IEEE Std 802.5t-2000
(Amendment to
ANSI/IEEE Std 802.5, 1998 Edition;
ANSI/IEEE Std 802.5r, 1998 Edition; and
ANSI/IEEE Std 802.5j, 1998 Edition)

Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements

Amendment to Part 5: Token Ring Access Method and Physical Layer Specifications

Sponsor

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 13 January 2000

IEEE-SA Standards Board

Abstract: This supplement specifies the changes required to ANSI/IEEE Std 802.5, 1998 Edition, (Base standard) and ANSI/IEEE 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, (Amendment 1 standard) to support 100 Mbit/s Dedicated Token Ring (DTR) operation. The Base standard, together with the Amendment 1 standard, specifies shared and dedicated (point-to-point) Token Ring operation at both 4 Mbit/s and 16 Mbit/s using either the TKP Access Protocol or the TXI Access Protocol. This supplement extends Token Ring operation to 100 Mbit/s for the DTR C-Port and Station using the TXI Access Protocol. Extensions to the medium access control (MAC) have been made to accommodate the requirements for high media rates (100 Mbit/s and above).
Keywords: data processing interconnection, dedicated token ring, fill duplex operation, local area network (LAN), medium access control (MAC), 100 Mbit/s operation, token ring

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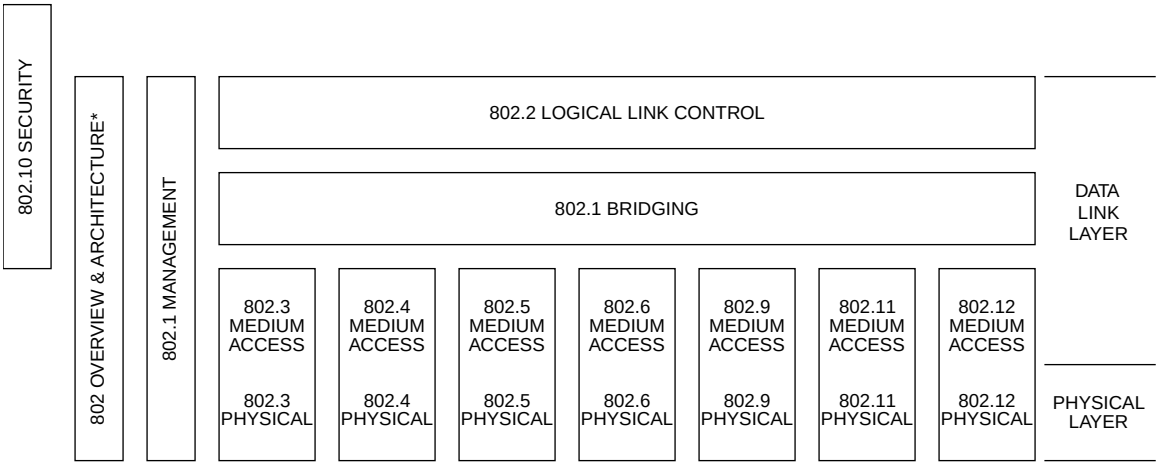
Introduction

(This introduction is not part of IEEE Std 802.5t-2000, Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Amendment to Part 5: Token Ring Access Method and Physical Layer Specifications.)

This standard is part of a family of standards for local and metropolitan area networks. The relationship between this standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard numbers.)



* Formerly IEEE Std 802.1A.

This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1:1994). The access standards define seven types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Other types are under investigation.

The standards defining the access technologies are as follows:

- IEEE Std 802 — *Overview and Architecture.* This standard provides an overview to the family of IEEE 802 Standards.
- ANSI/IEEE Std 802.1B and 802.1k [ISO/IEC 15802-2] — *LAN/MAN Management.* Defines an OSI management-compatible architecture, and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- ANSI/IEEE Std 802.1D [ISO/IEC 15802-3] — *Media Access Control (MAC) Bridges.* Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.
- ANSI/IEEE Std 802.1E [ISO/IEC 15802-4] — *System Load Protocol.* Specifies a set of services and protocol for those aspects of management concerned with the loading of systems on IEEE 802 LANs.
- IEEE Std 802.1F — *Common Definitions and Procedures for IEEE 802 Management Information*
- ANSI/IEEE Std 802.1G [ISO/IEC 15802-5] — *Remote Media Access Control Bridging* . Specifies extensions for the interconnection, using non-LAN communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.

- ANSI/IEEE Std 802.2 [ISO/IEC 8802-2] *Logical Link Control*
- ANSI/IEEE Std 802.3 [ISO/IEC 8802-3] *CSMA/CD Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.4 [ISO/IEC 8802-4] *Token Passing Bus Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.5 [ISO/IEC 8802-5] *Token Ring Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.6 [ISO/IEC 8802-6] *Distributed Queue Dual Bus Access Method and Physical Layer Specifications*
- ANSI/IEEE Std 802.9 [ISO/IEC 8802-9] *Integrated Services (IS) LAN Interface at the Medium Access Control and Physical Layers*
- ANSI/IEEE Std 802.10 *Interoperable LAN/MAN Security*
- IEEE Std 802.11 [ISO/IEC DIS 8802-11] *Wireless LAN Medium Access Control and Physical Layer Specifications*
- ANSI/IEEE Std 802.12 [ISO/IEC DIS 8802-12] *Demand Priority Access Method, Physical Layer and Repeater Specifications*

In addition to the family of standards, the following is a recommended practice for a common Physical Layer technology:

- IEEE Std 802.7 *IEEE Recommended Practice for Broadband Local Area Networks*

The following additional working groups have authorized standards projects under development:

- IEEE 802.14 *Standard Protocol for Cable-TV Based Broadband Communication Network*
- IEEE 802.15 *Wireless Personal Area Networks Access Method and Physical Layer Specifications*
- IEEE 802.16 *Broadband Wireless Access Method and Physical Layer Specifications*

Participants

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Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements

Amendment to Part 5: Token Ring Access Method and Physical Layer Specifications

1. Changes to Clause 1 of ANSI/IEEE Std 802.5, 1998 Edition, and ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition

1.1 Scope

Add the following item to Scope:

hh) Defines Dedicated Token Ring (DTR) operation at 100 Mbit/s.

1.2 Normative references

Add the following new references:

ANSI/IEEE Std 802.3:1998, Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

ANSI X3.263-1995, Fibre Distributed Data Interface (FDDI) —Token Ring Twisted Pair Physical Layer Medium Dependent (TP-PMD).

ISO/IEC 9314-3:1990, Information processing systems Fibre Distributed Data Interface (FDDI)—Part 3: Physical Layer Medium Dependent (PMD).

1.3 Definitions

Add the following definitions:

high media rate (HMR): This term is used to indicate a data rate of 100 Mbit/s or greater.

media independent interface (MII): A set of signals with electrical, logical, and physical definitions that provide the complete interface between the medium access control (MAC) layer and Physical Layer (PHY) (via the RS).

Station: When capitalized, Station refers to DTR station or a C-Port in Station Emulation mode.

Replace these definitions in the base standard as follows:

1.3.43 physical media components (PMC): PMC is the sublayer of the PHY responsible for interfacing with the transmission medium. The functions of the PMC include receive, transmit, clock recovery, and ring access control. The PMCs for different medium rates and types are different.

1.3.44 physical signaling components (PSC): PSC is the sublayer of the PHY responsible for changing the signal elements received from the ring by the PMC into indicators and sending these indicators to the MAC. It is also responsible for conditioning the indicators received from the MAC for inclusion as signal elements by the PMC in the repeated data stream. At a particular medium rate, the PSC may be the same for different medium types.

1.5 Abbreviations and acronyms

Add the following acronyms:

FDDI	fibre distributed data interface
HMR	high media rate
MII	media independent interface
PMC	physical media components
PSC	physical signaling components

Replace 1.6 through 1.8 in ANSI/IEEE Std 802.5, 1998 Edition, and 1.6 through 1.9 in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, with the following:

1.6 Conformance requirements

The conformance requirements for the Classic Token Ring entities (Clause 3 through Clause 8 in ANSI/IEEE Std 802.5, 1998 Edition) and the DTR entities (Clause 9 through Clause 13 in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, and Clause 13 and Clause 14 in this document) are specified in Annex A.

The supplier of a protocol implementation that is claimed to conform to this supplement shall complete a copy of the Protocol Implementation Conformance Statement (PICS) proforma in Annex A and shall provide the information necessary to identify both the supplier and the implementation.

Common conformance requirements—Station and C-Port

A Classic Token Ring Station implementing the TKP Access Protocol, or a DTR Station and DTR C-Port implementing the TKP Access Protocol or TXI Access Protocol claiming conformance to this standard shall

a) Implement the frame format, associated address formats and fields, and medium access control (MAC) frame vectors and subvectors specified as follows:
   1) Clause 3 for the Classic and DTR Station supporting the 4 Mbit/s or 16 Mbit/s media speeds;
   2) Clause 3 as amended by Clause 10 for the DTR C-Port or Station supporting the 4 Mbit/s or 16 Mbit/s media speeds;
   3) Clause 3 as amended by Clause 10 and Clause 14 for the DTR C-Port or Station supporting the High Media Rate (HMR) media speeds.

b) Support 48-bit addressing and use either a universally administered individual address or a locally administered individual address, as specified in 3.2.4.

c) Recognize the first bit of the source address as indication of the presence of the routing information field in the frame format defined in 3.2.5. Note that the ability to generate or respond to frames with source routing information is optional.

d) Exhibit external behavior corresponding to the system timing parameters specified as follows:
   1) Clause 3 for the Classic station supporting the 4 Mbit/s or 16 Mbit/s media speeds, and using the TKP Access Protocol;
   2) Clause 3 as amended by Clause 10 for the DTR C-Port or Station supporting the 4 Mbit/s or 16 Mbit/s media speeds, and using the TKP or TXI Access Protocols;
   3) Clause 3 as amended by Clause 10 and Clause 14 for the DTR C-Port or Station supporting the HMR media speeds, and using the TXI Access Protocol.

e) Exhibit external behavior corresponding to the Station Policy Flags and Variables specified as follows:
   1) Clause 3 for the Classic station supporting the 4 Mbit/s or 16 Mbit/s media speeds, and using the TKP Access Protocol;
   2) Clause 3 as amended by Clause 10 for the DTR C-Port or Station supporting the 4 Mbit/s or 16 Mbit/s media speeds, and using the TKP or TXI Access Protocols;
   3) Clause 3 as amended by Clause 10 and Clause 14 for the DTR C-Port or Station supporting the HMR media speeds, and using the TXI Access Protocol.

f) Implement capabilities corresponding to the Error Counters specified as follows:
   1) Clause 3 for the Classic station supporting the 4 Mbit/s or 16 Mbit/s media speeds, and using the TKP Access Protocol;
   2) Clause 3 as amended by Clause 10 for the DTR C-Port or Station supporting the 4 Mbit/s or 16 Mbit/s media speeds, and using the TKP or TXI Access Protocols;
   3) Clause 3 as amended by Clause 10 and Clause 14 for the DTR C-Port or Station supporting the HMR media speeds and using the TXI Access Protocol.

g) Perform the TKP and TXI Access Protocol functions as follows:
   1) Classic Token Ring for 4 Mbit/s or 16 Mbit/s using the TKP Access Protocol operation specified by the Station Operation Tables in ANSI/IEEE Std 802.5, 1998 Edition, Clause 4;
   2) DTR for 4 Mbit/s or 16 Mbit/s using the TKP Access Protocol operation specified by the Station and Port Operation Tables in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, 9.3 through 9.6;
   3) DTR for 4 Mbit/s or 16 Mbit/s using the TXI Access Protocol operation specified by the Station and Port Operation Tables in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, 9.2 and 9.3;
   4) DTR for the HMR using the TXI Access Protocol operation specified by the Station and Port Operation Tables in 9.2 and 9.3 in this document.

1.7 Fibre optic media conformance requirements

A 4 Mbit/s, 16 Mbit/s, and 100 Mbit/s media rate implementation, claiming conformance to this part of ANSI/IEEE Std 802.5, 1998 Edition, and operating in Station or Port mode, shall meet all appropriate parameters in Clause 13.

1.8 Local regulation

The supplier of a protocol implementation that is claimed to conform to this standard shall meet local safety and environmental regulations. Annex E provides some limited guidance in this area.

Replace the title of 2.2 with the following two titles to cover all types of Stations and C-Ports:

2.2 C-Port and Station functional organization and data flow

2.2.1 4 Mbit/s and 16 Mbit/s classic Station functional organization and data flow

The remainder of this clause remains unchanged.

Add a new title after 2.2.1 to cover the 100 Mbit/s DTR C-Port and Station:

2.2.2 100 Mbit/s C-Port and Station functional organization and data flow

Figure 2.2-1 and Figure 2.2-2 illustrate a C-Port's and Station's data flow, indicating which clauses of this standard address the various functions of a token ring C-Port or Station. Figure 2.2-1 is for a Station and C-Port connected using twisted-pair media. Figure 2.2-2 is for a Station and C-Port connected using fibre optic media.

a) The PMC/PSC internal service interface (PM_UNITDATA.request; PM_UNITDATA.indication) defines the information exchange between the physical media components (PMC) specified in 9.7 and 9.8 and the physical signaling components (PSC) specified in 9.8. This service interface is defined in 9.8.

b) The PSC/MAC internal service interface (PS_UNITDATA.indication, PS_UNITDATA.request) defines the information exchange between the PSC specified in 9.8 and the MAC sublayer specified in Clause 9 and Clause 14. Clause 14 defines frame formats and station facilities. Clause 9 also specifies the C-Port's Port Medium Access Control (PMAC) and Station's Station Medium Access Control (SMAC) protocol, which uses the formats and facilities defined in Clause 14 to receive and transmit information. This service interface is defined in 9.8.

c) The PMAC/SMAC/PHY internal service interface (PM_STATUS.indication, PS_CONTROL.request, and PS_STATUS.indication) provides the control mechanism for the physical layer (PHY) functions by the MAC protocol, and the mechanism for indicating the status of the PHY functions to the MAC protocol. The PM_ STATUS.indication service interface is defined in 9.7. The PS_CONTROL.request and PS_STATUS.indication service interfaces are defined in 9.8.

d) The PMAC/SMAC/LLC service interface (MA_UNITDATA.indication, MA_UNITDATA.request) is specified in ISO/IEC 15802-1 and is used as specified in 9.1. It defines the information exchange between the PMAC/SMAC sublayer and the Logical Link Control (LLC) sublayer.

e) The PMAC/SMAC/Bridge service interface (M_UNITDATA.indication, M_UNITDATA.request, M_UNITDATA.response) is specified in IEEE Std 802.1d and is used as specified in 9.1. It defines the information exchange between the MAC and the internal bridging sublayer.

f) The PMAC/SMAC/MGT service interface (MGT_UNITDATA.indication, MGT_UNITDATA.request, MGT_CONTROL.request, MGT_STATUS.indication) defines the control mechanism of, the mechanism for indicating the status of, and the information exchange between the PMAC/SMAC protocol specified in Clause 9 and the system management entity (MGT). The managed objects are specified in Clause 11. The MGT_UNITDATA.indication and MGT_UNITDATA.request primitives are specified in Clause 9 and are used to convey MAC management frames between the MAC and the appropriate management function (e.g., RPS, CRS, REM).

The PHY of the Station and C-Port consists of the PMCs, specified in 9.7 and 9.8, and the PSCs specified in 9.8. Operation over twisted pair media requires additional mandatory components. The use and availability of these components is explained in 9.7 and 9.8.

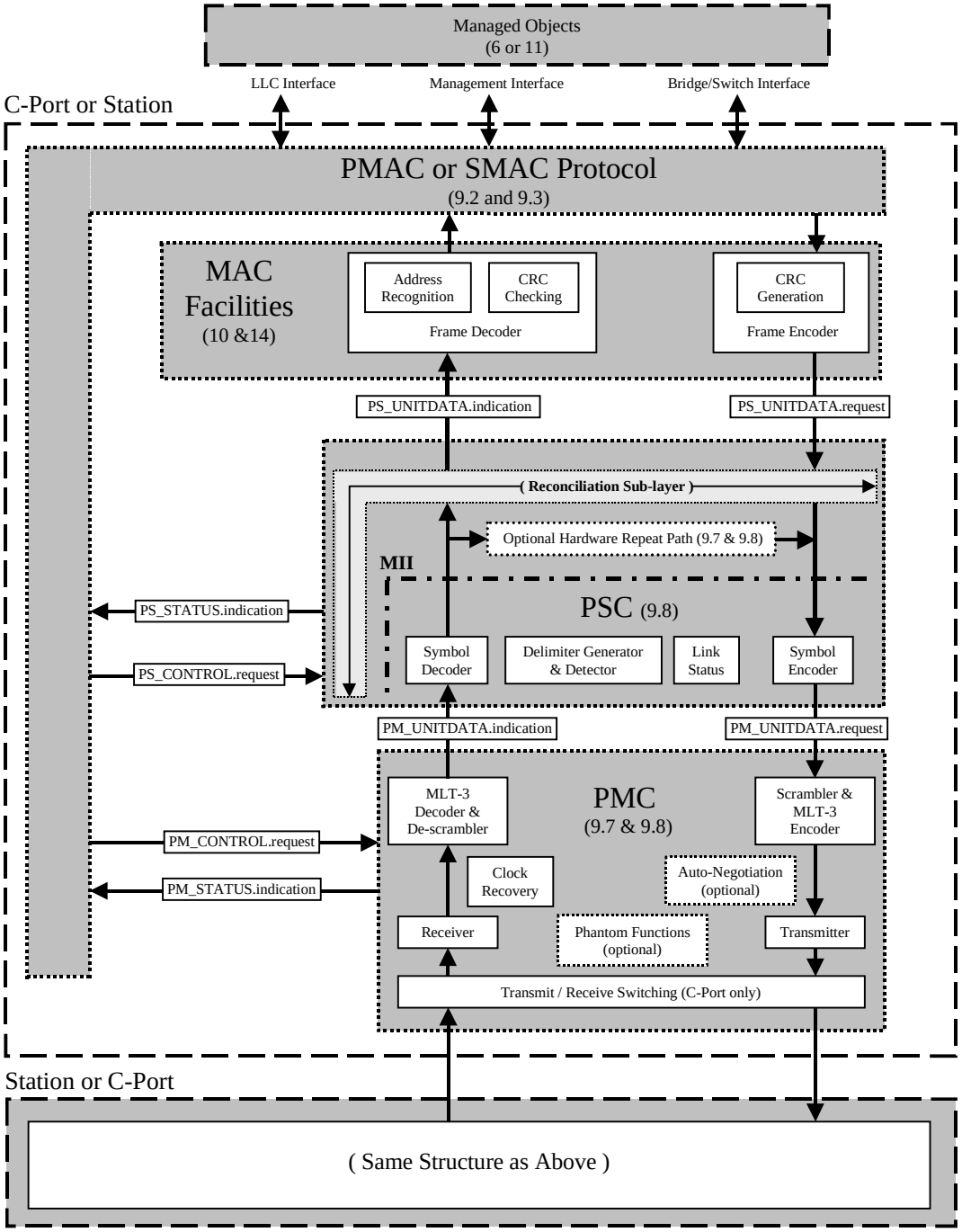

Figure 2.2-1—100 Mbit/s overview using Twisted Pair Media

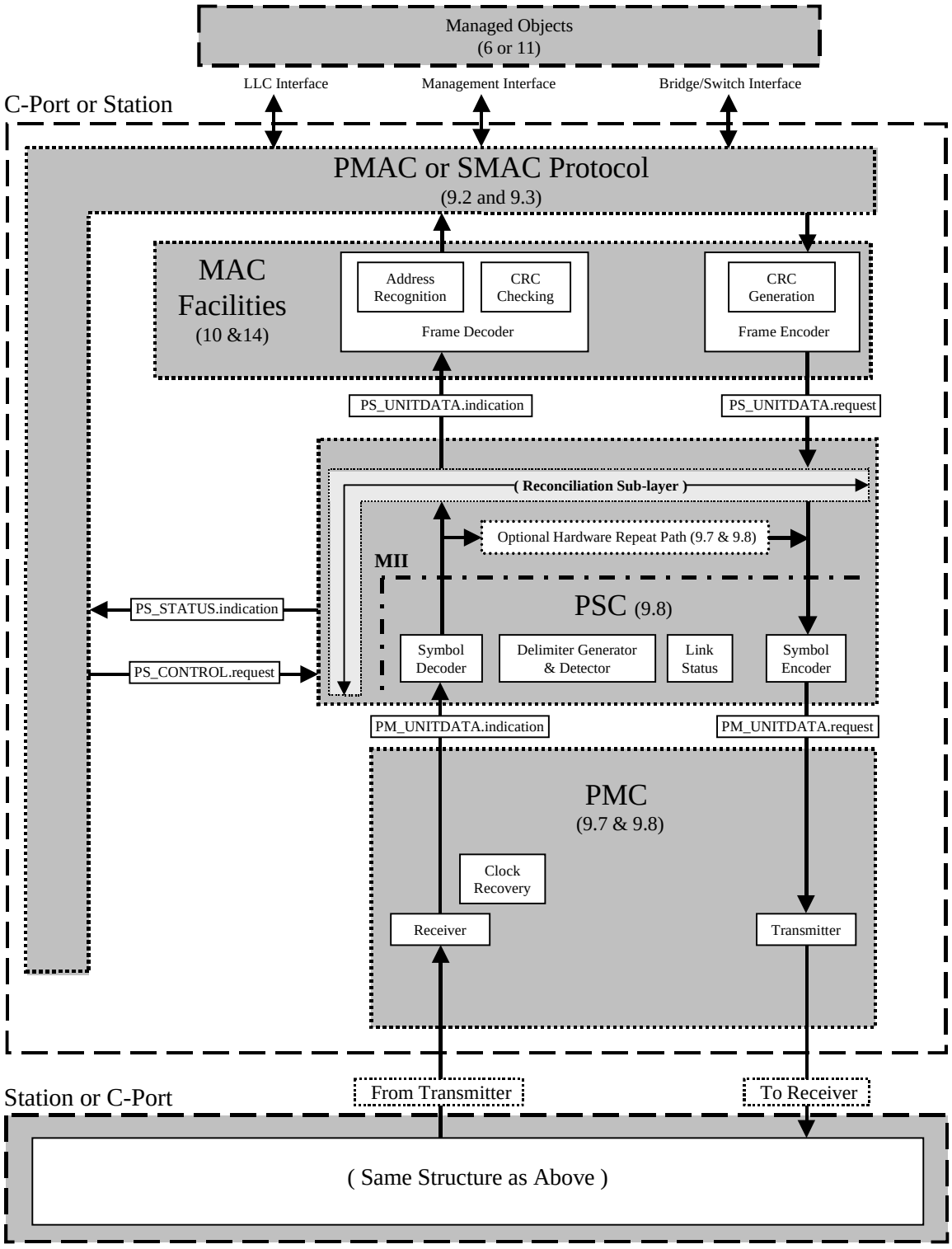

Figure 2.2-2—100 Mbit/s overview using Fibre Optic Media

Replace 9.0 with the following:

9. Dedicated Token Ring

This clause contains the specifications for the DTR Station and C-Port executing

— The TXI Access Protocol operating at 4 Mbit/s, 16 Mbit/s, or the HMR; and
— The TKP Access Protocol operating at 4 Mbit/s or 16 Mbit/s.

The TKP Access Protocol is not specified by this supplement for operation at the HMR.

This introduction illustrates and defines the DTR configurations supported, and concludes by describing the structure of Clause 9.

