Yes No

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
TestInfo R	Information Field content returned in response	ISO 4335-7.3.1.13	testOpp: M		testOpp: m	Yes No
TestInfo R2	Secondary returns TEST Frame without Information Field content when busy or cannot accept information field	ISO 4335-7.3.1.13	testOpp: M		testOpp: m	Yes No
uFrame	Support of U Frames	ISO 4335-6.1.4, 7.3	O	2.2.8	m	Yes
upCmd	Unnumbered Poll (Command only)	ISO 4335-6.1.4, 7.3.1.9	O		m	Yes
uiInfo	Unnumbered Information (Command and Response)	ISO 4335-6.1.4, 7.3.1.10	O		m	Yes
timer	***Timers***					
t1	Primary Station Timer (T1)			2.2.1.1	o.2	Yes No
t2	Secondary Station Timers (T2)			2.2.1.2	o.2	Yes No

A.6 PHYSICAL LAYER CONFORMANCE LIST

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
modem	Support Bell 202T Modem Characteristics	202T-2.1	O	2.3.1	m	Yes
interface	Line Interface					
2wire	two-wire	202T-2.5.1	M.1	2.3.1	m.3	Yes No
4wire	four-wire		M.1		m.3	Yes No
connector	Connector Pinouts					
P1	Pin 1 – Transmit 1	TS 2-1998	M	2.3.2	m	Yes
P2	Pin 2 – Transmit 2	3.3.3.1	M		m	Yes
P3	Pin 3 – reserved		M		m	Yes
P4	Pin 4 – Receive 1		M		4wire:m	Yes No
P5	Pin 5 – Receive 2		M		4wire:m	Yes No
P6	Pin 6 – Earth Ground		MO		m o	Yes Yes No
P7	Pin 7 – reserved		M		m	Yes
P8	Pin 8 – reserved		M		m	Yes
P9	Pin 9 – Earth Ground		MO		m o	Yes Yes No

A.7 MANDATORY OBJECT DEFINITIONS IF SNMP IS USED

A.7.1 HDLC Group

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
7.1	Support of lapbAdmnTable and lapbOperTable?					2.5.1	snmp:m	Yes No
lapb AT	lapbAdmnTable	SEQUENCE OF lapbAdmn Entry	Not-accessible	RFC 1381 Section 4	M	2.5.1	7.1:m	Yes
lapb AE	lapbAdmnEntry	LapbAdmn Entry	Not-accessible		M		7.1:m	Yes
lapb AI	lapbAdmnIndex	INTEGER (IfIndex Type)	read-only		M		7.1:m	Yes
lapb T1	lapbAdmn T1AckTimer	INTEGER (Positive Integer)	read-write		M		7.1 AND t1t3:m	Yes
lapb T2	lapbAdmn T2AckDelayTimer	INTEGER (Positive Integer)	read-write		M		7.1 AND t2t4:m	Yes
lapb OT	lapbOperTable	SEQUENCE OF lapbOper Entry	Not-accessible	RFC 1381 Section 4	M	2.5.1	7.1:m	Yes
lapb OE	lapbOperEntry	LapbOper Entry	Not-accessible		M		7.1:m	Yes
lapb OI	lapbOperIndex	INTEGER (IfIndex Type)	read-only		M		7.1:m	Yes
lapbO TNFS	lapbOper TransmitN1 FrameSize	INTEGER (Positive Integer)	read-only		M		7.1:m	Yes
lapbO RNFS	lapbOper ReceiveN1 FrameSize	INTEGER (Positive Integer)	read-only		M		7.1:m	Yes
lapbO oid	lapbOperPortId	OBJECT IDENTIFIER	read-only		M		7.1:m	Yes

A.7.2 RS232 Asynchronous Group

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
7.2	Support of rs232PortTable?						snmp:m	Yes No
rs232 No	rs232Number	INTEGER	read-write	RFC 1317 Section 5	M	2.5.2	7.2:m	Yes
rs232 PT	rs232PortTable	SEQUENCE OF rs232 PortEntry	Not-accessible		M		7.2:m	Yes
rs232 PE	rs232PortEntry	rs232 PortEntry	Not-accessible		M		7.2:m	Yes
rs232 PI	rs232PortIndex	INTEGER	read-only		M		7.2:m	Yes
rs232 PType	rs232PortType	INTEGER	read-only		M		7.2:m	Yes
rs232 APT	rs232AsyncPort Table	SEQUENCE OF rs232Async PortEntry	Not-accessible	RFC 1317 Section 5	M	2.5.3	7.2:m	Yes
rs232 APE	rs232 AsyncPortEntry	rs232Async PortEntry	Not-accessible		M		7.2:m	Yes
rs232 API	rs232 AsyncPortIndex	INTEGER	read-only		M		7.2:m	Yes
rs232 APFE	rs232AsyncPort FramingErrs	Counter	read-only		M		7.2:m	Yes
rs232 APOE	rs232AsyncPort OverrunErrs	Counter	read-only		M		7.2:m	Yes

A.7.3 HDLC Group Address Group

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
7.3	Support of the hdlcGroup Address Table?						snmp:m	Yes No
max GroupAddresses	maxGroup Addresses	INTEGER	Read-only	TS3.4 2.7.1	M	2.5.4	7.3:m	Yes
hdlc Group Address Table	hdlcGroup Address Table	SEQUENCE OF HdlcGroupAddressEntry	Not-accessible	TS3.4 2.7.2	M		7.3:m	Yes
hdlc Group Address Entry	hdlcGroup Address Entry	hdlcGroupAddressEntry	Not-accessible	TS3.4 2.7.2	M		7.3:m	Yes
hdlc Group Address Index	hdlcGroup Address Index	INTEGER	Read-only	TS3.4 2.7.2.1	M		7.3:m	Yes
hdlc Group Address	hdlcGroup Address	INTEGER	Read-write	TS3.4 2.7.2.2	M		7.3:m	Yes

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