DTR configurations illustrated

Figure 9-1 illustrates the DTR configurations based on the following operational modes of the C-Port:

— Configuration 1: C-Port in Port Mode using the TXI Access Protocol;
— Configuration 2: C-Port in Station Emulation Mode using the TXI Access Protocol;
— Configuration 3: C-Port in Port Mode using the TKP Access Protocol;
— Configuration 4: C-Port in Station Emulation Mode using the TKP Access Protocol.

Each of these configurations is labeled as to the type of support (C-Port in Port Mode; C-Port in Station Emulation Mode, Station, or Concentrator), the access protocol being used, and the subclause(s) used to specify the configuration. Figure 9-1 abbreviates the TKP Access Protocol as TKP AP and the TXI Access Protocol as TXI AP.

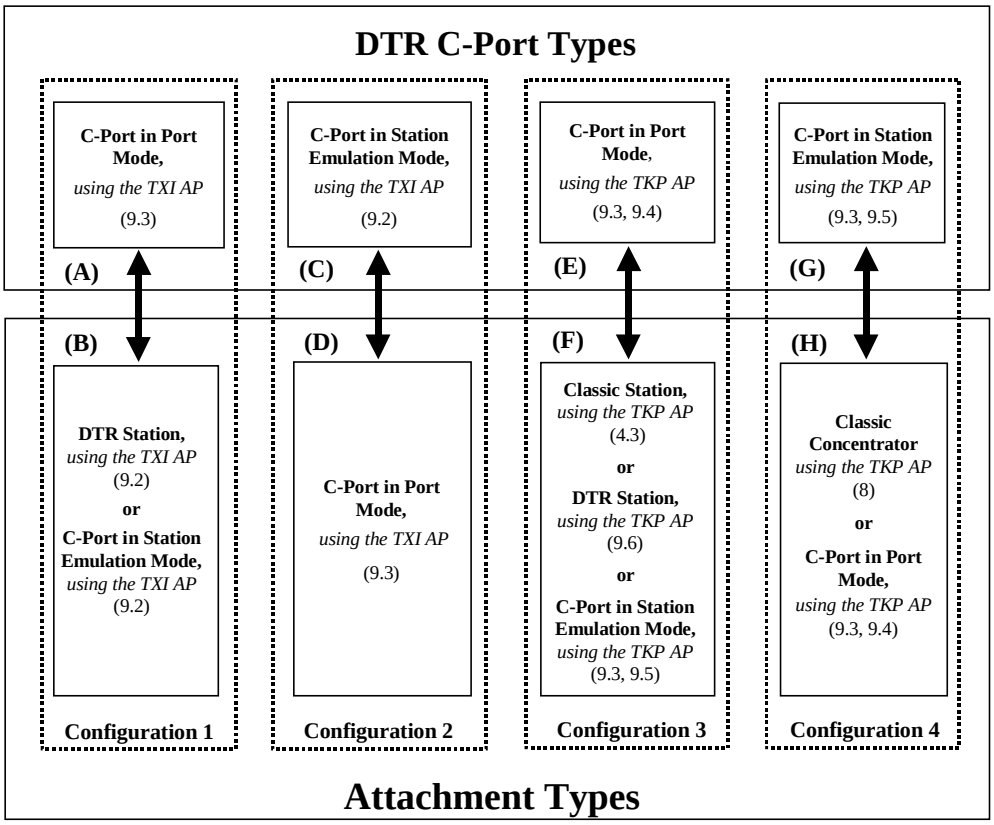

Figure 9-1—DTR configurations 1 through 4

DTR configurations

The following configurations are identified in Figure 9-1:

— Configuration 1 consists of a C-Port in Port Mode using the TXI Access Protocol (A) and an attached DTR Station (B) or C-Port in Station Emulation Mode (B).
— Configuration 2 consists of a C-Port in Station Emulation Mode using the TXI Access Protocol (C) and an attached C-Port in Port Mode (D).
— Configuration 3 consists of a C-Port in Port Mode using the TKP Access Protocol (E) and an attached Classic Station (F), DTR Station (F), or C-Port in the Station Emulation Mode (F).
— Configuration 4 consists of a C-Port in Station Emulation Mode using the TKP Access Protocol (G) and an attached Classic Concentrator (H) or C-Port in Port Mode (H).

Configuration functions

The Policy flags FSMRO (Station Media Rate Option) and FPMRO (C-Port Media Rate Option) are defined as follows:

— FSMRO=0 or FPMRO=0: 4 Mbit/s;
— FSMRO=1 or FPMRO=1: 16 Mbit/s;
— FSMRO<2 or FPMRO<2: 4 Mbit/s or 16 Mbit/s;
— FSMRO>1 or FPMRO>1: HMR;
— FSMRO=2 or FPMRO=2: 100 Mbit/s;
— FSMRO>2 or FPMRO>2: reserved and not defined by this supplement.

The functions used to support Configurations 1 and 2 are covered as follows:

— The DTR Station using the TXI Access Protocol when operating at 4 Mbit/s or 16 Mbit/s is defined in 9.1, 9.2, and 9.7.1, and when operating at the HMR is defined in 9.1, 9.2, 9.7.2, 9.8, and 13.9.
— The C-Port in Port Mode using the TXI Access Protocol when operating at 4 Mbit/s or 16 Mbit/s is defined in 9.1, 9.3, and 9.7.1, and when operating at the HMR is defined in 9.1, 9.3, 9.7.2, 9.8, and 13.9.
— The C-Port in Station Emulation Mode using the TXI Access Protocol when operating at 4 Mbit/s or 16 Mbit/s is defined in 9.1, 9.2, 9.3, and 9.7.1, and when operating at the HMR is defined in 9.1, 9.2, 9.3, 9.7.2, 9.8, and 13.9.

The functions used to support Configurations 3 and 4 are covered as follows:

— The DTR Station using the TKP Access Protocol, when operating at 4 Mbit/s or 16 Mbit/s, is defined in 9.1 and 9.6.
— The C-Port in Port Mode using the TKP Access Protocol, when operating at 4 Mbit/s or 16 Mbit/s, is defined in 9.1, 9.3, 9.4, and 9.7.1.
— The C-Port in Station Emulation Mode using the TKP Access Protocol, when operating at 4 Mbit/s or 16 Mbit/s, is defined in 9.1, 9.3, 9.5, and 9.7.1.
— The Classic Station, which uses only the TKP Access Protocol operating at 4 Mbit/s or 16 Mbit/s, is defined in Clause 4.
— The Classic Concentrator, which uses only the TKP Access Protocol operating at 4 Mbit/s or 16 Mbit/s, is defined in Clause 8.

Clause 9 structure

The remainder of Clause 9 is structured as follows:

— **Subclause 9.1** describes the common DTR Station and C-Port functions required to support the TXI Access Protocol when operating at 4 Mbit/s, 16 Mbit/s, or the HMR, and the TKP Access Protocol when operating at 4 Mbit/s or 16 Mbit/s.

  The description of the Classic Station is found in Clause 4 and is not covered in Clause 9.

— **Subclause 9.2** specifies the DTR Station and the C-Port in Station Emulation Mode using the TXI Access Protocol when operating at 4 Mbit/s, 16 Mbit/s, or the HMR.

  Annex L contains informative diagrams of the Low-Level Finite State Machines (FSMs) representing the SMAC contained in the Join, Transmit, and Monitor Station Operation Tables defined in 9.2.

— **Subclause 9.3** specifies the C-Port in Port Mode using the TXI Access Protocol when operating at 4 Mbit/s, 16 Mbit/s, or the HMR, and the TKP Access Protocol when operating at 4 Mbit/s or 16 Mbit/s. Subclause 9.3 defines the Join, Transmit, and Monitor functions for the TXI Access Protocol. Subclause 9.3 also defines the Join function for the TKP Access Protocol; the Transmit and Monitor functions for the TKP Access Protocol are defined in 9.4.

  Annex M contains informative diagrams of the Low-Level FSMs representing the PMAC contained in the Join, Transmit, and Monitor Port Operation Tables defined in 9.3.

— **Subclause 9.4** specifies the C-Port in Port Mode using the TKP Access Protocol when operating at 4 Mbit/s or 16 Mbit/s. Subclause 9.4 defines the Transmit and Monitor functions; the Join function is defined in 9.3.

Annex N contains informative diagrams of the Low-Level FSMs representing the PMAC contained in the Transmit and Monitor Port Operation Tables defined in 9.4.

— **Subclause 9.5** specifies the C-Port in Station Emulation Mode using the TKP Access Protocol when operating at 4 Mbit/s or 16 Mbit/s.

Annex R contains informative diagrams of the Low-Level FSMs representing the PMAC contained in the Join, Transmit, and Monitor Port Operation Tables defined in 9.5.

— **Subclause 9.6** specifies the DTR Station using the TKP Access Protocol when operating at 4 Mbit/s or 16 Mbit/s.

Annex Q contains informative diagrams of the Low-Level FSMs representing the MAC contained in the Join, Transmit, and Monitor Station Operation Tables defined in 9.6.

— **Subclause 9.7** specifies the C-Port specific components and specifications used when supporting the TXI or TKP Access Protocols. The PHY requirements unique to the C-Port are defined by 9.7.1 for 4 Mbit/s or 16 Mbit/s, and 9.7.2 for the HMR.

The PHY requirements shared between Classic Concentrators and Classic Stations are defined in Clauses 5, 7, and 8.

— **Subclause 9.8** specifies the PHY functions used as defined in 9.2, 9.3, and 9.7.2 when operating at the HMR.

Replace 9.1 with the following:

9.1 DTR TXI and TKP Access Protocol support

This subclause provides an overview of the TKP and TXI Access Protocol for the DTR C-Port, DTR Station, and Classic Station supporting Configurations 1 through 4 illustrated in Figure 9-1. The Station Operation Tables and C-Port Join Operation Tables defined in 9.2 and 9.3, respectively, determine which configuration is being supported. This determination is based on policy flags, results of the Registration process, and phantom signaling detection by the C-Port.

This clause contains an overview of the DTR Station and DTR C-Port when using the TXI Access Protocol or the TKP Access Protocols as follows:

a) The TXI definitions used by the C-Port and Station are described in 9.1.1.
b) The TXI Access Protocol functions used by the Station's SMAC specified in 9.2, and the C-Port's PMAC specified in 9.3, are discussed as follows*:*
    1) Protocol checking is described in 9.1.2;
    2) Error handling is described in 9.1.3;
    3) Registration is described in 9.1.4;
    4) Registration query is described in 9.1.5;
    5) Lobe Media Test (LMT) is described in 9.1.6;
    6) Duplicate Address Check (DAC) is described in 9.1.7;
    7) Transmit is described in 9.1.8;
    8) Heart Beat is described in 9.1.9;
    9) Hard error recovery is described in 9.1.10;
    10) Soft error reporting is described in 9.1.11;

11) Configuration control is described in 9.1.12;
12) SMAC and PMAC service interfaces are described in 9.1.13;
13) Trade-up protocol is described in 9.1.14;
14) Remove Alert protocol is described in 9.1.15.

Each of the above is described by covering the function's purpose and then, if required, covering the unique C-Port and Station support of the function.

c) The C-Port in Port Mode using the TKP Access Protocol in support of Configuration 3 is discussed in 9.1.16. The Port Operation Tables used to support this Configuration are specified in 9.4.
d) The C-Port in Station Emulation Mode using the TKP Access Protocol in support of Configuration 4 is discussed in 9.1.17. The Port Operation Tables used to support this Configuration are specified in 9.5.
e) The DTR Station using the TKP Access Protocol in support of Configuration 3 is discussed in 9.1.18. The Station Operation Tables used to support this configuration are specified in 9.6.

9.1.1 TXI definitions

This subclause contains definitions used by the C-Port and Station including FSM Notations and Interactions, PHY Signal Interpretation, frame Identification, Actions on frame Errors, and C-Port/Station Policy Variables.

9.1.1.1 FSM Notation

See 4.2.1 for the general rules controlling FSMs.

The C-Port Operation Tables and Station Operation Tables contain an abstract model of the DTR C-Port and Station Access Protocol machines. For all possible combinations of events and C-Port/Station states, the Operation Tables determine an unambiguous and consistent response by the C-Port or Station, including the next state, if necessary, and the primitives used at the various service interfaces.

The C-Port's Port Operation Tables in 9.3, 9.4, and 9.5, the Station Operation Tables in 9.2 and 9.6, and the FSMs defined in Annexes L, M, N, and R are evaluated as follows:

NOTE—The notation FxTI is used to mean FPTI or FSTI, FxTXC is used to mean FPTXC or FSTXC, TS=xTXN is used to mean TS=PTXN or TS=STXN, and TS=xTXD is used to mean TS=PTXD or TS=STXD.

a) A snapshot of the value of all event terms is taken at an instant in time.
b) All event statements are evaluated to TRUE or FALSE, depending on the truth of each element in the event statements.
c) The actions for all TRUE events are performed.
d) Actions are considered to occur simultaneously, except for Clock Source changes, Transmit Sequences (e.g., SFS, EFS, or FCS), and the transmission of fill.
e) The transmission of frame data is performed as follows when the C-Port or Station is using the TXI Access Protocol and operating at 4 Mbit/s, 16 Mbit/s, or the HMR.

   The starting point for the transmission of frames is the Transmit Normal state (TS=xTXN). In this state, the C-Port and Station transmit fill by setting FxTI=1 to invoke one of the following interface signals:

   — PS_CONTROL.request(Transmit_mode=Fill) [C-Port and Station]; or
   — PM_CONTROL.request(Transmit_mode=Fill) [C-Port only].

The following terms are defined:

Start-transmit-frame-data: The C-Port or Station detects the need to transmit a frame.
End-transmit-frame-data: The C-Port or Station detects the need to end frame data transmission.

1) TS=xTXN detects *Start-transmit-frame-data*

When one of the conditions for the *Start-transmit-frame-data* is detected, the C-Port's Transmit Port Operation Table 9.3-2, or the Station's Transmit Station Operation Table 9.2-2, transitions from the Transmit Normal state (TS=xTXN) to the Transmit Data state (TS=xTXD) as follows:

The Transmit Normal state (TS=xTXN) is exited and the following actions occur:

i) The fill being transmitted by TS=xTXN is stopped as follows:
- The Station stops transmitting fill by setting FSTI=0 to invoke the interface signal PS_CONTROL.request(Transmit_mode=No_fill).
- The C-Port stops transmitting fill by setting FPTI=0 to invoke one of the following interface signals: PS_CONTROL.request(Transmit_mode=No_fill) or PM_CONTROL.request(Transmit_mode=No_fill).

ii) The C-Port and Station use the PS_UNITDATA.request(Tx_indicator=Data_byte) signal for transmitting each octet. The transmission of the frame starts with the SFS [TX_SFS(P=x;R=0)].

iii) When the last octet of the SFS is transmitted, the Transmit Data state (TS=xTXD) is entered and the transmission of the frame's data is started.

iv) The Transmit Data state (TS=xTXD) causes each octet of the frame to be transmitted until one of the following *End-transmit-frame-data* conditions is detected:
- The frame's end of data (EOD) occurs;
- A Station Error or C-Port Error occurs.

2) TS=xTXD detects *End-transmit-frame-data*

When the *End-transmit-frame-data* condition is detected, the C-Port's Transmit Port Operation Table or the Station's Transmit Station Operation Table transitions from the Transmit Data state (TS=xTXD) to the Transmit Normal state (TS=xTXN) as follows:

The Transmit Data state (TS=xTXD) is exited and the following actions occur:

i) The following actions occur if the *End-transmit-frame-data* is caused by the frame's EOD:
- The transmission of a valid FCS (TX_FCS), followed by the transmission of the EFS [TX_EFS(I=E=0) for 4 Mbit/s and 16 Mbit/s, and TX_EFS(E=0) for the HMR].
- When the last octet of the EFS is transmitted, the transmission of fill is started as follows:

  The Station starts transmitting fill by setting FSTI=1 to invoke the interface signal PS_CONTROL.request(Transmit_mode=Fill).
- The C-Port starts transmitting fill by setting FPTI=1 to invoke one of the following interface signals: PS_CONTROL.request(Transmit_mode=Fill) or PM_CONTROL.request(Transmit_mode=Fill).
- The Transmit Normal state (TS=xTXN) is entered and the transmission of a frame has been completed.

ii) One of the following actions occurs if the *End-transmit-frame-data* is caused by a Station Error or C-Port Error:

If FxASO=0, then the Abort Sequence is supported and the frame is aborted with an Abort Sequence (TX_AB) as follows:

- The transmission of the Abort Sequence is started.
- When the last octet of the Abort Sequence is transmitted, the transmission of fill is started as follows:

  The Station starts transmitting fill by setting FSTI=1 to invoke the interface signal PS_CONTROL.request(Transmit_mode=Fill).

  The C-Port starts transmitting fill by setting FPTI=1 to invoke one of the following interface signals: PS_CONTROL.request(Transmit_mode=Fill) or PM_CONTROL.request(Transmit_mode=Fill).

- The Transmit Normal state (TS=xTXN) is entered and the transmission of a frame has been completed.

If FxASO=1, then the Abort Sequence is not supported, the frame is aborted with an invalid FCS, and the E-bit is set to 1 [TX_INV_FCS; TX_EFS(E=1)] as follows:

- The transmission of an invalid FCS (frame shall not pass FCS receive checking) followed by the transmission of the EFS.
- When the last octet of the EFS is transmitted, the transmission of fill is started as follows:

  The Station starts transmitting fill by setting FSTI=1 to invoke the interface signal PS_CONTROL.request(Transmit_mode=Fill).

  The C-Port starts transmitting fill by setting FPTI=1 to invoke one of the following interface signals: PS_CONTROL.request(Transmit_mode=Fill) or PM_CONTROL.request(Transmit_mode=Fill).

- The Transmit Normal state (TS=xTXN) is entered and the transmission of a frame has been completed.

f) The C-Port repeat function, when using the TXI Access Protocol and operating at the 4 Mbit/s and 16 Mbit/s media rates, or operating at the HMRs and the C-Port's option flag FPRPTO=1 (indicating the hardware repeat path is supported), is performed as follows.

Notes and definitions:

Clock source change notes:

— At the 4 Mbit/s and 16 Mbit/s media rates, the C-Port shall delay at least 1.5 ms after a clock source change before proceeding (required by 5.7.1). This delay is required to allow the attached Station's receiver enough time to synchronize to the new clock source.

— At the HMRs, no clock source change shall occur because the C-Port always transmits using a signal that is derived from its internal crystal clock.

The following flag, defined in 9.3, is used to control the C-Port's repeat function when the C-Port's option flag FPRPTO=1:

— FPRPT=1: The C-Port's Transmit Normal state (TS=PTXN) detects the need to *start* the repeat function.

— FPRPT=0: The C-Port's Repeat state (TS=PRPT) detects the need to *stop* the repeat function.

The starting point for the C-Port repeat function is the Transmit Normal state (TS=xTXN). The C-Port transmits fill in this state by setting FPTI=1 to invoke one of the following interface signals:

— PS_CONTROL.request(Transmit_mode=Fill); or

— PM_CONTROL.request(Transmit_mode=Fill).

1) TS=PTXN detects FPRPT=1

The C-Port's Transmit Port Operation Table transitions from the Transmit Normal state (TS=PTXN) when the FPRPT=1 condition is detected to the Repeat state (TS=PRPT) and takes the following actions:

i) The C-Port, when operating at 4 Mbit/s or 16 Mbit/s, changes its transmit clock source by setting FPTXC=0 (causing the transmit clock to be derived from the C-Port's received signal).

ii) The C-Port stops transmitting fill by setting FPTI=0 to invoke one of the following interface signals: PS_CONTROL.request(Transmit_mode=No_fill) or PM_CONTROL.request(Transmit_mode=No_fill).

iii) The C-Port, when operating at 4 Mbit/s or 16 Mbit/s, shall delay for at least 1.5 ms before proceeding.

iv) The TS=PRPT state is entered and the following occurs: the data received at the C-Port's receiver is transmitted without change (with the exception of the E-bit, which, if present, may or may not be set).

2) TS=PRPT detects FPRPT=0

The C-Port's Transmit Port Operation Table transitions from the Repeat state (TS=PRPT) when the FPRPT=0 condition is detected to the Transmit Normal state (TS=PTXN) and the takes following actions:

i) The C-Port, when operating at 4 Mbit/s or 16 Mbit/s, changes its transmit clock source by setting FPTXC=1 (causing the transmit clock to be derived from the C-Port's internal crystal clock).

ii) The C-Port starts transmitting fill by setting FPTI=1 to invoke one of the following interface signals: PS_CONTROL.request(Transmit_mode=Fill) or PM_CONTROL.request(Transmit_mode=Fill).

iii) The C-Port, when operating at 4 Mbit/s or 16 Mbit/s, shall delay for at least 1.5 ms before proceeding.

iv) The Transmit Normal state (TS=PTXN) is entered and the repeat function has been completed.

g) Items e) and f) in 9.1.1.1 cover the operation of the C-Port's Transmit Port Operation Table 9.3-2 and Station's Transmit Station Operation Table 9.2-2.

However, a transmit clock source change (value of FxTXC changes) can also occur when operating at 4 Mbit/s or 16 Mbit/s via actions in the C-Port's Join and Monitor Port Operation Tables 9.3-1 and 9.3-3, and the Station's Join and Monitor Station Operation Tables 9.2-1 and 9.2-3. Since this change in the value of FxTXC *is not* under control of the C-Port or Station Transmit Operation Tables 9.3-2 or 9.2-2, enough time for the attached entity to synchronize to the new clock source shall occur *before* using the services of these two Transmit tables.

Therefore, the following general restriction is put upon *any* transition *outside* the C-Port's Transmit Port Operation Table and the Station's Transmit Station Operation Table that causes the value of FxTXC to change.

The C-Port or Station, when operating at 4 Mbit/s or 16 Mbit/s, shall delay at least 1.5 ms *before* attempting to transmit a frame via the transmit function specified by Port Operation Table 9.3-2 or Station Operation Table 9.2-2.

h) Evaluation is repeated beginning with Step 1.

The C-Port and Station must have a way of ordering simultaneous external events, which would otherwise cause contradictory actions, such as simultaneous frame arrival and timer expiration. Except for the case of simultaneous events, the actions associated with the set of TRUE event statements in the FSM and C-Port and Station Operation Tables are never contradictory. The method that a C-Port and Station use to arbitrate simultaneous events is implementation dependent and not constrained by this standard. The C-Port and Station may act on simultaneous events in any order prior to considering subsequent events.

Actions do not affect the truth of event statements until the next snapshot.

Constants used in the tables are in hexadecimal notation, unless otherwise indicated.

9.1.1.2 Special optional notation used in Port and Station Operation Tables

When appropriate, some of the Port and Station Operation Table transitions have an Action/Output column that includes the notations: (optional), (optional-i), (optional-x), and (optional-unk). All of the optional actions are enclosed within brackets.

This standard provides the following guidance for this notation:

Notation	Meaning of notation
(Optional)	New implementations are allowed to include or exclude this option.
(Optional-i)	New implementations are encouraged to include this option.
(Optional-x)	New implementations are encouraged to exclude this option.
(Optional-unk)	Implementations supporting any transition containing the “FR_LTH=UNK” term shall implement this option.

9.1.1.3 PMAC and SMAC Protocol flags

C-Port and Station protocol flags use the notations FP (name of flag) and FS (name of flag), respectively. Protocol flags, which remember the occurrence of an event for a later action, are used internally by the Port Operation Tables and Station Operation Tables, and are not meant to imply any implementation requirements.

All C-Port and Station protocol flags are set to 0 by the “Set_initial_conditions” action.

In general, protocol flags are set to 1 when a condition occurs and set to 0 when the condition no longer exists or when the appropriate action is taken.

9.1.1.4 C-Port Interface Flags

The C-Port Interface Flags are used by the Join Port Operation Table as a method of communication between the Port Operation Tables in 9.2, 9.3, 9.4, and 9.5 as follows:

— Interface Flags are set to 0 by the C-Port action, “Set_initial_conditions.”
— Interface Flags are set to 1 by the C-Port upon the detection of an appropriate condition.
— Interface Flags do not represent any implementation requirements.

C-Port Interface Flags use the notation FIP (name in the form of: Access Protocol, C-Port Operation, Condition Reported [optional]). This notation is illustrated in Figure 9.1-1.

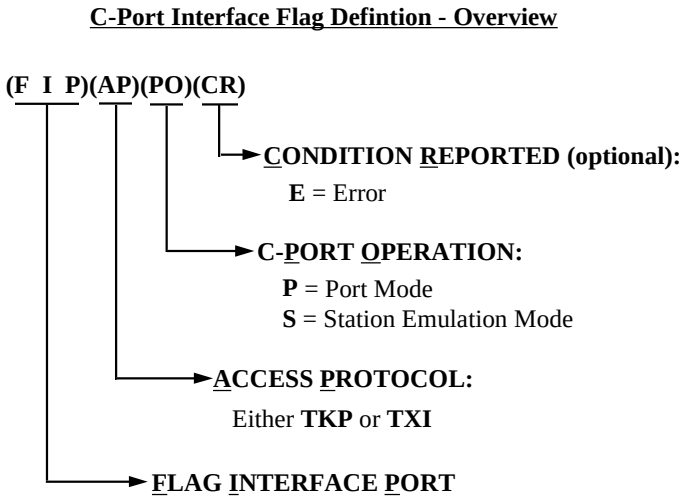

Figure 9.1-1—Interface Flag overview

The following Interface Flags are defined to support Configurations 2, 3, or 4.

9.1.1.4.1 Interface Flag support of the TXI Access Protocol

Flag, Interface C-Port TXI Station Emulation (FIPTXIS)

The flag FIPTXIS is set to 1 by the C-Port's Join FSM in 9.3, when it recognizes the need to enter the C-Port in Station Emulation Mode using the TXI Access Protocol. The Station Operation Tables in 9.2 use this flag to activate transitions necessary to support the C-Port functions (e.g., MRI handling).

The flag FIPTXIS is used to support the Configuration 2 entity (C).

9.1.1.4.2 Interface Flag Support of the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

Flag, Interface C-Port TKP Port Mode (FIPTKPP)

The flag FIPTKPP is set to 1 by the C-Port's Join FSM in 9.3, when it recognizes the need to enter the C-Port in Port Mode using the TKP Access Protocol. The Port Operation Tables in 9.4 use this flag to activate transitions necessary to support the C-Port in this mode.

The flag FIPTKPP is used to support the Configuration 3 entity (E) or Configuration 4 entity (H).

Flag, Interface C-Port TKP Port Mode Error (FIPTKPPE)

The flag FIPTKPPE is set to 1 by the C-Port's Monitor FSM in 9.4 to inform the Join Port Operation Table in 9.3 that the attached Station did not successfully complete its LMT during its Beacon Test state.

The flag FIPTKPPE is used to support the Configuration 3 entity (E) and Configuration 4 entity (H).

Flag, Interface C-Port TKP Station Emulation (FIPTKPS)

The flag FIPTKPS is set to 1 by the C-Port's Join FSM in 9.3, when it recognizes the need to enter the C-Port in Station Emulation Mode using the TKP Access Protocol. The Port Operation Tables in 9.5 use this flag to activate transitions necessary to support the C-Port in this mode.

The flag FIPTKPS is used to support the Configuration 3 entity (F) and Configuration 4 entity (G).

9.1.1.5 Join, Monitor, and Transmit FSM interaction

This subclause and its figure (Figure 9.1-2) explain the interaction of the DTR C-Port and Station TXI Access Protocol Join, Monitor, and Transmit FSMs. Functions performed by these C-Port and Station FSMs are defined in the TXI Access Protocol Specifications defined in 9.2.5 and 9.3.4, respectively. The Join Ring FSM is the parent to the Monitor FSM and the Transmit FSM. Figure 9.1-2 illustrates the interaction of the Join Ring (Master), Transmit (Slave), and Monitor (Slave) FSMs.

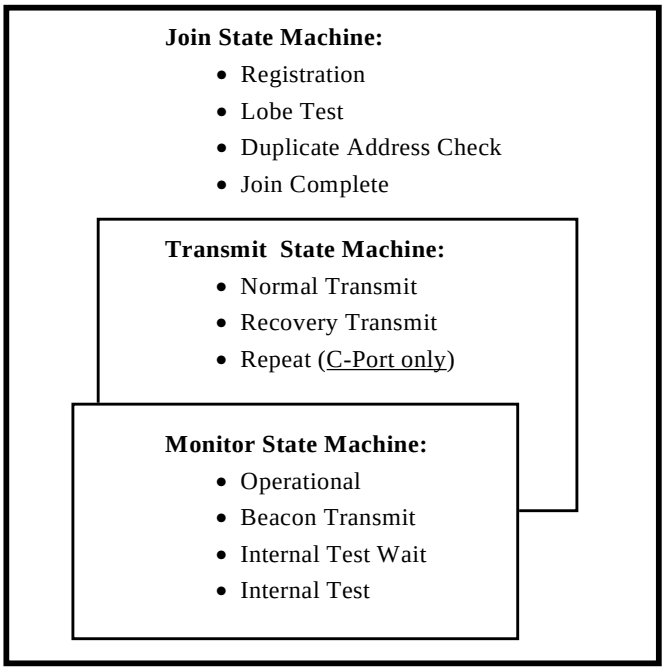

Figure 9.1-2—Join, Transmit, and Monitor FSM interaction

The starting state for the TKP Access Protocol and TXI Access Protocol is the Bypass state (JS=BP).

— The Bypass State is the initial state of the Join FSM. A C-Port or Station completing a power on reset sequence activates its Join FSM in this state. Entry into this state, when under FSM control, can occur due to local management action, network management action, or the detection of an uncorrectable error. Exit from the Bypass State is controlled by the local management actions: Connect.MAC, Connect.SMAC, or Connect.PMAC.

— The Transmit and Monitor states (TS=x, MS=x) *are not* specified while the Join Machine is in the Bypass state (JS=BP).

The following starting conditions (i.e., power on) for the C-Port and Station FSMs shall be established prior to leaving the Bypass State:

a) Counters are set to zero (0).

b) Event Flags are set to zero (0).

c) Stored values are set to zero (0).

d) C-Port and Station Policy Flags, and C-Port and Station Policy Variables, are set according to the C-Port and Station operational policies; and they are set *prior* to leaving the Bypass State (JS=BP).

Policy Flags and Policy Variables are examined, but are *never* changed by the Port Operation Tables or Station Operation Tables.

e) Timers are not running (stopped, thus cannot expire).

f) The FA(LMT) and FA(monitor) shall be set to 0.

g) All transmit and receive queues shall be flushed.

9.1.1.6 PMAC and SMAC frame and token signals

The PMAC's C-Port Operation Tables and the SMAC's Station Operation Tables use four frame signals and one token signal. They are Frame (FR), Frame with Error (FR_WITH_ERR), Frame Header (FR_FC), Frame Access Control (FR_AC), and Token Access Control (TK_AC). These frame or token signals, which cause certain actions to be taken by the PMAC and SMAC, are defined separately for the 4 and 16 Mbit/s media rate, and for the HMR. The unique definitions of these signals for the TXI Access Protocol are defined below.

4 Mbit/s and 16 Mbit/s

The TK_AC signal is defined in 4.3.1; the FR, FR_WITH_ERR, and FR_AC signals are defined in 4.3.2; and the FR_FC is defined below.

Properties of a frame. (See Clause 3 and Clause 10 for definitions of frame and code symbols.)

A — Starts with valid SD (code symbol JK0JK0).
E — The frame format bits in the FC field are equal to 00 or 01.
K — The AC field has no code violations in the P-bits and T-bit, and optionally the M-bit and R-bits.
L — The T-bit is equal to 1, indicating a frame.
M— The FC field has no code violations.

Frame header *(FR_FC).* The FR_FC signal indicates a frame's SD, AC, and FC fields have been received that satisfy the following conditions:

A & K & L & M & E

High Media Rate

The FR, FR_WITH_ERR, FR_AC, and FR_FC signals for the HMR are defined below.

Properties of a frame. (See Clause 14 for the definition of a frame.)

A — Starts with valid SSD signal.
B — The AC field has no code violations.
D — Has no code violations in the FC field.
E — Is an integral number of octets in length.
F — Has FF bits in FC field equal to 00 or 01.
G — Has a valid FCS.
H — T bit is equal to 1, indicating a frame.
J — Is composed of only hexadecimal values (0 through F) between the SSD and ESD.
K — Has a minimum of 19 octets between SSD and ESD.
L — Ends with two valid hexadecimal values (0 through F), followed by a valid ESD signal.
M— Ends with at least one hexadecimal value (0 through F) in the two code-groups preceding a valid ESD signal.

Frame (FR). The FR signal indicates a valid frame has been received that satisfies one of the following conditions:

A & E & F & G & H & J & K & L **(for MAC and LLC frames)**

or **A & E & -F & H & J & L** **(for undefined frame formats)**

Frame with error (FR_WITH_ERR). The FR_WITH_ERR signal indicates a frame has been detected that **satisfies** one of the following conditions:

A & F & H & M & (-E or -G or -J or -K) **(for MAC and LLC frames)**

or **A & -F & H & M & (-E or -J)** **(for undefined frame formats)**

Frame access control (FR_AC). The FR_AC signal indicates a frame's SSD and AC fields have been received that satisfy the following conditions:

A & B & H

Frame header (FR_FC). The FR_FC signal indicates a frame's SSD, AC, and FC fields have been received that satisfy the following conditions:

A & B & D & F & H

9.1.1.7 Actions on a frame with error condition

When a frame is addressed to a C-Port or Station and has a frame with error (FR_WITH_ERR) condition (as specified in 4.3.2 for the 4 Mbit/s and 16 Mbit/s media rates and 9.1.1.6 for the HMR), the frame is not processed other than to count the error condition.

9.1.1.8 TXI Policy Flags and Variables

TXI Policy Flags and Variables are set *prior* to the Connect.SMAC or Connect.PMAC interface start-up signals and cannot be changed by the C-Port's Port Operation Tables or the DTR Station's Station Operation Tables. The Station and C-Port TXI Policy Flags and Variables are defined in 10.5 and 14.5.

9.1.1.9 Interpreting the FSMs

The high-level FSMs contained in 9.2 through 9.6, and the low-level FSMs contained in Annexes L, M, N, Q, and R, use the following set of rules.

These FSMs illustrate only the Port and Station Join, Transmit, and Monitor Operation Tables, even though *all* Port and Station Operation Tables defined are required for correct operation.

The Join, Transmit, and Monitor FSMs can operate simultaneously. Each FSM can have only *one* State active at a time.

Figure 9.1-3 illustrates states and transitions as follows:

a) STATES as vertical lines, with the State name at the top of the line.
b) TRANSITIONS as horizontal lines; always contain an arrowhead to show a connection to a STATE and may contain a state/transition number (e.g., J12).
c) When state/transition numbers (e.g., J12) are present within a FSM:
    1) The first character represents the current FSM (J for Join, T for Transmit, and M for Monitor);

2) The second character is the State within the current FSM being exited;
3) The third character is the State within the current FSM being entered.

Occasionally, a transition between two states can be caused by a number of different conditions, each with different resulting actions. In these cases, the different paths are differentiated by the addition of a letter in the state transition label (e.g., J13A and J13B).

d) Entry into a STATE occurs *only* when the transition ends at a STATE with an arrowhead.
e) Some transitions are awkward to illustrate because of location within the FSM. TRANSITION J31 exits STATE J3 and enters STATE J1 [e.g., J31 labeled (A)].
f) Some transitions cross a STATE without an arrowhead and indicate the STATE *is not* entered. TRANSITION J31 exits STATE J3 and enters STATE J1 [e.g., J31 labeled (B)].
g) OPTIONAL conditions are enclosed in brackets (e.g., [Condition_6]).
h) OPTIONAL actions are enclosed in brackets (e.g., [Action_6]).

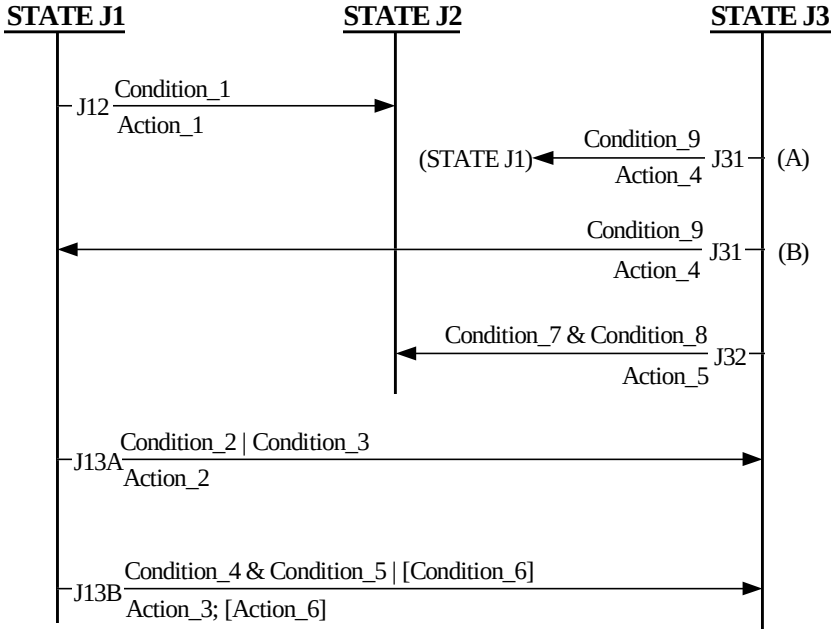

Figure 9.1-3—State/transitions (S/T) illustration

Figure 9.1-3 illustrates the following state transitions:

— STATE J1 to STATE J2 (transition J12) due to event of Condition_1, action of Action_1.
— STATE J1 to STATE J3 (transition J13A) due to event of Condition_2 OR Condition_3, action of Action_2.
— STATE J1 to STATE J3 (transition J13B) due to event of Condition_4 AND Condition_5, OR optional by Condition_6, action of Action_3, and optionally Action_6.
— STATE J3 to State J1: two different ways of illustrating the same transition.

- STATE J3 to STATE J1 (transition J31) due to event of Condition_9, action of Action_4.
- STATE J3 to STATE J1 (transition J31) due to event of Condition_9, action of Action_4.

In the Port and Station Operation Tables in Clause 9, the “Event/Event and conditions” column contains the current state. This state is not shown in the Low-Level FSMs in Annexes L, M, N, Q, or R because the vertical line illustrates the current state.

In the Port and Station Operation Tables in Clause 9, the “Actions/Outputs” column contains the state being entered. This state is not shown in the Low-Level FSMs in Annexes L, M, N, Q, or R because the state being entered is illustrated by the arrowhead connection to a vertical line.

Some of the Port and Station Operation Tables in Clause 9 contain transitions without a S/T entry. Although these transitions are not shown in the FSMs in Annexes L, M, N, Q, or R, they *are* required for correct FSM operation.

Some of the Port and Station Operation Tables in Clause 9 contain transitions that appear redundant because they seem to overlap. Close examination shows that uniqueness and redundant conditions do exist between the transitions. However, these are recognized at different points in time during the frame checking process. The following two examples extracted from Station Operation Table 9.2-1 appear redundant, but are not. The "Actions/Outputs" column explains under which conditions the event works, and following the table is an explanation of the differences in the frame checking processes.

S/T	REF	Event/Event and conditions	Actions/Outputs (with explanation)
JB0	3103	**FR_MAC(SA<>MA & SA<>SUA & VC=00)** & JS=SLT	JS=BP This action occurs for *any* MAC frame and *only* when (SA<>MA & SA<>SUA & VC=00).
JB0	3165	**FR_SMP(SA<>MA)** & JS=SLT NOTE—VC has an implicit value of 00 because of the definition of the SMP MAC frame.	JS=BP This action occurs *only* for a SMP MAC frame with (SA=SUA & VC=00), *and* 3103 does not operate.

Reference 3103 occurs during early frame checking *before* the type of MAC frame is recognized, while reference 3165 works *after* the SMP MAC frame has been recognized and is being checked for validity. For conditions that cause *both* transitions to work, reference 3103 operates.

9.1.2 TXI protocol checking

The Station and C-Port TXI Protocol Checking functions, when active, prevent TXI Access Protocol contamination. These functions are active when the Join FSM is in the following states: JS=SREG, JS=SLT, JS=SDAC, JS=SJC, JS=PLT, JS=PDAC, and JS=PJCI. A TXI Protocol Check causes the C-Port or Station to

a) Return to the Bypass state (JS=BP); and
b) Notify the appropriate Management entity of this event.

All frames are ignored during the Station's HMR Trade-up State (JS=SHMRTU). The C-Port's HMR Trade-up State (JS=PHMRTU) acts on REG_REQ frames only.

9.1.3 TXI error handling

The Station or C-Port using the TXI Access Protocol can experience error conditions that are classified as either Hard or Soft Errors, as follows:

a) Hard Errors, which are defined in 9.1.10, are faults that prevent the Station from receiving the C-Port's Heart Beat (PHB) MAC frames, or prevent the C-Port from receiving the Station's Heart Beat (SHB) MAC frames.
b) Soft Errors, which are defined in 10.6, are faults that cause data corruption, but do not prevent frames from being exchanged between the C-Port and the Station.

Error detection, reporting, and recovery procedures require Stations and C-Ports to identify and isolate fault conditions. In some cases, the Station and/or C-Port causing the fault condition is required to remove from the Network and report the error condition to the appropriate Management entities.

All error conditions are isolated to the fault domain described in 9.1.3.1. The Registration Process described in 9.1.4 establishes the operational domain of the TXI Access Protocol, including the individual addresses of the Station and C-Port. This operational domain is reported as the Fault Domain (as described in 9.1.3.2) either by the Beacon MAC frame for Hard Errors or by the Error Report MAC frame for Soft Errors as follows:

— Recovery from hard error conditions is managed by Hard Error Recovery, as described in 9.1.10.
— Reporting of soft error conditions is handled by the Station or C-Port, as described in 9.1.11.

9.1.3.1 TXI Fault Domain

The C-Port and Station *fault domain* establishes a boundary around an error condition and identifies the location of the fault for the appropriate corrective action. The Fault Domain for the TXI Access Protocol consists of the following, as illustrated in Figure 9.1-4:

a) The C-Port (A);
b) The Station (B); and
c) The components (e.g., medium, connectors) between the C-Port and the Station.

In this fault domain, error reporting is accomplished by

— The Station (B) detecting an error condition and reporting this fault condition as being downstream of the C-Port (A); or
— The C-Port (A) detecting an error condition and reporting this fault condition as being downstream of the Station (B).

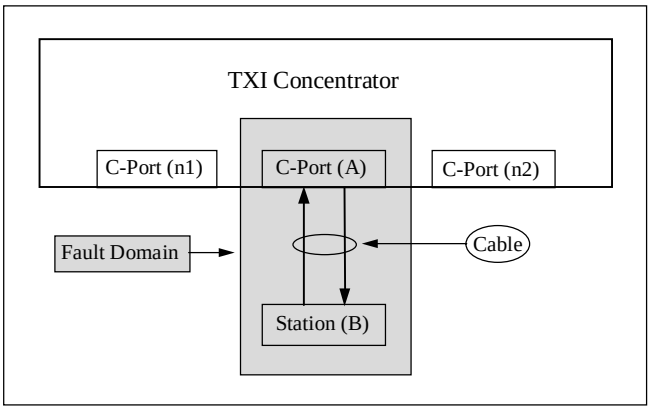

Figure 9.1-4—Fault domain illustration

9.1.3.2 TXI fault reporting

The TXI Access Protocol uses two reporting schemes, one for soft errors and one for hard errors. Subclauses 9.1.3.2.1 and 9.1.3.2.2 explain the handling of hard errors and soft errors using the fault domain illustrated by Figure 9.1-4.

9.1.3.2.1 Hard Errors

The TXI Access Protocol uses the Hard Error Recovery Process (see 9.1.10) in an attempt to recover from a Hard Error condition and restore normal operation. If recovery is not possible, the Beacon MAC frame identifies the Hard Error's fault domain for analysis by network management functions (Network Management and/or Station Management) as follows:

a) *Station* Detected Hard Error

The Hard Error's fault domain is identified and reported by Station (B) transmitting Beacon MAC frames when the Station detects a Hard Error (e.g., broken cable between C-Port [A] and Station [B]). This Beacon MAC frame

1) Contains the addresses of the detecting Station (B) and the connected C-Port (A); and
2) Allows the Station (B) to attempt to alert the C-Port (via the Beacon MAC frame) and its management that normal TXI Access Protocol is suspended until the hard error condition is terminated or removed. However, the nature of the Hard Error condition may make it impossible for the C-Port to receive the Station's Beacon MAC frame. When this occurs, C-Port management will not be aware the Station has detected an error condition.

b) *C-Port* Detected Hard Error

The Hard Error's fault domain is identified and reported by C-Port (A) transmitting Beacon MAC frames when the C-Port detects a Hard Error (e.g., broken cable between Station [B] and C-Port [A]). This Beacon MAC frame

1) Contains the addresses of the detecting C-Port (A) and the connected Station (B); and
2) Allows the C-Port (A) to attempt to alert the Station (via the Beacon MAC frame) and its management that normal TXI Access Protocol is suspended until the Hard Error condition is terminated or removed. However, the nature of the Hard Error condition may make it impossible for the Station to receive the C-Port's Beacon MAC frame. When this occurs, Station management will not be aware the C-Port has detected an error condition.

9.1.3.2.2 Soft Errors

The C-Port's and Station's TXI Access Protocol detects and reports Soft Errors as follows:

a) *Station* Detected Soft Error

The Soft Error's fault domain is identified and reported by Station (B) transmitting an Error Report MAC frame when the Station (B) detects a Soft Error (e.g., interference causing increased bit error rate (BER) between C-Port [A] and Station [B]). This Error Report MAC frame

1) Contains the addresses of the detecting Station (B) and the connected C-Port (A);
2) Contains the count of the errors detected (see 10.6); and
3) Is sent to the REM functional address for analysis by a Management application designed for the TXI Access Protocol.

b) *C-Port* Detected Soft Error

The Soft Error's fault domain is identified and reported by C-Port (A) indicating an Error Report Management Status when the C-Port (A) detects a Soft Error (e.g., interference causing increased BER between C-Port [A] and Station [B]). This Error Report Management Status

1) Contains the addresses of the detecting C-Port (A) and the connected Station (B);
2) Contains the count of the errors detected (see 10.6); and
3) Is sent via a Management Routing Interface (MRI) status indication for analysis by a Management application designed for the TXI Access Protocol.

9.1.4 TXI registration

The C-Port and the Station Join Machines use the Registration function to exchange the following information:

— Station saves the C-Port's source address (PMAC Address) in its Stored Upstream Address (SUA).
— C-Port saves the Station's source address (SMAC Address) in its SUA.
— C-Port saves the Station's Individual Address Count (IAC) in its Stored Individual Address Count (SIAC). The Station is required to support only the SMAC address, but may optionally support multiple individual addresses. The C-Port does not support multiple Individual Addresses.

— C-Port saves the Station's Phantom Drive (PD) subvector value in its Stored Phantom Drive (SPD) variable.

In addition, the C-Port and the Station Join Machines use Registration to determine whether the Station and C-Port are compatible (e.g., they are capable of using the same Access Protocols).

a) If they are not compatible, the Registration function causes the following actions:
   1) The C-Port notifies the Station of the incompatibility via the Registration Response (REG_RSP) MAC frame with an AP_RSP subvector value of X'0000' and remains in its Registration State.
   2) The Station returns to the Bypass State and notifies the appropriate Management function.

b) If they are compatible, the Registration function in the C-Port notifies the Station via the Registration Response (REG_RSP) MAC frame with an AP_RSP subvector with a value of X'0002' for the TXI Access Protocol, or a value of X'0004' for the HMR Trade-up Protocol.

9.1.4.1 Station support of registration

After a delay controlled by the timer TSIS, the registration function determines whether the C-Port can support the TXI Access Protocol by setting its request counter CSREQ to a value in the range of 4 through 12 (see 9.2.3.1 and 9.2.5), resetting the pacing timer TSREQ, and transmitting the Registration Request MAC frame defined in 10.3.5.1. The station proceeds with one of the following actions:

a) If the Station receives a C-Port REG_RSP MAC frame and its AP_RSP subvector value is equal to X'0002', then the C-Port has accepted the Station's request and the Station, after delaying for a period controlled by TSLMTD, begins the TXI Access Protocol defined in 9.2 by entering the Station Lobe Test state (JS=SLT).

b) If the Station has not received the C-Port's REG_RSP MAC frame prior to the expiration of TSREQ and CSREQ>0, then the Station retransmits the REG_REQ MAC frame, resets timer TSREQ, and decrements CSREQ.

c) If the Station has not received the C-Port's REG_RSP MAC frame prior to the expiration of TSREQ and CSREQ=0, then the station takes one of the following actions, depending on the option flag FSOPO:
   1) When operating at the 4 Mbit/s or 16 Mbit/s media rate and if FSOPO=0, the Station attempts to join using the TKP Access Protocol by entering the Lobe Test state (JS=LT) defined in Clause 4 for the Classic Station and in 9.6 for the DTR Station.
   2) When operating at any media rate and if FSOPO=1, the Station does not allow selection of the TKP Access Protocol, enters the Bypass state (JS=BP), and reports this failure to Management.

d) If the Station receives a C-Port REG_RSP MAC frame and its AP_RSP subvector value is X'0000' (indicating the C-Port has denied the Station's request), then the Station takes one of the following actions, depending on the option flag FSRDO:
   1) When operating at the 4 Mbit/s or 16 Mbit/s media rate and if FSRDO=0, the Station attempts to join using the TKP Access Protocol and enters the Lobe Test state (JS=LT) defined in Clause 4 for the Classic Station and in 9.6 for the DTR Station.
   2) When operating at any media rate and if FSRDO=1, the Station does not allow selection of the TKP Access Protocol, enters the Bypass state (JS=BP), and reports this failure to Management.

e) If the Station operating at 4 Mbit/s or 16 Mbit/s receives a REG_RSP MAC frame with an AP_RSP subvector value of X'0004' (indicating the C-Port has honored the Station's request to trade up to the HMR), then the Station continues with the HMR Trade-up protocol described in 9.1.14.

f) If the C-Port in Station Emulation Mode (FIPTXIS=1) operating at 4 Mbit/s or 16 Mbit/s with its Trade-up function active (FSHMRTUA=1), receives a REG_RSP MAC frame with an AP_RSP subvector value of X'0000' (indicating the C-Port has rejected the request to trade up to the HMR), then it restarts the Registration process to request operation at 4 Mbit/s or 16 Mbit/s.

9.1.4.2 C-Port support of registration

The C-Port supports the Registration function by entering the Registration State (JS=PREG) as follows:

4 Mbit/s and 16 Mbit/s

In the Registration state, a reliable repeat path is provided only if the C-Port is configured to support the TKP Access protocol [AND(PPV(AP_MASK),0001)=0001]. While in the Registration state, the C-Port waits for the Station's Registration Request (REG_REQ) MAC frame. Upon reception of the Station's Registration Request (REG_REQ) MAC frame, the C-Port examines the AP_REQ *and* PD subvector values and takes one of the following actions:

— If the value of the Station's AP_REQ when logically ANDed with the C-Port's PPV(AP_MASK) results in a value of X'0000' (indicating the AP_REQ value is not supported), *or* the value of the Station's PD when logically ANDed with the C-Port's PPV(PD) results in a value of X'0000' (indicating the PD value is not supported by the C-Port), then the C-Port denies the Station request by transmitting a Registration Response (REG_RSP) MAC frame with an AP_RSP subvector value of X'0000'. The C-Port remains in the Registration state (JS=PREG).

— If the value of the Station's AP_REQ when logically ANDed with the C-Port's PPV(AP_MASK) results in a value of X'0002', *and* the value of the Station's PD when logically ANDed with the C-Port's PPV(PD) results in a value of X'0001', then the C-Port accepts the Station request to use the TXI Access Protocol by transmitting a Registration Response (REG_RSP) MAC frame with an AP_RSP subvector value of X'0002', sets up the C-Port to support the Station's Lobe Test, and enters the C-Port Lobe Test state (JS=PLT).

NOTE—The Station's PD subvector shall have a value of X'0001' (indicating Phantom Drive is supported) when operating at the 4 Mbit/s and 16 Mbit/s media rates.

— If the value of the Station's AP_REQ when logically ANDed with the C-Port's PPV(AP_MASK) results in a value of X'0004', then the C-Port requests the Station to execute its Trade-up protocol by transmitting a Registration Response (REG_RSP) MAC frame with an AP_RSP subvector value of X'0004', and continues with the HMR Trade-up protocol described in 9.1.1.4.

High Media Rate

While in the Registration state, the C-Port waits for the Station's Registration Request (REG_REQ) MAC frame. Upon reception of the Station's Registration Request (REG_REQ) MAC frame, the C-Port examines the AP_REQ *and* PD subvector values and takes one of the following actions:

— If the value of the Station's AP_REQ when logically ANDed with the C-Port's PPV(AP_MASK) results in a value of X'0000' (indicating the AP_REQ value is not supported), *or* the value of the Station's PD when logically ANDed with the C-Port's PPV(PD) results in a value of X'0000' (indicating the PD value is not supported by the C-Port), then the C-Port denies the Station's request by transmitting a Registration Response (REG_RSP) MAC frame with an AP_RSP subvector value of X'0000'. The C-Port remains in the Registration state (JS=PREG).

— If the value of the Station's AP_REQ when logically ANDed with the C-Port's PPV(AP_MASK) results in a value of X'0002', *and* the value of the Station's PD when logically ANDed with the C-Port's PPV(PD) results in a value of X'0001' or X'0002', then the C-Port accepts the Station request to use the TXI Access Protocol by transmitting a Registration Response (REG_RSP) MAC

frame with an AP_RSP subvector value of X'0002', sets up the C-Port to support the Station's Lobe Test, and enters the C-Port Lobe Test state (JS=PLT).

NOTE—When operating at the HMR, the Station's PD subvector may have a value of X'0001' (indicating Phantom Drive is supported) or X'0002' (indicating Phantom Drive is not supported).

9.1.5 Registration Query Protocol

The purpose of the Registration Query Protocol is to allow two TXI-capable entities connected by a dedicated lobe, which have joined using the TKP Access protocol, to attempt to switch to the TXI Access Protocol. This situation could arise from a TXI-capable station attempting registration before the C-Port is ready to respond.

The Protocol is initiated by the C-Port completing Neighbor Notification and entering the Port Registration Query state (JS=PRQ). In this state, the C-Port will transmit up to five (5) Registration Query MAC frames to the attached station. If the Station is configured to respond to the Registration Query MAC frames, the Station drops Phantom, delays for the time specified by TSRW (allows the C-Port to detect phantom loss and change states), and re-enters the Registration State (JS=SREG) to begin the Registration Process. While in the Registration Query state (JS=PRQ), the C-Port responds to the loss of Phantom by entering its Registration state (JS=PREG).

If the Station does not drop phantom while the C-Port is in JS=PRQ and CPRQ decrements to zero, the C-Port ends Registration Query and completes the Join Process (JS=PJCP).

9.1.6 TXI Lobe Media Test

The Station, with support of the C-Port, uses the LMT function to determine if the media (lobe) and the associated hardware *between* the Station's SMAC and the C-Port are operating at an acceptable BER.

The type of LMT supported by the Station is determined by the option flag FSLMTO specified in 14.5.1.1.2 as follows.

— If FSLMTO is set to 0, the Station uses the 4 Mbit/s or 16 Mbit/s method of testing (TXI_TEST) defined in 9.1.6.1.
— If FSLMTO is set to 1, the Station uses the 4 Mbit/s, 16 Mbit/s, or HMR method of testing (FSRLMT=1) defined in 9.1.6.2.

9.1.6.1 LMT for FSLMTO=0

This LMT function is designed to be used at the 4 Mbit/s and 16 Mbit/s media rates, with the C-Port PHY repeat path (FPRPTO=1), as defined in 9.1.6.1.2. This PHY repeat path causes the C-Port to return the LMT frame transmitted by the Station.

The Station shall start the LMT with the TXI_TEST action. The operation of this test is defined in 9.1.6.1.1 and specified in 9.2.5.1 by Station Operation Table 9.2-1. The C-Port's support of this test is defined in 9.1.6.1.2 and specified in 9.3.4.1 by Port Operation Table 9.3-1.

9.1.6.1.1 Station support of the LMT

The Station shall be responsible for execution of the LMT function to determine if the lobe has an acceptable BER, as specified in Annex P. The Station's LMT normally uses the LMT MAC frame to test the lobe. The Station's LMT may use other frames for testing, but shall not use the Ring Recovery MAC frames (BN, CT, and RP) or the Neighbor Notification MAC frames (AMP and SMP). The Station transmits the frame and then checks this frame at its receiver for error conditions. The pass/fail criteria for BER calculations are specified in Annex P. If the Station detects success of the LMT function, it continues the Join process. If the

Station detects a failure of the LMT function, the Station assumes the lobe is bad, notifies the Station Management, and enters the Bypass state (JS=BP).

9.1.6.1.2 C-Port support of the LMT

The C-Port shall provide one of the two Repeat Paths defined in 9.7.1 to allow the Station to test the lobe, as stated in 9.1.6.1.1. Both of these repeat paths shall cause the C-Port to return the frames received from the Station unchanged, with the following exceptions:

— The Ending Delimiter's E-bit may or may not be set;
— The Frame Status A-bits may or may not be set; and
— The Frame Status C-bits may or may not be set.

9.1.6.2 LMT for FSLMTO=1

This LMT function tests the lobe by transmitting frames *without* Tokens and is designed to be used at any media rate (e.g., 4, 16, 100, etc.). Frames are returned by the C-Port to the Station as defined in 9.1.6.2.2.

The Station shall start the LMT by setting the flag Station Request LMT (FSRLMT) to 1. The operation of this test is defined in 9.1.6.2.1 and specified in 9.2.5.7 by Station Operation Table 9.2-7. The C-Port's support of this test is defined in 9.1.6.2.2 and specified in 9.3.4.1 by Port Operation Table 9.3-1.

During the LMT Testing stage defined in 9.1.6.2.1, the Station and C-Port activate their LMT functional addresses [FA(LMT)=1] as follows:

— When the Station detects the need to execute the LMT Testing Stage defined in 9.1.6.2.1;
— When the C-Port enters its C-Port Lobe Test state (JS=PLT) *and* it is using the PMAC lobe test repeat mechanism.

9.1.6.2.1 Station support of the LMT

The Station shall be responsible for execution of the LMT function to determine if the lobe has an acceptable BER, as specified in Annex P. The Station's LMT function shall not be sensitive to the form of the repeat mechanism provided by the C-Port and defined in 9.1.6.2.2.

This LMT function is divided into two stages: *Notification* and *Testing*. Annex X provides an analysis of the timing requirements for the Notification and Testing stages.

LMT Notification Stage

The Station enters the LMT Notification Stage when it detects conditions requiring the execution of the LMT function.

The Station in the LMT Notification Stage shall transmit the LMT Notification MAC frame, addressed to the *broadcast* address, to request the C-Port to prepare for the LMT Testing Stage. The Station uses an assured delivery process by periodic retransmission of this frame and proceeds as follows:

— If the Station does not receive a LMT Notification MAC frame before its timer TSLMTR expires, then the Station assumes the lobe is bad, notifies the Station Management, and enters the Bypass state (JS=BP).
— If the Station receives a LMT Notification MAC frame (indicating the C-Port has prepared for the Station's LMT), then it stops transmitting this frame and enters the LMT Testing Stage described next.

LMT Testing Stage

The Station in the LMT Testing Stage shall transmit the LMT MAC frame, addressed to the LMT functional address (see 10.2.3), to test the lobe as follows:

a) The Station timer TSLMTC controls the total LMT time allotted for the Station's LMT. Therefore, the SMAC shall provide an *average* receive and transmit path time of *less than* 0.9 ms for *all* LMT MAC Frames to prevent the total LMT time from exceeding the time allowed by TSLMTC.
b) The Station shall transmit "n7+1" (see 9.2.5) LMT MAC frames, each with a length of 112 octets, inclusive of the FCS. This standard does not specify the data values for the Wrap Data subvector.
c) The Station shall fail its LMT if
    1) More than one frame out of the "n7+1" frames transmitted is either not received or is received with an error; or
    2) The total time for the LMT is exceeded (TSLMTC expires).

9.1.6.2.2 C-Port support of the LMT

The C-Port shall provide a repeat mechanism to allow the Station to test the lobe as stated in 9.1.6.2.1. The policy flag FPRPTO controls the type of repeat mechanism through the C-Port as follows:

a) If FPRPTO=0, then the C-Port shall provide a PMAC LMT repeat mechanism as follows:
    1) Upon reception of a valid LMT Notification or LMT MAC frame, the PMAC shall either
        i) Return the received frame; or
        ii) Generate a replacement LMT Notification or LMT MAC frame.

        The LMT Notification and LMT MAC frames shall be transmitted to the Station as follows:

        The LMT Notification MAC frame shall contain the same information field as the one transmitted by the Station, but *may* or *may not* contain the same SA. This frame indicates the C-Port has

        — Recognized the Station's request to start the LMT function; and
        — Activated its PMAC repeat mechanism.

        The LMT MAC frame shall be of the same length, but *may* or *may not* contain the same SA or information field as the one transmitted by the Station.

        The total LMT time allotted for the Station's LMT is controlled by the Station timer TSLMTC. Therefore, the PMAC shall provide an *average* repeat time of *less than* 0.9 ms for *all* LMT MAC Frames to prevent the total LMT time from exceeding the time allowed by TSLMTC.

    2) LMT Notification and LMT MAC frames detected with a FR_WITH_ERR condition shall be ignored by the C-port.
b) If FPRPTO=1, then the C-Port shall provide the PHY repeat path defined in 9.7.2. This repeat path shall cause the C-Port to return the frames received from the Station unchanged with the following exceptions:
    1) The Ending Delimiter's E-bit may or may not be set;
    2) The Frame Status A-bits may or may not be set; and
    3) The Frame Status C-bits may or may not be set.

9.1.7 TXI Duplicate Address Check (DAC)

The DTR Station and C-Port use DAC to determine whether the Station has an individual address acceptable to the DTR Concentrator's Data Transfer Unit (DTU) defined in Annex K. It is intended that the scope of the DAC should be the set of MACs connected to the ports on a DTR Concentrator that together

comprise *one* logical ring (K.3.2.2). The DAC is completed when the C-Port's Insert Response (INS_RSP) MAC frame is sent as a result of the Station transmitting an Insert Request (INS_REQ) MAC frame.

9.1.7.1 Station support of DAC

The Station starts its DAC function by transmitting the Insert Request (INS_REQ) MAC frame and waits for the C-Port's INS_RSP MAC frame. The Station takes one of the following actions:

a) If the Station receives an INS_RSP MAC frame with a response code of X'8020' (indicating the Station's address is detected as a duplicate address), then the Station does not remain attached to the DTR Concentrator, enters the Bypass State (JS=BP), and notifies the appropriate Management functions.
b) If the Station receives an INS_RSP MAC frame with a response code of X'0000' (indicating the Station's address is not detected as a duplicate address), then the Station enters the Join Complete state (JS=SJC).

The Station's DAC function is terminated by the occurrence of the following events:

— If the Station's timer TSJC expires prior to the reception of the C-Port's INS_RSP MAC frame, the Station enters the Bypass State (JS=BP) and notifies the appropriate Management functions.
— If the Station's timer TSRHB expires while the Station is in the DAC state (JS=SDAC), the Station enters the Bypass State (JS=BP) and notifies the appropriate Management functions.

9.1.7.2 C-Port support of DAC

The C-Port starts the DAC function during Registration and completes DAC when it receives the Station's INS_REQ MAC frame and a response from the DTU interface [DTU_DAC.response(RC)] by transmitting the Insert Response (INS_RSP) MAC frame. The C-Port takes one of the following actions:

a) The C-Port transmits an INS_RSP MAC frame with a response code of X'8020' if a duplicate address is detected, and terminates support of the Station by returning to the Bypass state (JS=BP).
b) The C-Port transmits an INS_RSP MAC frame with a response code of X'0000' if a duplicate address is not detected, and completes Join by entering the Join Complete TXI state (JS=PJCI).

9.1.8 TXI Transmit Function

The C-Port and Station TXI Transmit Functions operate as shown in Figure 9.1-5. This figure illustrates the TXI Transmit Functions allowing frames to be transmitted by: first, requiring the conditions to be met and second, allowing the selection of Transmit Immediate frames (TXI_REQ) for transmission *prior* to the transmission of any queued frames (QUE_PDU).

The C-Port and Station may support multiple transmit queues. If multiple queues are supported, the operation of these queues is not standardized, other than requiring the condition and selection capabilities.

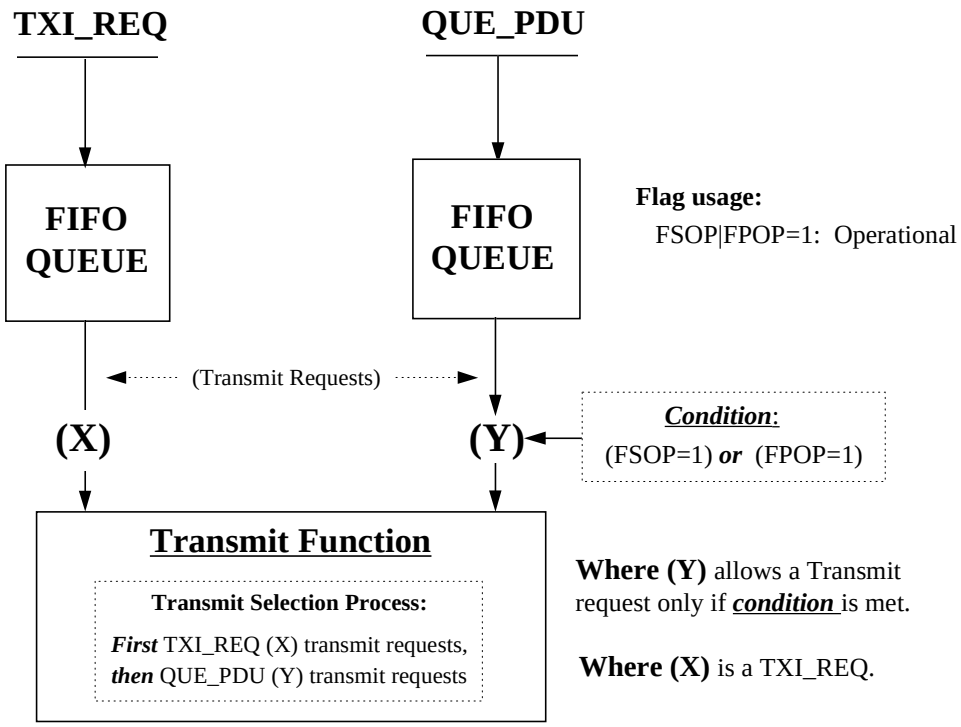

Figure 9.1-5 C-Port and Station Transmit Function

9.1.8.1 Station TXI Transmit Function

The Station's TXI Transmit function is supported by two states, Transmit Normal (TS=STXN) and Transmit Data (TS=STXD), as follows:

4 Mbit/s and 16 Mbit/s

Transmit Normal State (TS=STXN). This is the normal state for the Station's TXI Transmit Function. In this state, the Station is transmitting idles from either its crystal (FSTXC=1) or its recovered clock (FSTXC=0). The Join and Monitor Station Operation Tables control the setting of the Flag FSTXC.

If a transmit request is made, the Station honors the condition and selection scheme identified in 9.1.8 by providing the frame transmit sequence specified by 9.1.1.1, item 5, and entering the Transmit Data (TS=STXD) state.

Transmit Frame Data State (TS=STXD). This state is used by the Station or the C-Port in the Station Emulation Mode to transmit the frame's data. The data is transmitted until one of the following conditions is detected:

— The Station or the C-Port in the Station Emulation Mode has no more data to transmit (EOD reached). The Station or C-Port then releases the end-of-frame sequence (EFS) and returns to the Transmit Normal state (TS=STXN).
— The Station or the C-Port in the Station Emulation Mode detects a transmission error. The Station or C-Port then takes one of the actions defined under "Transmission Error" in 9.1.1.7.

High Media Rate

The Station's TXI Transmit Function always transmits idles (FSTI=1) and frame data (FSTI=0) using its crystal as the PHY's timing reference by setting the flag FSTXC=1 when the Join Station Operation Table exits the JS=BP state.

Transmit Normal State (TS=STXN). This is the normal state for the Station's TXI Transmit Function. In this state, the Station is transmitting idles.

If a transmit request is made, the Station honors the condition and selection scheme identified in 9.1.8 by providing the frame transmit sequence specified by 9.1.1.1, item 5, and entering the Transmit Data (TS=STXD) state.

Transmit Frame Data State (TS=STXD). This state is used by the Station or the C-Port in the Station Emulation Mode to transmit the frame's data. The data is transmitted until one of the following conditions is detected:

— The Station or the C-Port in the Station Emulation Mode has no more data to transmit (EOD reached). The Station or C-Port then releases the EFS and returns to the Transmit Normal state (TS=STXN).
— The Station or the C-Port in the Station Emulation Mode detects a transmission error. The Station or C-Port then takes one of the actions defined under "Transmission Error" in 9.1.1.7.

9.1.8.2 C-Port TXI Transmit Function

4 Mbit/s and 16 Mbit/s

The C-Port's TXI Transmit function is supported by three states: Transmit Normal (TS=PTXN), Transmit Frame Data (TS=PTXD), and Transmit Repeat (TS=PRPT).

Transmit Normal State (TS=PTXN). This is the normal state for the C-Port's TXI Transmit Function. During this state, the C-Port is transmitting idles (FPTI=1). The clock source is dependent on the state of the Join FSM as follows: prior to entering JS=PDAC, the clock source is recovered from the input signal (FPTXC=0); after entering JS=PDAC and in JS=PJCI, the clock source is its crystal (FPTXC=1).

When a transmit request is made (TXI_REQ or QUE_PDU) *and* a repeat request has not been made (FPRPT=0), the C-Port honors the condition and selection scheme identified in 9.1.8, turns off transmit idles (FPTI=0), transmits the appropriate starting frame sequence (see 9.1.1.1), and enters the Transmit Data state (TS=PTXD).

When a repeat request is made (FPRPT=1), the C-Port turns off crystal transmit (FPTXC=0) so its transmit signal is derived from the recovered clock, repeats received data (FPTI=0), and enters the Transmit Repeat state (TS=PRPT).

Transmit Frame Data State (TS=PTXD). This state is used by the C-Port to transmit frame data. The data is transmitted until one of the following conditions is detected:

— The C-Port detects it has no more data to be transmitted (EOD), releases the EFS, and returns to the Transmit Normal state (TS=PTXN).
— The C Port detects a transmission error and takes one of the actions defined under "Transmission Error" in 9.1.1.7.

Transmit Repeat (TS=PRPT). This state is used by the C-Port to provide a repeat path to support the Station's TXI LMT function defined in 9.1.6.

This repeat path, which is activated by the Transmit Normal state (TS=PTXN) detecting the flag FPRPT=1, is not required to examine data being repeated; however, the C-Port must receive any frame with a destination address equal to any of its addresses.

This repeat path is deactivated upon detection of the flag FPRPT being set to 0. The C-Port starts transmitting idles (FPTI=1), changes its clock source to its crystal (FPTXC=1) if FPOP=1, and returns to the Transmit Normal state (TS=PTXN).

The characteristics of the repeat path used by the C-Port are found in 9.7.

High Media Rate

The C-Port's TXI Transmit Function always transmits idles (FPTI=1) and frame data (FPTI=0) using its crystal as the PHY's timing reference by setting Flag FSTXC=1 when the Join Port Operation Table exits the JS=BP state. The C-Port's TXI Transmit function is supported by two states: Transmit Normal (TS=PTXN) and Transmit Frame Data (TS=PTXD).

Transmit Normal State (TS=PTXN). This is the normal state for the C-Port's TXI Transmit Function. During this state, the C-Port is transmitting idles (FPTI=1).

When a transmit request is made (TXI_REQ or QUE_PDU), the C-Port honors the condition and selection scheme identified in 9.1.8, turns off transmit idles (FPTI=0), transmits the appropriate starting frame sequence (see 9.1.1.1), and enters the Transmit Data state (TS=PTXD).

Transmit Frame Data State (TS=PTXD). This state is used by the C-Port to transmit frame data. The data is transmitted until one of the following conditions is detected:

— The C-Port detects it has no more data to be transmitted (EOD), releases the EFS, and returns to the Transmit Normal state (TS=PTXN).
— The C Port detects a transmission error and takes one of the actions defined under "Transmission Error" in 0.

Transmit Repeat (TS=PRPT). This state is used by the C-Port to provide a repeat path when FPRPTO=1 to support the Station's TXI LMT function defined in 9.1.6.

9.1.9 TXI Heart Beat

The TXI Heart Beat function is used to determine if the link between the C-Port and Station is operative as follows:

a) If the C-Port or Station detect the *presence* of the Heart Beat MAC frame, then they reset their respective Heart Beat timers (TPRHB or TSRHB) and the TXI Heart Beat function continues.
b) If the C-Port or Station detect the *absence* of the Heart Beat MAC frame by the expiration of their respective Heart Beat timers (TPRHB or TSRHB), then they take one of the following actions:
    1) If Join has been completed, they enter Hard Error Recovery (see 9.1.10);
    2) If Join has not been completed, they enter the Bypass state (JS=BP).

The TXI Heart Beat function is activated and deactivated by the Heart Beat Active flags, FPHBA and FSHBA, as follows:

— When the flags FPHBA=0 or FSHBA=0, the C-Port and Station TXI Heart Beat function is inactive.
— When the flags FPHBA=1 or FSHBA=1, the TXI Heart Beat function is active. The C-Port and the Station use their Queue Heart Beat timers (TPQBH or TSQHB) to pace the transmission of the C-Port Heart Beat MAC frames and Station Heart Beat MAC frames, respectively.

9.1.9.1 Station support of TXI Heart Beat

The Station's TXI Heart Beat function is activated by setting flag FSHBA to 1 when it detects the successful completion (TEST_OK) of its LMT and by entering its DAC state (JS=SDAC).

If the Station receives a C-Port Heart Beat MAC frame prior to the expiration of its Receive Heart Beat timer TSRHB, the Station resets TSRHB and the TXI Heart Beat function continues without interruption.

If the Station fails to receive a C-Port Heart Beat MAC frame before its Receive Heart Beat timer TSRHB expires (a TXI Heart Beat failure is detected), then the Station takes one of the following actions:

a) If Join is complete (FSJC=1), the Station disables the TXI Heart Beat function by setting flag FSHBA to 0 and enters Hard Error Recovery (MS=STBN).
b) If Join is not complete (FSJC=0), the Station enters its Bypass state (JS=BP) and notifies Management of the failure.

9.1.9.2 C-Port support of TXI Heart Beat

The C-Port's TXI Heart Beat function is activated by setting flag FPHBA to 1 when the C-Port detects the completion of the Station's LMT due to the reception of the Station's Insert Request (INS_REQ) MAC frame. This event causes the C-Port to enter its DAC state (JS=PDAC).

If the C-Port receives a Station Heart Beat MAC frame prior to the expiration of its Receive Heart Beat timer TPRHB, then the C-Port resets TPRHB and the TXI Heart Beat function continues without interruption.

If the C-Port fails to receive a Station Heart Beat MAC frame before its Receive Heart Beat timer TPRHB expires (a TXI Heart Beat failure is detected), then the C-Port takes one of the following actions:

a) If Join is complete (FPJC=1), then the C-Port disables the TXI Heart Beat function by setting flag FPHBA to 0 and enters Hard Error Recovery (MS=PTBN).
b) If Join is not complete (FPJC=0), then the C-Port enters its Bypass state (JS=BP) and notifies Management of the failure.

9.1.10 TXI Hard Error Recovery

Hard Error Recovery is a simple function used by the TXI Access Protocol to recover from a C-Port, Lobe, or Station failure that prevents communication between the Station and the C-Port. One of the major changes made to the Hard Error Recovery scheme for the TXI Access Protocol is to *always* require the C-Port and Station to execute the Station's LMT. This change eliminates the TKP Access Protocol's shortcoming of the Beacon Transmitter successfully completing Beacon Test, although the Lobe is operating at an unacceptable BER.

A Hard Error detected by the C-Port when Join has completed (FPJC=1) causes one of the following conditions to occur:

— The C-Port's TXI Heart Beat function fails, causing entry into the Beacon Transmit state (MS=PTBN).
— The C-Port receives a Beacon MAC frame while in its Operational State (MS=POPT), causing entry into the Port Internal Test state (MS=PIT).

A Hard Error detected by the Station when Join has completed (FSJC=1) causes one of the following conditions to occur:

— The Station's TXI Heart Beat function fails, causing entry into the Beacon Transmit state (MS=STBN).
— The Station receives a Beacon MAC frame while in its Operational State (MS=SOPT), causing entry into the Wire Fault Delay state (MS=SWFD).

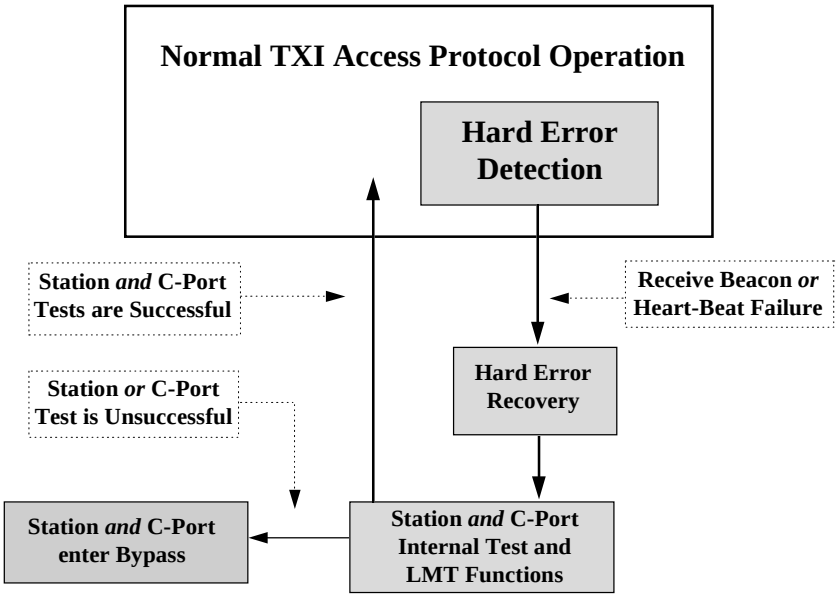

Figure 9.1-6—Hard Error Recovery

The TXI Hard Error Recovery scheme, illustrated in Figure 9.1-6, consists of the C-Port and Station Beacon Transmit states, the Station's Wire Fault Delay state, and the C-Port and Station Internal Test states. These states operate as follows:

9.1.10.1 Beacon Transmit State (MS=STBN or MS=PTBN)

A TXI Heart Beat function (see 9.1.9) failure causes the C-Port and Station to enter the Beacon Transmit state (MS=PTBN and MS=STBN, respectively) and transmit a Beacon MAC frame containing the reason for Beaconing (Beacon Type) and the address of its upstream entity (UNA). Once the Beacon Transmit State has been entered, the C-Port and Station always execute their Internal Tests as follows:

— When the C-Port enters the Beacon Transmit State, it resets the timer TPIT. Expiration of TPIT causes the C-Port to enter its Internal Test State (MS=PIT).
— When the Station enters the Beacon Transmit State, it resets the timer TSIT. Expiration of the timer TSIT causes the Station enter its Internal Test State (MS=SIT).

Hard Error Recovery relies on the Beacon MAC frame and its Beacon Type subvector. A failure of the TXI Heart Beat causes the C-Port and/or Station to transmit *each* Beacon MAC frame with the value of the Beacon Type subvector set according to the value of the flag, Signal Loss (FPSL or FSSL). It is possible at 4 Mbit/s and 16 Mbit/s for the C-Port and Station loss-of-signal functions to have different flag Signal Loss (FPSL or FSSL) values. The loss-of-signal function is not supported by the HMR; thus, flags FPSL and FSSL are always equal to 0.

The following is an explanation of each Beacon Type used in Beacon Transmit:

Beacon Type 2 (4 Mbit/s and 16 Mbit/s only). The C-Port and/or Station *have* detected the presence of a long-term loss-of-signal because flags FPSL and/or FSSL are equal to 1. A Beacon Type 2 example includes a break in the medium, causing the Station and/or C-Port to be unable to detect the appropriate signal at their receivers.

Beacon Type 5 (4 Mbit/s and 16 Mbit/s only). The C-Port and/or Station *have* detected a Heart Beat failure, but *have not* detected the presence of a long-term loss-of-signal because flags FPSL and/or FSSL are equal to 0. Beacon Type 5 may be caused by bit streaming (i.e., the data received does not correspond to expected protocol). A Beacon Type 5 example includes the continuous transmission of fill by the C-Port and/or Station.

Beacon Type 5 (HMR only). The C-Port and/or Station *have* detected a Heart Beat failure. Beacon Type 5 may be caused by bit streaming (i.e., the data received does not correspond to expected protocol). A Beacon Type 5 example includes the continuous transmission of fill by the C-Port and/or Station.

9.1.10.2 Station Wire Fault Delay State (MS=SWFD)

The Station's Wire Fault Delay state is entered when the Station receives a Beacon MAC frame with SA=SUA, indicating it is upstream from the fault. This delay allows the Station enough time to detect a Wire Fault condition that may be the cause of C-Port's Beaconing before attempting to continue with Hard Error Recovery.

Upon entry into the Wire Fault Delay State, the Station causes its timers, TSIT and TSLMT, to be reset. When the timer TSIT expires and the Station has not detected a Wire Fault condition, the Station continues Hard Error Recovery by entry into its Internal Test State (MS=SIT). The timer TSLMT is used by the Station to start execution of its Lobe Test (JS=SLT).

9.1.10.3 Internal Test States (MS=SIT or MS=PIT)

The Station's Internal Test state (MS=SIT) is entered when the timer TSIT expires. The C-Port's Internal Test state (MS=PIT) is entered when the timer TPIT expires, or when the C-Port receives a Beacon MAC frame (SA=SUA) while in the Operational state (MS=POPT) or the Beacon Transmit state (MS=PTBN). Internal testing begins on entry into the MS=PIT or MS=SIT states.

The exact requirements of the C-Port and Station Internal Tests are not specified by this standard. However, it is recommended that the Station and C-Port entities test as much of their internal circuitry as possible, because the Station or C-Port has determined that a fault condition exits. This prevents the Hard Error Recovery function from providing incorrect fault information to Management entities.

The C-Port and Station Internal Test states operate as follows:

a) If the C-Port or Station Internal Tests are unsuccessful, the failing entity removes itself from the TXI Lobe Connection and reports to its Management entity.

   It is possible for the C-Port to remove from the TXI Lobe connection without the knowledge of the Station, or for the Station to remove from the TXI Lobe connection without the knowledge of the C-Port. In order to diagnose the cause of such a failure, an external agent must coordinate the error reports from the C-Port and Station. The definition of the external agent is outside the scope of this standard.

b) If the C-Port and Station Internal Tests are successful, the Station and C-Port prepare their Join functions to execute the Station's LMT, as follows:

1) The Station waits for timer TSLMT to expire before causing the Station's Internal Test state to inform Join Machine to re-enter the Station's Lobe Test state (JS=SLT) by setting FSBNT to 1 (see 9.1.6.1).

2) When operating at any media rate and Phantom detection is supported, the C-Port waits for the loss of Phantom Drive (FPINSD=0) before enabling its Repeat Path (see 9.7.1) by setting FPRPT to 1, and informs its Join Machine to re-enter the C-Port's Lobe Test state (JS=PLT) by setting FPBNT to 1 (see 9.3.3.2).

3) When operating at the HMR and Phantom detection is not supported, the C-Port performs the following actions upon reception of a LMT Notification frame from the Station. It transmits a LMT Notification frame if its PMAC repeat path is being supported (FPRPTO=0). It informs its Join Machine to re-enter the C-Port's Lobe Test state (JS=PLT) by setting FPBNT to 1 (see 9.3.3.2).

9.1.11 TXI Soft Error Reporting

When a C-Port or Station detects a soft error condition (e.g., a FCS error), it increments the appropriate Error Counter (see 10.6). The expiration of TSER or TPER causes the value of the Error Counters to be reported using the Station's Error Report MAC frame or the C-Port's MRI. The Error Counters are reset after they have been reported. Persistent errors can be detected and isolated and, if required, the necessary action can be taken by Management.

9.1.12 TXI Configuration Control

As part of the function of maintaining the network configuration, the CRS can alter the configuration of the network by requesting DTR Stations or C-Ports to remove themselves from the network. The CRS can also query DTR Stations or C-Ports for various status information and can configure the DTR Station, and optionally the DTR C-Port, using the Change Parameters MAC frame.

9.1.13 DTR Service Interfaces

Subclauses 9.1.13.1 through 9.1.13.2 define the Service Interfaces supported by the Station's SMAC and the C-Port's PMAC.

9.1.13.1 TXI SMAC Service Interfaces

The LLC, Bridge, and Management interfaces are specified to provide the service required by other standards. These interfaces serve to specify operation and do not imply any particular implementation.

9.1.13.1.1 Service to LLC

Upon receipt of an MA_UNITDATA.request primitive from the local LLC entity, the SMAC shall compose a frame using the parameters supplied to create the FC, DA, SA, RI (if present), and INFO (user data) fields and calculate the FCS field. The RII bit shall be set to 1 if, and only if, routing information is present. The value of the YYY bits shall be either the value of the User_priority parameter (recommended) or optionally set to B'000'. The frame is then queued for transmission. If the Destination_address parameter matches the Station's individual address, one of the Station's group addresses, an active functional address, or one of the broadcast addresses, then an MA_UNITDATA.indication is made to the local LLC entity.

An MA_UNITDATA.indication is made to the local LLC entity when a valid LLC frame is received with a DA that matches any of the following:

— The Station's individual address;
— One of the Station's group addresses;

— An active functional address;
— One of the Station's broadcast addresses.

The value of the User_priority parameter shall be equal to the value of the YYY bits in the FC field.

9.1.13.1.2 Service to the Bridge

Upon receipt of an M_UNITDATA.request primitive from the local bridge entity, the SMAC shall compose a frame using the parameters supplied to create the FC, DA, SA, RI (if present), INFO (user data), and FCS fields. The RII bit shall be set to 1 if, and only if, the Routing Information Field is present. The Access_priority parameter is not used, and the User_priority parameter is encoded in the YYY bits of the FC field. If the FCS parameter is not specified, then the Station calculates the FCS value. The frame is then queued for transmission. If the Destination_address parameter matches the Station's individual address, one of the Station's group addresses, an active functional address, or one of the broadcast addresses, then an MA_UNITDATA.indication is made to the local LLC entity.

When a valid frame is received (independent of any address match), an M_UNITDATA.indication is made to the bridge entity. If the frame type is LLC, then the value for the User_priority parameter shall be the value of the YYY bits in the FC field; otherwise, the value for the User_priority parameter is unspecified.

9.1.13.1.3 Service to Management

Upon receipt of an MGT_UNITDATA.request primitive from the local management entity, the SMAC shall compose a MAC frame using the parameters supplied to create the FC, DA, SA, RI (if present), and INFO (vector) fields and calculate the FCS field. The RII bit shall be set to 1 if, and only if, the Routing Information Field is present. The frame is then queued for transmission.

If a valid MAC frame with a non-zero destination class is received with a DA that matches the Station's individual address, one of the group addresses, an active functional address, or one of the broadcast addresses, then an MGT_UNITDATA.indication is made to the local management entity.

9.1.13.2 PMAC Service Interfaces

The DTU and MRI interfaces are specified to provide the service required by the DTR Concentrator. These interfaces serve to specify operation and do not imply any particular implementation.

9.1.13.2.1 Service to the MRI

Upon receipt of an MRI_UNITDATA.request primitive from the MRI, the PMAC shall compose a MAC frame using the parameters supplied to create the FC, DA, SA, RI (if present), and INFO fields. The PMAC calculates the FCS field only if it is not present. The requested access priority (Pm) of the frame, defined only when the PMAC is operating the TKP Access Protocol, is specified as either 0, 3, or 7. The frame is then queued for transmission.

When a valid MAC frame is received (independent of any address match) where the destination class is neither 0 nor 3, then an MRI_UNITDATA.indication is made to the MRI.

9.1.13.2.2 Service to the DTU

Upon receipt of a DTU_UNITDATA.request primitive from the DTU, the PMAC shall compose a frame using the parameters supplied to create the FC, DA, SA, RI (if present), and INFO fields. The PMAC calculates the FCS field only if it is not present. The requested access priority (Pm) of the frame, defined only when the PMAC is operating the TKP Access Protocol, should be the greater of 4 or the User_priority, if the Frame_type parameter indicates user_data. The frame is then queued for transmission.

When a valid frame is received, independent of any address match, a DTU_UNITDATA.indication is made to the DTU. If the frame type is LLC, then the value for the User_priority parameter shall be the value of the YYY bits in the FC field; otherwise, the value of the User_priority parameter is unspecified.

During TXI Registration, when a valid Registration Request MAC frame is received, a DTU_DAC.request is made to the DTU. The Station_address parameter is the SA of the received frame. The Individual_address_count (IAC) parameter is the value of the IAC subvector from the received frame. Flag FPDTUREQ is set to 1, indicating there is an outstanding DTU_DAC.request that requires a response.

Upon receipt of a DTU_DAC.response primitive from the DTU, the PMAC shall store the result in SDAC_RC, and flag FPDTUREQ, which was set to 1 to indicate an outstanding DTU_DAC.request required a response, is set to 0. The SDAC_RC is used to compose an Insert Response MAC frame when the C-Port Join Port Operation Table is in the DAC state (JS=PDAC) in response to an Insert Request MAC frame.

9.1.14 HMR Trade-up Protocol

The HMR Trade-up protocol is used *only* by a Station that is registering to operate at 4 Mbit/s or 16 Mbit/s, but has been given permission to trade up to the HMR via the Policy flag FSHMRTUO (=1). During Registration, the Station indicates to the C-Port that it wants to use the TXI Access Protocol and that it is capable and, with permission, will support 100 Mbit/s (using the AP_REQ subvector value of X'0006').

If the C-Port *does not* support the HMR as requested by the Station, then the C-Port responds with a Registration Response MAC frame AP_RSP subvector value of X'0000' (registration failure) or X'0002' (registration complete). When the AP_RSP is X'0002', the C-Port and Station do not start the Trade-up function, but rather operate at the media speed originally requested by the Station. When the AP_RSP is X'0000', the Station will attempt another Registration Request, without indication that it can support 100 Mbit/s.

If the C-Port *does* support the HMR, then the C-Port responds with a Registration Response MAC frame AP_RSP subvector value of X'0004' (indicating the C-Port supports the HMR) and both the C-Port and Station start the Trade-up function.

9.1.14.1 Station support of the HMR Trade-up function

The Station, upon receipt of a Registration Response MAC frame with an AP_RSP subvector value of X'0004', starts the Trade-up function by entering the HMR Trade-up state (JS=SHMRTU), activating the HMR link speed, and resetting the timer TSHMRW.

If TSHMRW expires *before* the PS_STATUS.indication(Link_status=Asserted) signal occurs, then the HMR link failed to operate; the Station then enters the Bypass state (JS=BP) and provides management with an indication that the HMR request failed (an indication that the setting of the Policy flag FSHMRTUO needs to be changed by management).

If the PS_STATUS.indication(Link_status=Asserted) signal occurs *before* timer TSHMRW expires, then the C-Port and Station can operate at the HMR. The Station restarts the registration process at the HMR using the TXI Access Protocol.

9.1.14.2 C-Port support of the HMR Trade-up function

The C-Port, upon receipt of a Registration Request MAC frame with a AP_REQ subvector value of X'0006', determines whether it is able to support the HMR request.

If the C-Port *does not* support the HMR (FPHMRTUO=0), then the C-Port responds with a Registration Response MAC frame with an AP_RSP subvector value of X'0002', indicating that the C-Port and Station will continue to operate at the media speed originally requested by management.

If the C-Port *does* support the HMR (FPHMRTUO=1), then the C-Port responds with a Registration Response MAC frame with an AP_RSP subvector value of X'0004', indicating that the C-Port and Station will attempt operating at the HMR. The C-Port starts the Trade-up function by entering the HMR Trade-up state (JS=PHMRTU) and starting the assured delivery timer TPTUAD and the Trade-up timeout timer TPHMRW.

— If another Registration Request MAC frame is received by the C-Port from the Station *before* TPTUAD expires, then the C-Port transmits another Registration Request MAC frame.
— When TPTUAD expires, the C-Port activates the HMR link.
— If TPHMRW expires *before* the PS_STATUS.indication(Link_status=Asserted) signal occurs, then the HMR link failed to operate; the C-Port enters the Bypass state (JS=BP) and provides management with an indication that the HMR request failed (an indication that the setting of the Policy flag FPHMRTUO needs to be changed by management).
— If the PS_STATUS.indication(Link_status=Asserted) signal occurs *before* timer TPHMRW expires, then the C-Port and Station can operate at the HMR. The C-Port enters the Registration state and waits for the Station to request operation at the HMR using the TXI Access Protocol.

9.1.15 Remove Alert Protocol (TXI Access Protocol at the HMR only)

The Remove Alert function allows either the C-Port to inform the Station or the Station to inform the C-Port that an unexpected condition has been detected forcing its entry into the Bypass state. The intention of the Remove Alert function is to allow local management (either C-Port or Station) to understand that the entity on the other end of the link has stopped participating in the TXI Access Protocol and prevent false error conditions from being reported.

The following explains when the Remove Alert function is required, the actions taken when the Remove Alert function is executed, and the actions taken when the Remove Alert MAC frame is received.

a) The following events shall execute the Remove Alert function:
   1) When the C-Port or Station have completed Join (FPJC=1 and FSJC=1 respectively) *and* are in their Lobe Test, DAC, or Join Complete states and
      i) The Station detects a Disconnect.SMAC;
      ii) The C-Port detects a Disconnect.PMAC; or
      iii) The Station receives a Remove MAC frame.
   2) When the C-Port or Station have completed Join (FPJC=1 and FSJC=1 respectively) *and* are in the Join Complete state and
      i) The C-Port detects the expiration of its timer TPPLD (failure to detect the expected Phantom loss or the reception of the LMT Notification MAC frame in the appropriate time);
      ii) The C-Port detects the expiration of its timer TPPD (failure to detect the expected Phantom presence in the appropriate time); or
      iii) The Station detects a Wire Fault condition.
   3) When the Station detects a LMT failure and the Station has completed Join (FSJC=1) *and* is in the Lobe Test state.
b) The following actions shall occur when the Remove Alert function is executed:
   1) If the Station or C-Port is in the Join Complete state, the operational flag (FPOP or FSOP) is set to 0 to prevent transmission of upper layer frames.

2) In the Station, if phantom is asserted, then de-assert phantom.
3) The Remove Alert Transmit counter (CPRAT or CSRAT) is set to its initial value and the Remove Alert Pacing timer (TPRAP or TSRAP) is reset.
4) The Remove Alert MAC frame is transmitted.
5) The Remove Alert Wait state is entered (JS=PRAW or JS=SRAW) to disable all Join functions except the Remove Alert function. The following actions occur while in the Remove Alert Wait state:
   i) Upon expiration of the Remove Alert Pacing timer and when the Remove Alert Transmit counter is *non-zero*, the Remove Alert counter is decremented, the Remove Alert Pacing timer is reset, and the Remove Alert MAC frame is transmitted. The C-Port or Station remain in their respective Remove Alert Wait states waiting for expiration of the Remove Alert Pacing timer.
   ii) Upon expiration of the Remove Alert Pacing timer and when the Remove Alert Transmit counter is *zero*, the C-Port or Station enter their respective Bypass states.

c) The Remove Alert MAC frame shall be recognized as follows:

   The Remove Alert MAC frame causes entry into the Bypass state whenever the C-Port or Station have completed Join (FPJC=1 and FSJC=1 respectively) *and* are in their Lobe Test, DAC, or Join Complete states.

9.1.16 C-Port in Port Mode using the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

This subclause identifies the changes required in 4.3 to support the C-Port in Port Mode using the TKP Access Protocol [Configuration 3, entity (E)] to provide for the attachment of the following:

— The Classic Station [Configuration 3, entity (F)].
— The DTR Station using the TKP Access Protocol [Configuration 3, entity (F)].
— The C-Port in Station Emulation Mode using the TKP Access Protocol [Configuration 3, entity (F)].

These changes are specified in 9.4 and summarized as follows:

a) In the TKP Access Protocol, the Station's Beacon Test state (MS=BNT) normally indicates the Station should perform Hard Error Recovery. The C-Port is not allowed to execute the Beacon Test function, but in its place provides a repeat path to allow the attached Station to perform its Beacon Test function.
b) Soft Error conditions cause the C-Port to report these errors to the MRI.
c) The detection of the interface signal PM_STATUS.indication(INSERT=DETECTED) is the equivalent of the ANSI/IEEE Std 802.5, 1998 Edition, Beacon Test "TEST_OK" condition. This signal allows the C-Port in Port Mode using the TKP Access Protocol to return to the state causing entry into the Beacon Test state (MS=BNT) [either the Repeat Beacon state (MS=RBN) or the Transmit Beacon state (MS=TBN)].
d) The detection of the attached Station's failure to return to its Repeat Beacon state (MS=RBN) or the Transmit Beacon state (MS=TBN) indicating the Station has failed either its internal tests or LMT.

9.1.17 C-Port in Station Emulation Mode using the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

This subclause identifies the changes required in 4.3 to support the C-Port in Station Emulation Mode using the TKP Access Protocol [Configuration 4, entity (G)]. These changes allow the following attachments:

— The Classic Concentrator [Configuration 4, entity (H)].
— The C-Port in Port Mode using the TKP Access Protocol [Configuration 4, entity (H)].

These changes are specified in 9.5 and summarized as follows:

— The queuing transmission of frames with an unknown length (FR_LTH=UNK) is supported by adding a check which prevents the Transmit Data state (TS=DATA) from transmitting frames longer than allowed by PPV(MAX_TX).
— The handling of Soft Error conditions is augmented by causing the C-Port in DTR Station Emulation Mode to report these errors to the MRI.

9.1.18 DTR Station using the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

A DTR Station using the TKP Access Protocol [Configuration 3, entity (F)] is defined by reference to Clause 3 and Clause 4, and modified by 9.6. In summary, when the DTR Station elects to use the TKP Access Protocol, the DTR Station transitions are specified in 9.6. These transitions are identical to the Classic Station, except for the addition of the Registration Query Protocol. The Registration Query protocol allows the C-Port to invite the DTR Station to change to the TXI Access Protocol if supported.

Replace 9.2 with the following:

9.2 Station TXI Access Protocol specification

This subclause defines the TXI Access Protocol as follows:

— The DTR Station (FIPTXIS=0) in support of Configuration 1, entity (B).
— The DTR C-Port in the Station Emulation Mode (FIPTXIS=1) in support of Configuration 2, entity (C).

The decision as to which configuration is being supported is made as follows:

— The DTR Station's Join Station Operation Table (Table 9.2-1 in this subclause); or
— The DTR C-Port's Join Port Operation Table (Table 9.3-1 in 9.3).

For ease of reading, the DTR Station and the DTR C-Port in the Station Emulation Mode are referred to as the "Station" in the explanatory portion of this subclause.

Seven Station Operation Tables specify Station support of the TXI Access Protocol as follows:

— Station Join Station Operation Table 9.2-1;
— Station Transmit Station Operation Table 9.2-2;
— Station Monitor Station Operation Table 9.2-3;
— Station Error Handling Station Operation Table 9.2-4;
— Station Interface Signals Station Operation Table 9.2-5;
— Station Miscellaneous Frame Handling Station Operation Table 9.2-6;
— Station LMT when FSLMTO=1 Station Operation Table 9.2-7.

Low-Level FSMs representing the state changes in the Join, Transmit, and Monitor Station Operation Tables are presented in Annex L.

In case of a discrepancy between the Station Operation Tables, the FSM diagrams, or their supporting text, the Station Operation Tables shall take precedence.

9.2.1 FSM overviews

This subclause provides a functional overview of the Join, Transmit, and Monitor Station Operation Tables using three high-level FSM diagrams.

9.2.1.1 Station Join FSM overview

The Station Join FSM, shown in Figure 9.2-1, is used to join the Station in the TXI Access Protocol to the C-Port. Station Operation Table 9.2-1 specifies the Join FSM.

The Station Join FSM enters the Registration state (JA) from one of the following:

— The Bypass state (J0) as the result of this subclause detecting a Connect.SMAC to start the Station's TXI Access Protocol;
— The Bypass state (J0) as the result of 9.3 entering the C-Port in Station Emulation Mode using the TXI Access Protocol; or
— The Registration Wait state (J9) as the result of the 9.5 or 9.6 Station Operation Tables using the TKP Access Protocol responding to a Registration Query request from the C-Port.

The activation of the TXI Access Protocol is the result of the Registration Process and uses the Station Operation Tables specified in this subclause.

The TKP Access Protocol is activated as the result of the Registration Process as follows:

— For the DTR Station, via an exit to the 9.6 Station Operation Tables;
— For the C-Port in Station Emulation Mode, via an exit to the 9.5 Port Operation Tables.

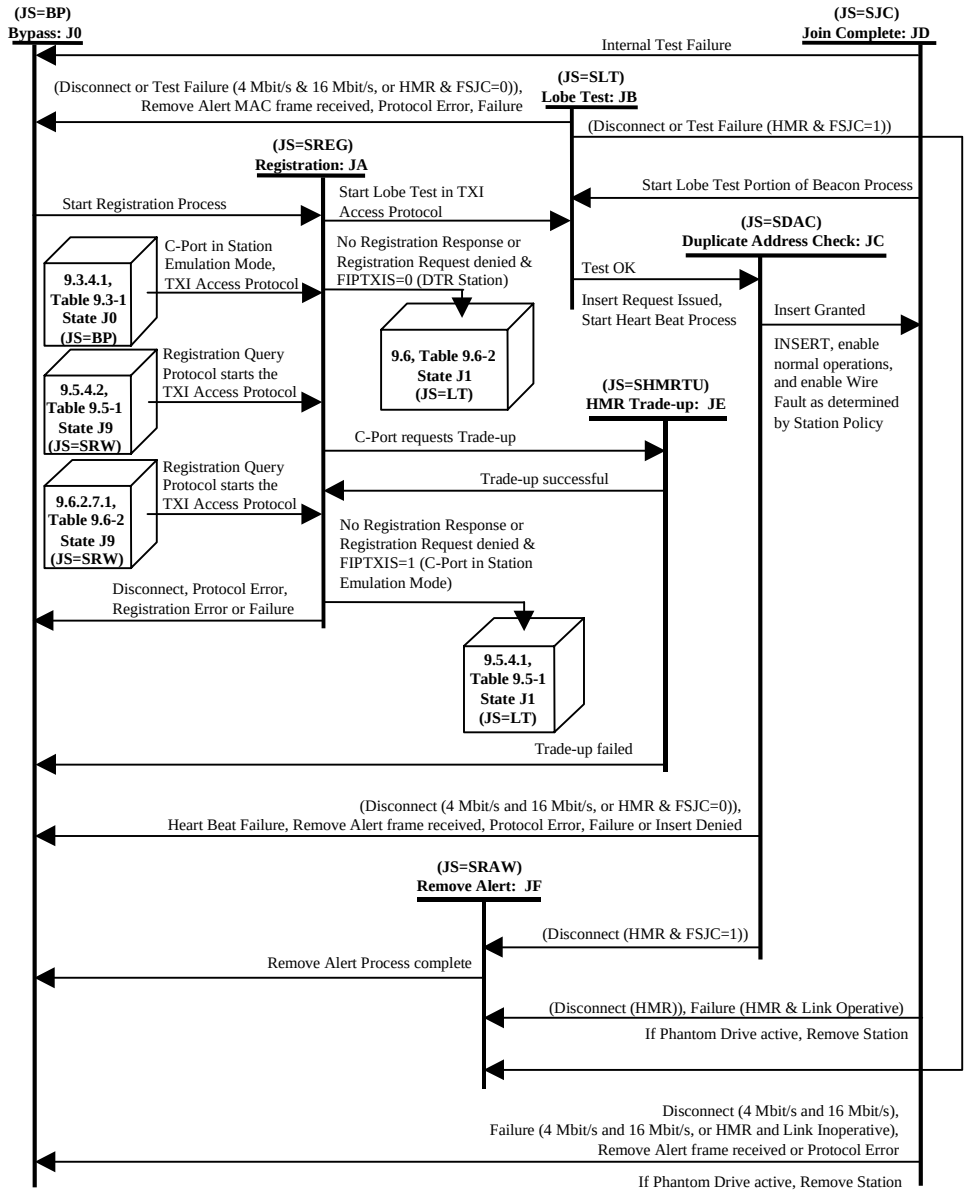

Figure 9.2-1—Station Join FSM overview

9.2.1.2 Station Transmit FSM overview

The Station Transmit FSM, shown in Figure 9.2-2, is used to transmit frames using the TXI Access Protocol. Station Operation Table 9.2-2 specifies this Transmit FSM.

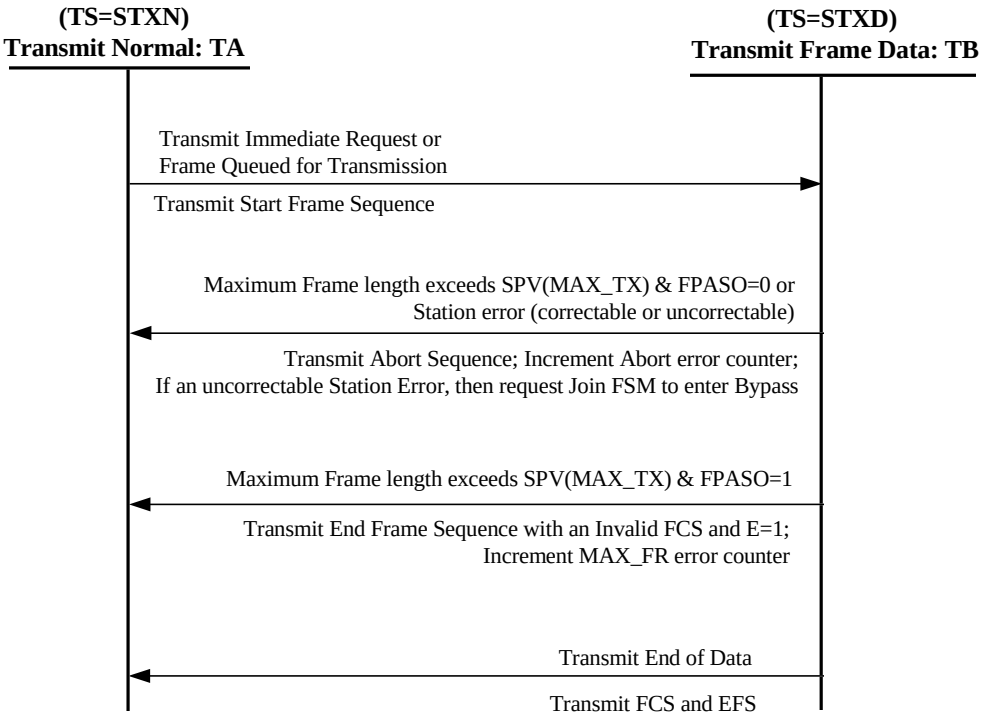

Figure 9.2-2—Station Transmit FSM overview

9.2.1.3 Station Monitor FSM overview

The Station Monitor FSM, shown in Figure 9.2-1, supports the Heart Beat and Hard Error Recovery functions. Station Operation Table 9.2-3 specifies the Monitor FSM.

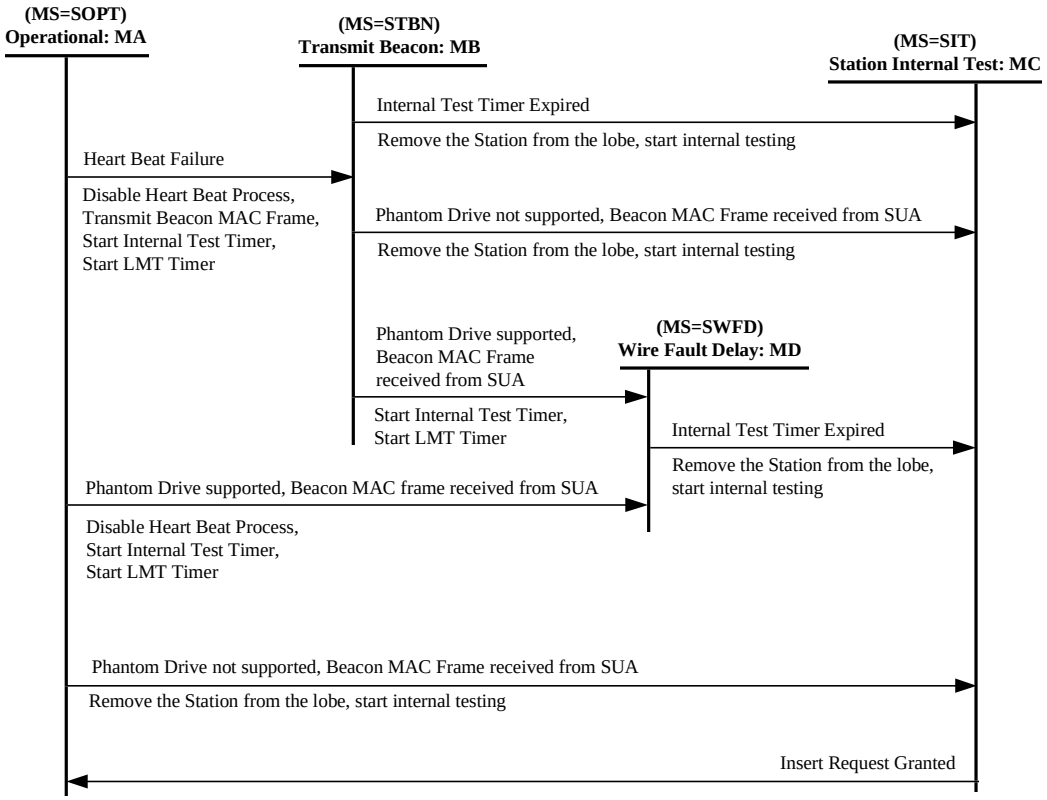

Figure 9.2-3—Station Monitor FSM overview

9.2.2 Specification—abbreviations and notations

The following abbreviations and notations are used in the Station Operation Tables.

PMAC Policy Flag Notations

FPASO = Flag, C-Port abort sequence option

FPMRO = Flag, C-Port media rate option

PMAC Protocol Flag Notations

FPTX_LTH = Flag, C-Port transmit length

FPMR = Flag, C-Port media rate

SMAC C-Port Interface Flag Notations

FIPTKPS = Flag, Interface C-Port TKP Station Emulation

FIPTXIS = Flag, Interface C-Port TXI Station Emulation

SMAC Policy Flag Notations

FSANO = Flag, Station auto-negotiation option

FSASO = Flag, Station abort sequence option

FSECO = Flag, Station error counting option

FSHMRTUO = Flag, Station HMR Trade-up option

FSLMTO = Flag, Station LMT option

FSMRO = Flag, Station medium rate option

FSOPO = Flag, Station open option

FSRDO = Flag, Station registration denied option

FSREGO = Flag, Station registration option

FSRRO = Flag, Station reject remove option

SMAC Stored Value Notation

SUA = Stored upstream address

SMAC Station Policy Variables Notations

SPV(AP_MASK) = Access Protocol Mask Station Policy Variable

SPV(IAC) = Individual address count Station Policy Variable

SPV(MAX_TX) = Maximum octets transmit count Station Policy Variable

SPV(PD) = Phantom Drive Station Policy Variable

SMAC Transmit State Notations

TS=STXD : Station Transmit Frame Data

TS=STXN : Station Transmit Normal

SMAC Station Counters

CSBTX = Counter, station byte transmitted

CSREQ = Counter, station registration request

CSTFQ = Counter, station TXI frames queued

CSLTF = Counter, Station lobe test frames

CSRAT = Counter, Station remove alert transmit

SMAC Error Counter Notations

CSABE = Counter, Station abort error

CSBE = Counter, Station burst error

CSFE = Counter, Station frequency error

CSIE = Counter, Station internal error

CSLE = Counter, Station line error

CSRCE = Counter, Station receive congestion error

SMAC Join State Notations

JS=BP : Bypass

JS=SDAC : Station DAC

JS=SHMRTU : Station HMR Trade-up

JS=SJC : Station Join Complete

JS=SLT : Station Lobe Test

JS=SRAW : Station Remove Alert wait

JS=SREG : Station Registration

SMAC Monitor State Notations

MS=SIT : Station Internal Test

MS=SOPT : Station Operational

MS=STBN : Station Transmit Beacon

MS=SWFD : Station Wire Fault Delay

SMAC Protocol Flag Notations

FSBNT = Flag, Station beacon test

FSBPF = Flag, Station bypass force

FSER = Flag, Station error report

FSHBA = Flag, Station heart beat active

SMAC Protocol Flag Notations *(continued)*

FSHMRTUA = Flag, Station HMR Trade-up active

FSIRD = Flag, Station insert request delay

FSJC = Flag, Station join process complete

FSLMTF = Flag, Station LMT failure

FSLMTS = Flag, Station LMT success

FSMR = Flag, Station media rate

FSRLMT = Flag, Station request LMT

FSLTA = Flag, Station lobe test active

FSLTFE= Flag, Station lobe test frame error

FSOP = Flag, Station operational

FSPDC = Flag, Station phantom drive control

FSPDA = Flag, Station phantom drive active

FSRC = Flag, Station registration complete

FSRRC = Flag, Station return to recovered clock

FSSL = Flag, Station signal loss

FSSLD = Flag, Station signal loss detected

FSSLMT = Flag, Station start LMT

FSTAS = Flag, Station Transmit Abort Sequence

FSTI = Flag, Station transmit idles

FSTXC = Flag, Station transmit from crystal

FSWF = Flag, Station wire fault

FSWFA = Flag, Station wire fault active

FTI = Flag, Transmit Idles (from Clause 4)

SMAC Station Timer Notations

TSHMRW = Timer, Station HMR wait

TSER = Timer, Station error report

TSIP = Timer, Station insert process

TSIS = Timer, Station initial sequence

TSIT = Timer, Station internal test

TSJC = Timer, Station join complete

TSLMT = Timer, Station LMT

TSLMTNP = Timer, Station LMT notification pacing

TSLMTP = Timer, Station LMT pacing

TSLMTR = Timer, Station LMT response

TSLMTC = Timer, Station LMT complete

TSLMTD = Timer, Station LMT delay

TSQHB = Timer, Station queue heart beat

TSQP = Timer, Station queue PDU

TSRAP = Timer, Station remove alert pacing

TSREQ = Timer, Station registration request

TSRHB = Timer, Station receive heart beat

TSSL = Timer, Station signal loss

TSWF = Timer, Station wire fault

TSWFD = Timer, Station wire fault delay

9.2.3 State machine elements

The state machines use the Error Counters defined in 10.6, as well as the following counters, flags, and states to describe the operation of the Station. These are logical elements used solely to describe the operation and do not specify an implementation. The value of the flags and counters are only meaningful to the Station Operation Tables. Conformance to this standard is based only on externally observable behavior.

9.2.3.1 SMAC counters

Unless otherwise specified, all counters are set to 0 by the "Set_initial_conditions" action.

A counter may be set to a value, counted up (increment), or counted down (decrement) as a result of an action specified in the Station Operation Table.

Counter, Station byte transmitted (CSBTX)

The counter CSBTX is used by the Transmit FSM to limit the number of octets that can be transmitted. This counter shall be used when the C-Port in Station Emulation Mode (Interface Flags FIPTKPS=1 or FIPTXIS=1) is supporting the FR_LTH=UNK (frame length unknown) condition. The counter CSBTX is optional if the Station does not support FR_LTH=UNK.

The counter CSBTX is compared against SPV(MAX_TX) and the Station takes one of the following actions:

— If CSBTX>SPV(MAX_TX), then the frame being transmitted is larger than allowed by SPV(MAX_TX) and the frame is aborted using an Abort Sequence.
— If CSBTX<=SPV(MAX_TX), the transmission of the frame continues.

The value of SPV(MAX_TX) is specified in 10.5.1.2 when operating at 4 Mbit/s or 16 Mbit/s, and 14.5.1.2 when operating at 100 Mbit/s.

Counter, Station Lobe Test frames (CSLTF)

The counter CSLTF is used when FSLMTO=1 to count the number of frames to be transmitted as described in 9.1.6. Its initial value is specified in 9.2.5 as "n7."

Counter, Station Remove Alert Transmit (CSRAT), HMR only

The counter CSRAT is used when supporting the HMR (FSMR>1) to determine the number of Remove Alert MAC Frames yet to be transmitted. Its initial value is specified in 9.2.5 as "n8."

Counter, Station Registration Request (CSREQ)

The counter CSREQ is used to control the number of times the REG_REQ MAC frame will be retransmitted (an assured delivery process) before Registration fails. The Station sets counter CSREQ=n6 (see 9.2.5) when the first REG_REQ MAC frame is transmitted. Each time the Station retransmits the REG_REQ MAC frame, it decrements counter CSREQ by one.

When the counter CSREQ=0, the Station has not received a response to its REG_REQ MAC frame and takes one of the following actions:

— If the flag FSOPO=0, the Station supports the TKP Access Protocol and enters the Lobe Test state (JS=LT) of the TKP Access Protocol Join FSM defined by 4.3.

— If the flag FSOPO=1, the Station does not support the TKP Access Protocol; it enters the Bypass state (JS=BP) and notifies management of the error.

Counter, Station TXI frames queued (CSTFQ), 4 Mbit/s and 16 Mbit/s only

The counter CSTFQ is used by the Join FSM during JS=SDAC to track the number of frames currently in the TXI_REQ transmit queue (see 9.1.8). During JS=SDAC, this counter is incremented when a Station Heartbeat (TXI_SHB) or Insert Request (TXI_INS_REQ) is added to the TXI_REQ transmit queue. CSTFQ is decremented by the Transmit FSM when the Join FSM state is JS=SDAC and an EOD, a PORT_ERR(correctable), or a STATION_ERR(correctable) event is detected. CSTFQ is set to 1 when the Join FSM enters JS=SDAC.

9.2.3.2 Station protocol flags

The following Station protocol flags, listed alphabetically, are defined.

Flag, Station Beacon Test (FSBNT)

The flag FSBNT is used by the Monitor machine to signal the Join Machine to enter the Lobe Test (JS=SLT) state and perform the LMT function specified in 9.1.6 as part of the Hard Error Recovery Process. The flag is set to 1 by the Monitor machine when TSLMT has expired. The flag is set to 0 by the Join Machine when entering the Lobe Test state (JS=SLT).

Flag, Station Bypass Force (FSBPF)

When the Transmit Data state (TS=STXD) detects a "STATION_ERR(not_correctable)" condition, an Abort Sequence is optionally transmitted and the flag FSBPF is set to 1. The Join Machine enters the Bypass state (JS=BP) upon detecting flag FSBPF=1 and TS=STXN.

Flag, Station Error Report (FSER)

The flag FSER is set to 1 when the first reportable error is detected and indicates that subsequent errors should not reset the error timer TSER. Flag FSER is set to 0 when the error timer expires and the Report Error MAC frame is transmitted.

Flag, Station Heart Beat Active (FSHBA)

Flag FSHBA is set to 1 to activate the Heart Beat process and set to 0 to deactivate the Heart Beat Process. Flag FSHBA is set to 1 when the Station enters the DAC state (JS=SDAC). While flag FSHBA is set to 1, Loss of Heart Beat can be detected and Hard Error Recovery started. Flag FSHBA is set to 0 to deactivate the Heart Beat Process when the Monitor exits the Operational state (MS=SOPT) to enter either the Beacon Transmit state (MS=STBN) or the Wire Fault Delay state (MS=SWFD).

Flag, Station HMR Trade-up Active (FSHMRTUA), 4 Mbit/s and 16 Mbit/s only

The flag FSHMRTUA is set to 1 when the Station has an outstanding HMR Trade-up registration request. It is used to allow the Station to retry registration without the HMR Trade-up option, after the C-Port has rejected the request.

Flag, Station Insert Request Delay (FSIRD), 4 Mbit/s and 16 Mbit/s only

The flag FSIRD is used by the Station in the DAC state (JS=SDAC) to delay changing from recovered clock to crystal clock as the result of expiration of the timer, Station Insert Process (TSIP). The Station in the JS=SDAC state normally uses recovered clock; however, when expiration of the timer TSIP occurs, the

Station is required to transmit the Insert Request MAC frame using crystal clock, and the Station sets FSIRD=1. When the transmit machine enters the Transmit Normal state (TS=TSXN) and FSIRD=1, the Station sets FSIRD=0, activates crystal clock, and transmits the Insert Request MAC frame.

Flag, Station Join Complete (FSJC)

The flag FSJC indicates whether the Station has completed Join with FSJC=0, meaning Join is not complete, and FSJC=1, meaning Join is complete. FSJC is set to 1 upon successful completion of the Station's DAC (JS=SDAC). When FSJC=1, the Station is allowed, for example, to queue frames for transmission, and to activate the Hard Error Recovery and Error Counter functions.

Flag, Station LMT Failure (FSLMTF)

The flag FSLMTF is used to indicate that the Station has detected a LMT failure. Flag FSLMTF is set to 1 when the Station detects a failure of either the LMT Notification Stage or the LMT Testing Stage and causes the Station to enter the Bypass state. The flag FSLMTF is set to 0 by the Set_initial_conditions action, but the value of 0 is not used.

Flag, Station LMT Success (FSLMTS)

The flag FSLMTS is used to indicate the success of the Station's LMT. Flag FSLMTS is set to 1 when the Station detects the successful completion of the LMT Testing Stage. FSLMTS is set to 0 when the Station transmits its INS_REQ MAC frame.

Flag, Station Lobe Test Active (FSLTA)

The flag FSLTA is used to indicate that the Station's LMT function described in 9.1.6.2 is active. This flag is set to 1 when the Station starts the LMT function specified in Station Operation Table 9.2-7. This flag is set to 0 when the Station successfully exits the LMT state (JS=SLT).

Flag, Station Lobe Test Frame Error (FSLTFE).

The flag FSLTFE is used to indicate that the Station has detected a LMT error. Flag FSLTFE is set to 1 when the Station detects an error within its LMT frame, or if it fails to receive its LMT frame. If an error is detected while FSLTFE is set to 1 (indicating more than 1 LMT error), the station indicates LMT Testing Stage failure.

Flag, Station Media Rate (FSMR)

The flag FSMR is used to control the operation of the Station Operation Tables as it relates to the operational speed of the media. It has the same definition as the FSMRO flag defined in 14.5.1.1.4, except it is set as needed by the Station Operation Tables.

Flag, Station Operational (FSOP)

The flag FSOP indicates when the Station is operational. Flag FSOP is set to 1 when the Station enters Join Complete (JS=SJC) and becomes active in the network. Flag FSOP is set to 0 when the Station closes (JS=BP). FSOP is set to 0 when the Station enters the Hard Error Recovery Process, and set to 1 when the Station inserts after successful completion of the Hard Error Recovery Process.

Flag, Station Phantom Drive Control (FSPDC), HMR only

The flag FSPDC indicates whether the Station using the HMR has attempted to request the C-Port to use no Phantom after its request to use Phantom Drive during Station Registration (JS=SREG) has been rejected.

Flag FSPDC is set to 0 by the Set_initial_conditions action. Flag FSPDC is set to 1 when the Station recognizes that a Registration Request with Phantom Drive was rejected and a Registration Request is being made without Phantom Drive [SPV(PD)=0002].

Flag, Station Phantom Drive Active (FSPDA)

The flag FSPDA indicates whether the Station is using Phantom Drive. Flag FSPDA is set to 0 when the Station is not using Phantom Drive. Flag FSPDA is set to 1 when the Station is using Phantom Drive.

Flag, Station Registration Complete (FSRC)

The flag FSRC is set to 1 when a valid Registration Response MAC frame is received during the Station Registration state (JS=SREG) to disable the Registration process while waiting for timer (TSLMTD) expiration.

Flag, Station Request LMT (FSRLMT)

The flag FSRLMT is used to request the execution of the Station's LMT function described in 9.1.6.2. This flag is set to 1 when the Station detects the need to execute the LMT and executes the process defined in Station Operation Table 9.2-7. This flag is set to 0 after the Station starts the LMT function specified in Station Operation Table 9.2-7.

Flag, Station Return to Recovered Clock (FSRRC), 4 Mbit/s and 16 Mbit/s only

The flag FSRRC is used with the counter CSTFQ during JS=SDAC to cause the station to change its clock source from crystal (FSTXC=1) to recovered clock (FSTXC=0). FSRRC is set to 1 when an Insert Request (TXI_INS_REQ) is added to the TXI_REQ transmit queue (See 9.1.8). FSRRC is set to 0 when CSTFQ decrements to 0 and FSRRC is set to 1.

Flag, Station Signal Loss (FSSL), 4 Mbit/s and 16 Mbit/s only

The flag FSSL indicates the presence or absence of a valid signal from the lobe, as defined by 5.1.4.1. FSSL is set to 1 to indicate the absence of a valid signal when SMAC detects PM_STATUS.indication(Signal_detected=Signal_loss) for the entire period of timer TSSL (signal loss is filtered). FSSL is set to 0 to indicate the presence of a valid signal whenever SMAC detects PM_STATUS.indication(Signal_detected=Signal_acquired).

Flag, Station Signal Loss Detected (FSSLD), 4 Mbit/s and 16 Mbit/s only

The flag FSSLD is used to determine if the SMAC Signal Loss Filtering process is active or inactive. The Signal Loss Filtering process is used to determine whether or not the PHY signal loss (see 5.1.4.1) event is a steady-state condition. FSSLD is set to 1 to activate the Signal Loss Filtering process if not already active whenever the SMAC detects PM_STATUS.indication(Signal_detected=Signal_loss). FSSLD is set to 0 to deactivate the Signal Loss Filtering process whenever the SMAC detects PM_STATUS.indication(Signal_detected=Signal_acquired).

Flag, Station Start LMT (FSSLMT)

The flag FSSLMT is used to control the LMT defined in 9.1.6.2.1 (FSLMTO=1). When FSSLMT=1, the LMT Notification Stage is active. When FSSLMT=0, the LMT Testing Stage is active.

Flag FSSLMT is set to 1 upon entry into the LMT Notification Stage. Flag FSSLMT is set to 0 upon successful completion of the LMT Notification Stage and starts the LMT Testing Stage.

Flag, Station Transmit Abort Sequence (FSTAS)

The flag FSTAS is used to control the counting of Abort Sequences. When the transmitter releases an Abort Sequence, it sets FSTAS to 1. When the Error Handling Station Operation Table detects this condition, it sets FSTAS to 0 and takes the appropriate action to increment the counter CSABE.

Flag, Station Transmit Idles (FSTI)

The flag FSTI is used to control the transmission of idles (Fill) as follows:

The TXI Access Protocol always has the flag FSTI set to 1 [indicates PS_CONTROL.request(Transmit_ mode=Fill); see 5.1.2.4 for 4 Mbit/s and 16 Mbit/s, and 9.8.1.1.4 for the HMR], causing the Station to source fill *except* when the Transmit FSM is transmitting frame data (TS=STXD).

When the Station closes or starts the TKP Access Protocol, flag FSTI is set to 0 [indicates PS_CONTROL.request(Transmit_mode=No_fill); see 5.1.2.4 for 4 Mbit/s and 16 Mbit/s, and 9.8.1.1.4 for 100 Mbit/s] to support the TKP Access Protocol.

Flag, Station Transmit from Crystal (FSTXC)

The flag FSTXC is used to select the Station's transmitter timing reference as follows:

4 Mbit/s and 16 Mbit/s. The setting of FSTXC controls the Station's transmit clock and affects the PSC interface as follows:

— When FSTXC is 1, the PS_CONTROL.request(Crystal_transmit=Asserted) signal indicates that the Station's SMAC transmit timing reference is derived from the Station's internal crystal clock. Implementations of this standard may include an Elastic Buffer (5.8.3) and a Fixed Latency Buffer (5.8.2) with a latency of 24 symbols, thus allowing 802.5 TKP implementations to function without hardware modification.
— When FSTXC is 0, the PS_CONTROL.request(Crystal_transmit=Not_asserted) indicates that the Station's SMAC transmit timing reference is derived from the Station's clock recovery circuit. There shall be no Elastic Buffer (5.8.3) or Fixed Latency Buffer (5.8.2) in the data path.

100 Mbit/s. FSTXC is set to 1 when the Connect.SMAC or Connect.PMAC (C-Port in Station Emulation Mode) condition occurs. When FSTXC is set to 1, the PS_**CONTROL**.request(Crystal_transmit=Asserted) (see 9.8.1.1.4) indicates that the Station's SMAC is deriving clock from its crystal clock as the transmit timing reference.

FSTXC is never set to 0 when operating at the 100 Mbit/s.

Flag, Station Wire Fault (FSWF), only when Phantom Drive is active (FSPDA=1)

Flag FSWF is set to 1 to indicate wire fault is present and set to 0 to indicate no wire fault is present. [See 5.1.4.1 PM_STATUS.indication(Wire_fault)].

Flag, Station Wire Fault Active (FSWFA), only when Phantom Drive is active (FSPDA=1).

Flag FSWFA is set to 1 to activate wire fault detection and is set to 0 to deactivate wire fault detection.

Flag, Transmit Idles (FTI), 4 Mbit/s and 16 Mbit/s only.

The flag FTI is a TKP Access Protocol flag, defined by ANSI/IEEE Std 802.5, 1998 Edition, 4.2.4.2, used to control the transmission of idles (Fill).

— When flag FTI is set to 1, the MAC indicates PS_CONTROL.request(Transmit_mode=Fill), which causes the station to source fill rather than repeating the received data.
— When flag FTI is set to 0, the MAC indicates PS_CONTROL.request(Transmit_mode=No_fill), which causes the station to repeat the received data.

9.2.4 SMAC States

There are a set of states for the Join Ring FSM, the Monitor FSM, and the Transmit FSM. A FSM can be in only one state at any instant in time.

9.2.4.1 Station Join States

The Station Join State (JS=) notation is used to identify the current state of the Station join FSM. The TXI Station's join state values are Bypass, Registration, Lobe Test, DAC, and Join Complete. Join states, listed by state value, are defined below.

Join State J0, Bypass (JS=BP)

This state is the rest state of the TXI Station. The only events recognized are the start signals, Connect.SMAC or Connect.PMAC, and FPOTO=0, which causes the Station to examine the flag (FSREGO) to determine whether this is a DTR-capable Station.

Join State JA, Station Registration (JS=SREG)

This state is entered when the Bypass state (JS=BP) detects a Connect.SMAC and FSREGO=1, or Connect.PMAC and FPOTO=0. This state determines the mode in which the Station is to operate, either supporting the TXI or TKP Access Protocols. If the TXI Access Protocol is supported, this state sets certain parameters required by the TXI Access Protocol.

Join State JB, Station Lobe Test (JS=SLT)

This state is entered from either Station Registration (JS=SREG) or Station Join Complete (JS=SJC) and performs one of the two lobe test functions described in 9.1.6.

Join State JC, Station DAC (JS=SDAC)

This state is entered when the Lobe Test state (JS=SLT) successfully completes and causes the TXI Station to request insertion and start the TXI Heart Beat function. As a result of the Insert Request, the Station waits for the C-Port to respond with an Insert Response MAC frame. If the insert response indicates the Station's address is a duplicate to another Station within the DTR Concentrator's address domain, then the Station enters the Bypass state (JS=BP). If the insert response indicates the Station's address is unique within the DTR Concentrator's address domain, then the Station enters Join Complete (JS=SJC).

Join State JD, Station Join Complete (JS=SJC)

This state is entered when the DAC state (JS=SDAC) detects the C-Port has determined the TXI Station has a unique address within the DTR Concentrator's address domain and marks the completion of the Join Process.

Join State JE, Station HMR Trade-up (JS=SHMRTU)

This state is entered when the Station's Registration state (JS=SREG) detects the C-Port has agreed to its request to trade up from 4 Mbit/s or 16 Mbit/s operation to the HMR operation and the Station has activated its HMR PHY. The Station HMR Trade-up state waits for one of the following actions to occur:

— If the HMR Link status becomes active before timer TSHMRW expires, then enter the Registration state (JS=SREG) to restart the Registration state (JS=SREG) at the HMR.
— If HMR Link Status fails to become active before the timer TSHMRW expires, then enter the Bypass state (JS=BP).

Join State JF, Station Remove Alert Wait (JS=SRAW), HMR only

This state is entered when the Station in the Join Complete state (JS=SJC) detects that it needs to enter the Bypass state (JS=BP) because of an error condition or a management action. The Remove Alert function allows the Station to notify the C-Port it is entering the Bypass state. The initial Remove Alert MAC frame is transmitted by the detection of any condition causing the Station to enter the Remove Alert Wait state. The counter CSRAT controls the number of Remove Alert MAC frames transmitted while in the Remove Alert Wait state. When counter CSRAT reaches zero, the Station enters the Bypass state.

9.2.4.2 Station Monitor States

The Monitor State (MS=) notation is used to identify the current state of the Station's Monitor FSM. The monitor state values are Operational, Transmit Beacon, Wire Fault Delay, and Internal Test.

The Station's Monitor States, listed by state value, are defined as follows.

Monitor State MA, Station Operational (MS=SOPT)

The Station Operational state is started when the DAC state (JS=SDAC) enters the Join Complete state (JS=SJC).

If, while in the Station Operational state, the Station detects a Heart Beat function failure and flag station operational (FSOP) is 1, then the Station sets FSOP to 0, resets the timers TSIT and TSLMT (synchronization for Hard Error Recovery), disables queued frame transmissions, and enters the Transmit Beacon state (MS=TSBN).

If, while in the Station Operational state, the Station receives a Beacon MAC frame from its C-Port (SA=SUA) and flag station operational (FSOP) is 1, the Station sets FSOP to 0, resets the timers TSIT and TSLMT (synchronization for Hard Error Recovery), disables queued frame transmissions, and enters the Wire Fault Delay state.

Monitor State MB, Station Transmit Beacon (MS=STBN)

The Station Transmit Beacon State causes the Station to transmit Beacon MAC frames with a Beacon Type set according to 9.1.10.1 until the timer TSIT expires, indicating the Station is ready to execute its internal test and to enter the Internal Test state (MS=SIT).

If, while in the Station Transmit Beacon state, the Station detects the reception of a Beacon MAC frame from its C-Port (SA=SUA), the Station resets its timers TSIT and TSLMT (synchronization for Hard Error Recovery), and enters the Wire Fault Delay state (MS=SWFD).

Monitor State MC, Station Internal Test (MS=SIT)

The Internal Test state is started when the Monitor's Transmit Beacon state (MS=STBN) or Wire Fault Delay state (MS=SWFD) indicates the Station has not detected a Wire Fault and is ready to execute its internal tests.

This state is not defined by this standard other than the Station shall determine whether it is capable of continuing to operate the TXI Access Protocol. The Internal Test performs the following actions, depending on its success or failure:

a) Upon successful completion of the Station's Internal Test, the Station waits for its timer TSLMT to expire before setting flag FSBNT to 1, causing the Join Machine to execute its Lobe Test (JS=SLT) and DAC (JS=SDAC) states.
b) Upon failure of the Station's Internal Test, the Station's Join machine returns to the Bypass state (JS=BP).

If the Station's Internal Test was successful, the Internal Test state waits for the reception of the INS_RSP MAC frame, indicating the C-Port has detected the successful completion of the Hard Error Recovery LMT and DAC functions, and then enters the Monitor's Operational state (MS=SOPT).

Monitor State MD, Station Wire Fault Delay State (MS=SWFD)

This state allows the Station's Wire-Fault detection process (if supported by the Station) to determine if a Wire Fault condition exists before entering its Internal Test state (MS=SIT). If a Wire Fault condition does exist, the Station removes from the link (JS=BP) and indicates to management the Wire Fault condition.

This state is started when one of the following occurs:

— The SMAC in the Monitor Operational state (MS=SOPT) detects the reception of a Beacon MAC frame from its C-Port (SA=SUA) and the flag FSJC=1 (join complete).
— The Beacon Transmit state (MS=STBN) detects the reception of a Beacon MAC frame from its C-Port (SA=SUA).

Either of these conditions causes the timers TSIT and TSLMT to be reset. The station delays entry into the Internal Test state until timer TSIT expires (indicating the Station did not detect a Wire Fault condition).

9.2.4.3 Transmit States

The Transmit State (TS=) notation is used to identify the current state of the transmit FSM. The transmit state values are Transmit Normal and Transmit Frame Data. Transmit states, listed by state value, are defined as follows.

Transmit State TA, Transmit Normal (TS=STXN)

The transmit state TS=STXN is set when the transmit FSM enters its normal state of transmitting idles and is not transmitting (sourcing) frames.

At 100 Mbit/s, the PS_CONTROL.request(Transmit_mode=Fill) signal defined in 9.8.1.1.4 is used to transmit idles in this state.

Transmit State TB, Transmit Frame Data (TS=STXD)

The transmit state TS=STXD is entered when the transmit FSM is transmitting the *data* portion of a frame (FC, DA, SA, RIF if present; INFO if present; and FCS fields).

At 100 Mbit/s, the PS_CONTROL.request(Transmit_mode=No_fill) signal defined in 9.8.1.1.4 turns off the transmission of idles and the frame's data is transmitted, one octet at a time, using the signal PS_UNITDATA.request(Tx_indication=Data_octet) defined in 9.8.1.1.2.

9.2.5 TXI Access Protocol SMAC Specification

This subclause specifies the procedures used in the SMAC in support of the Station using the TXI Access Protocol using Station Operation Tables as follows:

a) Station Join Station Operation Table 9.2-1;
b) Station Transmit Station Operation Table 9.2-2;
c) Station Monitor Station Operation Table 9.2-3;
d) Station Error Handling Station Operation Table 9.2-4;
e) Station Interface Signals Station Operation Table 9.2-5;
f) Station Miscellaneous Frame Handling Station Operation Table 9.2-6;
g) Station LMT when FSLMTO=1 Station Operation Table 9.2-7.

These Station Operation Tables use the term “optional,” as defined in 9.1.1.2.

Each Station Operation Table starting point has its event/condition shaded and each Station Operation Table exit point has its action/output shaded.

The DTR Station (FIPTXIS=0) supports the Bridge (M_UNITDATA), LLC (MA_UNITDATA), and MGT (MGT_UNITDATA) Interfaces defined in 9.1.13.1, but has *no access* to the DTU (DTU_UNITDATA) or MRI (MRI_UNITDATA) Interfaces defined in 9.1.13.2.

The DTR C-Port in Station Emulation Mode (FIPTXIS=1) supports the DTU and MRI Interfaces defined in 9.1.13.2, but has *no access* to the Bridge, LLC, or MGT Interfaces defined in 9.1.13.1.

Parameters n6, n7, and n8 represent the initial value of the counters CSREQ, CSLTF, and CSRAT, respectively, to allow flexibility among station implementations.

Parameter	MIN	MAX	Used with	Description
n6	4	12	CSREQ	n6 is the initial setting of CSREQ, which governs the maximum number of Registration Request Frames retransmitted by the Station. The maximum number of frames sent is (n6+1).
n7	1117	1123	CSLTF	n7 is the initial setting of CSLTF, which governs the number of TEST MAC Frames transmitted by the Station’s LMT function when the policy flag FSLMTO=1 (see 9.1.6.2 for description). This form of LMT, specified by Station Operation Table 9.2-7, is designed to support any media rate.
n8	5	10	CSRAT	n8 is the initial setting of CSRAT, which governs the number of Remove Alert MAC Frames transmitted at the HMR by the Station’s Remove Alert state (JS=SRAW) before exiting to the Bypass state (JS=BP).

9.2.5.1 Station Join—Station Operation Table

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
J0A	1001	**Connect.PMAC** & FPMRO<2 & FPOTO=0 & FSREGO=1 & JS=BP << This transition is executed by 9.3.4.1. >> << One of the Starting Points for the C-Port in Station Emulation Mode using the TXI Access Protocol. >> << For information only. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=FPMRO; FPMR=FPMRO; FIPTXIS=1; TSIS=R
J0A	1107	**Connect.PMAC** & PS_STATUS.indication(Link_status=Asserted) & FPMRO>1 & FPANO=0 & FPOTO=0 & FSREGO=1 & JS=BP << This transition is executed by 9.3.4.1. >> << This transition requires Link_status to be active *before* Connect.PMAC operates. >> << One of the Starting Points for the C-Port in Station Emulation Mode using the TXI Access Protocol without Auto-Negotiation. >> << For information only. >> << HMR only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=FPMRO; FPMR=FPMRO; FIPTXIS=1; TSIS=R
J0A	3108	**Connect.SMAC** & FSMRO<2 & FSREGO=1 & AND(SPV(AP_MASK),0002)=0002 & JS=BP << One of the Starting Points for the DTR Station using the TXI Access Protocol. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=FSMRO; TSIS=R
J0A	3179	**Connect.SMAC** & PS_STATUS.indication (Link_status=Asserted) & FSMRO>1 & FSANO=0 & FSREGO=1 & AND(SPV(AP_MASK),0002)=0002 & JS=BP << This transition requires Link_status to be active *before* Connect.SMAC operates. >> << One of the Starting Points for the DTR Station using the TXI Access Protocol without Auto-Negotiation. >> << HMR only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=FSMRO; TSIS=R
	3170	**CSTFQ=0** & FSRRC=1 & FSMR<2 & JS=SDAC << 4 Mbit/s and 16 Mbit/s only. >>	FSRRC=FSTXC=0 << Insert Request MAC frame has been transmitted; return to recovered clock. >>
JC0	3133	**Disconnect.SMAC** & FSMR<2 & JS=SDAC << Station told by Station Management to remove from the network. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Station closed for unknown reason. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JC0	3152	**Disconnect.SMAC** & FSMR>1 & FSJC=0 & JS=SDAC << Station told by Station Management to remove from the network. >> << HMR only. >>	JS=BP << OPEN ERROR - Station closed for unknown reason. >>
JCF	3183	**Disconnect.SMAC** & FSMR>1 & FSJC=1 & JS=SDAC << Station told by Station Management to remove from the network. >> << HMR only. >>	JS=SRAW; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT << Station closed for unknown reason – start the Remove Alert process. >>
JD0C	3149	**Disconnect.SMAC** & FSMR<2 & JS=SJC << After Join Complete, Station told by Station Management to remove from the network. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP; Remove_station << Station closed for unknown reason. >>
JDFA	3180	**Disconnect.SMAC** & FSMR>1 & JS=SJC << After Join Complete, Station told by Station Management to remove from the network. >> << HMR only. >>	JS=SRAW; FSOP=0; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT; **If** FSPDA=1 then Remove_station << Station closed for unknown reason; start the Remove Alert process and if phantom drive is active, Remove_station. >>
JB0	3123	**Disconnect.SMAC** & FSMR<2 & JS=SLT << Station told by Station Management to remove from the network. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Station closed for unknown reason. >>
JB0	3184	**Disconnect.SMAC** & FSMR>1 & FSJC=0 & JS=SLT << Station told by Station Management to remove from the network. >> << HMR only. >>	JS=BP << OPEN ERROR; Station closed for unknown reason. >>
JBF	3193	**Disconnect.SMAC** & FSMR>1 & FSJC=1 & JS=SLT << Station told by Station Management to remove from the network. >> << HMR only. >>	JS=SRAW; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT << Station closed for unknown reason; start the Remove Alert process. >>
JA0	3109	**Disconnect.SMAC** & JS=SREG << Station told by Station Management to remove from the network. >>	JS=BP << Station closed for unknown reason. >>
JB0	3164	**FR_AMP** & JS=SLT << A TXI Access Protocol error has been detected by the reception of a TKP AMP MAC frame prior to the activation of the TXI Heart Beat function. >>	JS=BP << OPEN ERROR = Protocol Error >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JA0	3160	**FR_AMP** & JS=SREG << A TXI Access Protocol error has been detected by the reception of a TKP Access Protocol AMP MAC frame prior to the activation of the TXI Heart Beat function. >>	JS=BP << OPEN ERROR = Protocol Error >>
JC0	3134	**FR_BN** & JS=SDAC << TXI Access Protocol has detected the TKP Access Protocol is active by reception of a Beacon MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JA0	3110	**FR_BN** & JS=SREG << TXI Access Protocol has detected TKP Access Protocol is active by premature reception of a Beacon MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JB0	3124	**FR_BN(SA<>MA)** & JS=SLT << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Beacon MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JC0	3135	**FR_CT** & JS=SDAC << TXI Access Protocol has detected the TKP Access Protocol is active by reception of a Claim Token MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JD0A	3151	**FR_CT** & JS=SJC << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Claim Token MAC frame. >>	JS=BP; **If** FSPDA=1, then Remove_station << Protocol Error >>
JA0	3111	**FR_CT** & JS=SREG << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Claim Token MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JB0	3125	**FR_CT(SA<>MA)** & JS=SLT << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Claim Token MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JCD	3145	**FR_INS_RSP(DTR_RSP=0000)** & JS=SDAC << Response indicates C-Port has given permission for the TXI Station to complete Join. >>	JS=SJC; FSJC=FSOP=1; **If** FSECO=1, then (FSER=1; TSER=R); **If** FSPDA=1, then (INSERT; FSWFA=FSWF=0; TSWFD=R) << Start Error Report timer and if Phantom Drive is available, then assert Phantom Drive and activate Wire Fault detection. >>
JC0	3138	**FR_INS_RSP(DTR_RSP=8020)** & JS=SDAC	JS=BP << OPEN ERROR = DAC Failure >>
JC0	3112	**FR_MAC(SA<>MA & SA<>SUA & VC=00)** & JS=SDAC	JS=BP << OPEN ERROR = Protocol Error >>
JB0	3103	**FR_MAC(SA<>MA & SA<>SUA & VC=00)** & JS=SLT	JS=BP << OPEN ERROR = Protocol Error >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JA0	3101	**FR_MAC(SA<>MA & SA<>SUA & VC=00)** & SUA<>0 & JS=SREG	JS=BP << OPEN ERROR = Protocol Error >>
JD0A	3146	**FR_MAC(SA<>SUA & VC=00)** & JS=SJC	JS=BP; **If** FSPDA=1, then Remove_station << Protocol Error >>
JC0	3137	**FR_MAC(SA<>SUA & VC=03)** & JS=SDAC	JS=BP << OPEN ERROR = Protocol Error >>
JD0A	3148	**FR_MAC(SA<>SUA & VC=03)** & JS=SJC	JS=BP; **If** FSPDA=1, then Remove_station << Protocol Error >>
JB0	3107	**FR_MAC(SA<>SUA & VC=03)** & JS=SLT	JS=BP << Protocol Error >>
JA0	3102	**FR_MAC(SA<>SUA & VC=03)** & SUA<>0 & JS=SREG	JS=BP << OPEN ERROR = Protocol Error >>
JC0	3136	**FR_PHB(SA<>SUA)** & JS=SDAC << A TXI Access Protocol error has been detected by the reception of a TXI Heart Beat or a TKP AMP MAC frame (SA<>SUA of the known C-Port). >>	JS=BP << OPEN ERROR = Protocol Error >>
JA0	3113	**FR_REG_RSP(AP_RSP=0000)** & FSMR<2 & FSHMRTUA=0 & FSRDO=1 & JS=SREG << Response MAC frame indicates the C-Port has rejected the Station's TXI Access Protocol request. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << OPEN ERROR = Protocol Error >>
	3150	**FR_REG_RSP(AP_RSP=0000)** & FSMR>1 & FSPDC=0 & JS=SREG << Response MAC frame indicates the C-Port has rejected the Station's TXI Access Protocol request to use Phantom Drive. Retry Registration request without Phantom Drive capability. >> << HMR only. >>	FSPDC=1; FSPDA=0; CSREQ=n6; TSREQ=R; TXI_REG_REQ (AP_REQ=0002; IAC=SPV(IAC); PD=0002) << Request C-Port to use the TXI Access Protocol using no Phantom Drive. >>
JA0	3167	**FR_REG_RSP(AP_RSP=0000)** & FSMR>1 & FSPDC=1 & JS=SREG << Response MAC frame indicates the C-Port has rejected the Station's TXI Access Protocol request. >> << HMR only. >>	JS=BP << OPEN ERROR = Protocol Error >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3182	**FR_REG_RSP(AP_RSP=0000)** & FSMR<2 & FSHMRTUA=1 & JS=SREG << Response MAC frame indicates the C-Port has rejected the Station's TXI Access Protocol and Trade-up request. >> << 4 Mbit/s and 16 Mbit/s only. >>	CSREQ=n6; TSREQ=R; FSPDA=1; FSHMRTUA=0; TXI_REG_REQ (AP_REQ=0002; IAC=SPV(IAC); PD=SPV(PD)) << Transmit Registration Request with the AP_REQ, IAC, and PD Subvectors setup. >>
JA1A	3105	**FR_REG_RSP(AP_RSP=0000)** & FSRDO=0 & FSHMRTUA=0 & FIPTXIS=0 & AND(SPV(AP_MASK),0001)=0001 & JS=SREG << The DTR Station's Registration request is denied by the C-Port, but Management has enabled the DTR Station to use the TKP Access Protocol. >> **<< Note:** FSRDO=1 is required for the HMR. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=LT; FSTXC=FSTI=0; FTI=x; Set_initial_conditions; TEST << The DTR Station starts the TKP Access Protocol and exits to 9.6. >>
JA1B	3158	**FR_REG_RSP(AP_RSP=0000)** & FSRDO=0 & FSHMRTUA=0 & FIPTXIS=1 & AND(SPV(AP_MASK),0001)=0001 & JS=SREG << The C-Port in Station Emulation Mode Registration request is denied by the C-Port, but Management has enabled the C-Port in Station Emulation Mode to use the TKP Access Protocol. >> **<< Note:** FSRDO=1 is required for the HMR. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=LT; FSTXC=FSTI=0; FTI=x; FIPTXIS=0; FIPTKPS=1; Set_initial_conditions; TEST << The C-Port in Station Emulation Mode starts the TKP Access Protocol and exits to 9.5. >>
	3106	**FR_REG_RSP(AP_RSP=0002)** & FSREGO=1 & JS=SREG << Response indicates C-Port is supporting the TXI Access Protocol. Station remains in this state until timer TSLMTD expires. >>	FSRC=1; TSLMTD=R; SUA=SA << Registration complete. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JAE	3178	**FR_REG_RSP(AP_RSP=0004)** & FSREGO=1 & JS=SREG << Response indicates C-Port is supporting 100 Mbit/s, and the Station has requested the C-Port to support the 100 Mbit/s operation (FSHMRTUO=1) if supported. >>	JS=SHMRTU; TSHMRW=R; Flush_transmit_queues; PS_CONTROL.request (Initialize, Media_rate=2) << Station activates the 100 Mbit/s link and enters the HMR Wait state waiting for Link activation as follows: — If Link activation occurs before timer TSHMRW expires, then enter the Registration state (JS=SREG). — If timer TSHMRW expires before Link activation occurs, then enter the Bypass state (JS=BP). >>
JC0	3139	**FR_REMOVE(DA=Non_broadcast)** & FSMR<2 & FSRRO=0 & JS=SDAC << Station told by Network Management to remove from the network. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << OPEN ERROR = Remove Station Received >>
JC0	3198	**FR_REMOVE(DA=Non_broadcast)** & FSMR>1 & FSJC=0 & FSRRO=0 & JS=SDAC << Station told by Network Management to remove from the network. >> << HMR only. >>	JS=BP << OPEN ERROR; Remove Station Received >>
JCF	3196	**FR_REMOVE(DA=Non_broadcast)** & FSMR>1 & FSJC=1 & FSRRO=0 & JS=SDAC << Station told by Network Management to remove from the network. >> << HMR only. >>	JS=SRAW; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT << Remove Station Received; start the Remove Alert process >>
JD0C	3153	**FR_REMOVE(DA=Non_broadcast)** & FSMR<2 & FSRRO=0 & JS=SJC << Station told by Network Management to remove from the network after Join Complete. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP; Remove_station << Remove Station Received. >>
JDFA	3185	**FR_REMOVE(DA=Non_broadcast)** & FSMR>1 & FSRRO=0 & JS=SJC << Station told by Network Management to remove from the network after Join Complete. >> << HMR only. >>	JS=SRAW; FSOP=0; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT; **If** FSPDA=1, then Remove_station << Remove Station Received; start the Remove Alert process and if Phantom Drive is active, Remove_station. >>
JB0	3126	**FR_REMOVE(DA=Non_broadcast)** & FSMR<2 & FSRRO=0 & JS=SLT << Station told by Network Management to remove from the network. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << OPEN ERROR = Remove Station Received >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JB0	3199	**FR_REMOVE(DA=Non_broadcast)** & FSMR>1 & FSJC=0 & FSRRO=0 & JS=SLT << Station told by Network Management to remove from the network. >> << HMR only. >>	JS=BP << OPEN ERROR = Remove Station Received. >>
JBF	3197	**FR_REMOVE(DA=Non_broadcast)** & FSMR>1 & FSJC=1 & FSRRO=0 & JS=SLT << Station told by Network Management to remove from the network. >> << HMR only. >>	JS=SRAW; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT << Remove Station Received; start the Remove Alert process. >>
JA0	3115	**FR_REMOVE(DA=Non_broadcast)** & FSRRO=0 & JS=SREG << Station told by Network Management to remove from the network. >>	JS=BP << OPEN ERROR = Remove Station Received >>
JC0	3186	**FR_RMV_ALRT(VC=03 & SA=SUA)** & FSMR>1 & JS=SDAC << C-Port signals Station it is entering its Bypass state (JS=BP). >> << HMR only. >>	JS=BP << C-Port is not operational. >>
JD0A	3171	**FR_RMV_ALRT(VC=03 & SA=SUA)** & FSMR>1 & JS=SJC << C-Port signals Station it is entering JS=BP. >> << HMR only. >>	JS=BP; **If** FSPDA=1, then Remove_station << C-Port is not operational. >>
JB0	3001	**FR_RMV_ALRT(VC=03 & SA=SUA)** & FSMR>1 & JS=SLT << C-Port signals Station it is entering its Bypass state (JS=BP). >> << HMR only. >>	JS=BP << C-Port is not operational. >>
JC0	3140	**FR_RP** & JS=SDAC << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Ring Purge MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JD0A	3154	**FR_RP** & JS=SJC << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Ring Purge MAC frame. >>	JS=BP; **If** FSPDA=1, then Remove_station << Protocol Error >>
JA0	3116	**FR_RP** & JS=SREG << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Ring Purge MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error>>
JB0	3127	**FR_RP(SA<>MA)** & JS=SLT << TXI Access Protocol has detected TKP Access Protocol is active by reception of a Ring Purge MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JD0A	3163	**FR_SMP** & JS=SJC << TXI Access Protocol detects TKP Access Protocol is active by reception of a SMP MAC frame after Join complete. >>	JS=BP; **If** FSPDA=1, then Remove_station << Protocol Error >>
JA0	3161	**FR_SMP** & JS=SREG << TXI Access Protocol detects TKP Access Protocol is active by reception of a SMP MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JC0	3162	**FR_SMP(SA<>MA)** & JS=SDAC << TXI Access Protocol detects TKP Access Protocol is active by reception of a SMP MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error>>
JB0	3165	**FR_SMP(SA<>MA)** & JS=SLT << TXI Access Protocol detects TKP Access Protocol is active by reception of a SMP MAC frame. >>	JS=BP << OPEN ERROR = Protocol Error >>
JDB	3114	**FSBNT=1** & MS=SIT & JS=SJC << Monitor requests Join to run the Station's LMT and sets Beacon Test request flag inactive. >>	JS=SLT; FSBNT=0; **If** FSMR<2, then FSTXC=1; TSLMTC=R; **If** FSLMTO=0, then TXI_TEST; **If** FSLMTO=1, then FSRLMT=1 << Start the LMT Completion Timer and — If FSLMTO=0, then start the LMT defined by 9.1.6.1; or — If FSLMTO=1, then start the LMT defined by 9.1.6.2 and Table 9.2-7. >>
JC0	3142	**FSBPF=1** & TS=STXN & JS=SDAC	JS=BP << Station Fault, Transmit Error. >>
JD0A	3156	**FSBPF=1** & TS=STXN & JS=SJC	JS=BP; **If** FSPDA=1, then Remove_station << Station Fault, Transmit Error. >>
JB0	3129	**FSBPF=1** & TS=STXN & JS=SLT	JS=BP << Station Fault, Transmit Error. >>
JF0	3002	**FSBPF=1** & TS=STXN & JS=SRAW	JS=BP << Station Fault, Transmit Error. >>
JA0	3118	**FSBPF=1** & TS=STXN & JS=SREG	JS=BP << Station Fault, Transmit Error.>>
	3166	**FSIRD=1** & TS=STXN & JS=SDAC << Insert Request MAC frame delayed until transmitter has no frames being transmitted (TS=STXN). >> << 4 Mbit/s and 16 Mbit/s only. >>	FSIRD=0; FSRRC=FSTXC=1; CSTFQ=(CSTFQ+1); TSIP=R; TXI_INS_REQ << Transmit an Insert Request MAC frame using crystal transmit. >>
JB0	3189	**FSLMTF=1** & FSJC=0 & JS=SLT << Reason for LMT failure is determined when FSLMTF is set to 1 (see Table 9.2-7). >>	JS=BP << OPEN ERROR; LMT failure before join has completed. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JB0	3191	**FSLMTF=1** & FSJC=1 & FSMR<2 & JS=SLT << Reason for LMT failure is determined when FSLMTF is set to 1 (see Table 9.2-7). >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Hard Error Recovery LMT failure; enter Bypass. >>
JBF	3188	**FSLMTF=1** & FSJC=1 & FSMR>1 & JS=SLT << Reason for LMT failure is determined when FSLMTF is set to 1 (see Table 9.2-7). >> << HMR only. >>	JS=SRAW; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT << Hard Error Recovery LMT failure; start the Remove Alert process. >>
JBCB	3190	**FSLMTS=1** & JS=SLT << LMT function completed successfully; set Station's LMT functional address inactive and request Insertion. >>	JS=SDAC; FA(TEST)=0; **If** FSJC=0, then MS=SOPT; FSLMTS=0; FSHBA=FSRRC=1; **If** FSMR<2, then FSTXC=1; CSTFQ=1; TSJC=R; TSQHB=R; TSRHB=R; TSIP=R; TXI_INS_REQ
JC0	3141	**INTERNAL_ERR(not_correctable)** & JS=SDAC	JS=BP << OPEN ERROR = Station Fault, Internal Station Error >>
JD0A	3155	**INTERNAL_ERR(not_correctable)** & JS=SJC	JS=BP; **If** FSPDA=1, then Remove_station << Station Fault, Internal Station Error. >>
JB0	3128	**INTERNAL_ERR(not_correctable)** & JS=SLT	JS=BP << OPEN ERROR = Station Fault, Internal Station Error >>
JA0	3117	**INTERNAL_ERR(not_correctable)** & JS=SREG	JS=BP << OPEN ERROR = Station Fault, Internal Error >>
JD0B	3147	**INTERNAL_TEST_FAILURE** & MS=SIT & JS=SJC	JS=BP << Station Fault, Internal Test Failure. >>
JEA	3194	**PS_STATUS.indication (Link_status=Asserted)** & JS=SHMRTU << Station detects Trade-up to 100 Mbit/s and restarts registration. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=2; **If** FIPTXIS=1, then FPMR=2; TSIS=R << Set internal media rate flag(s) to 100 Mbit/s. >>
JC0	3172	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=SDAC << C-Port link was operational, but is now not operational. >> << HMR only. >>	JS=BP << C-Port/Station link not operational. >>
JD0A	3173	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=SJC << C-Port link was operational, but is now not operational. >> << HMR only. >>	JS=BP; **If** FSPDA=1, then Remove_station << Remove Alert MAC frame is not sent because the C-Port/Station link is not operational. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JF0	3187	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=SRAW << C-Port link was operational, but is now not operational. >> << HMR only. >>	JS=BP << Remove Alert MAC frame is not sent because the C-Port/Station link is not operational. >>
JB0	3174	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=SLT << HMR only. >>	JS=BP << C-Port/Station link not operational. >>
JA0	3175	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=SREG << HMR only. >>	JS=BP << C-Port/Station link not operational. >>
JB0	3130	**TEST_FAILURE** & JS=SLT << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << OPEN ERROR = Lobe Test Failure >>
JBCA	3132	**TEST_OK** & JS=SLT << TXI Station's LMT completed successfully and causes setup for TXI Station insertion. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=SDAC; **If** FSJC=0, then MS=SOPT; FSHBA=FSRRC=FSTXC=1; CSTFQ=1; TSJC=R; TSQHB=R; TSRHB=R; TSIP=R; TXI_INS_REQ
JE0	3195	**TSHMRW=E** & PS_STATUS.indication (Link_status=Not_asserted) & JS=SHMRTU << Station failed to detect Link activation in time allotted. >>	JS=BP << OPEN ERROR; Trade-up Failure. >>
	3104	**TSIP=E** & JS=SDAC & FSMR<2 << 4 Mbit/s and 16 Mbit/s only. >>	FSIRD=1 << Remember the TSIP=E event and delay the transmission of the Insert Request MAC frame until crystal clock is available. >>
	3168	**TSIP=E** & JS=SDAC & FSMR>1 << HMR only. >>	TSIP=R; TXI_INS_REQ << No delay is required since crystal clock is available. Transmit Insert Request MAC frame. >>
	3119	**TSIS=E** & FSMR<2 & JS=SREG << DTR Station makes its *first* request for TXI Access Protocol setup by setting subvector values for the REG_REQ_MAC frame and then queues the frame for transmission. >> << Request Trade-up to the HMR if the Trade-up policy is enabled. >> **<< NOTE:** 4 Mbit/s and 16 Mbit/s requires Phantom Drive to be active [SPV(PD)=0001]. >> << 4 Mbit/s and 16 Mbit/s only. >>	CSREQ=n6; TSREQ=R; FSPDA=1; FSHMRTUA=FSHMRTUO; TXI_REG_REQ (**If** FSHMRTUO=0, then AP_REQ=0002; **If** FSHMRTUO=1, then AP_REQ=0006; IAC=SPV(IAC); PD=SPV(PD)) << Transmit Registration Request with the AP_REQ, IAC, and PD Subvectors setup. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3177	**TSIS=E** & FSMR>1 & JS=SREG << DTR Station makes its *first* request for TXI Access Protocol setup by setting subvector values for the REG_REQ_MAC frame and then queues the frame for transmission. >> **<< NOTE:** The HMR allows Phantom Drive to be active [SPV(PD)=0001] or inactive [SPV(PD)=0002]. >> << HMR only. >>	CSREQ=n6; TSREQ=R; **If** SPV(PD)=0001, then FSPDA=1; **If** SPV(PD)=0002, then (FSPDC=1; FSPDA=0); TXI_REG_REQ (AP_REQ=0002; IAC=SPV(IAC); PD=SPV(PD)) << Setup Phantom Drive control and then transmit Registration Request with the AP_REQ, IAC, and PD Subvectors setup. >>
JC0	3143	**TSJC=E** & JS=SDAC	JS=BP << OPEN ERROR = Join Time-out Error >>
JB0	3131	**TSLMTC=E** & JS=SLT << Time allotted for Station's TXI LMT has been exceeded. >>	JS=BP << OPEN ERROR = Station Fault, Lobe Test Completion Time Exceeded >>
JAB	3121	**TSLMTD=E** & JS=SREG << Station's TXI LMT Delay completed. >>	JS=SLT; TSLMTC=R; **If** FSLMTO=0, then TXI_TEST; **If** FSLMTO=1, then FSRLMT=1 << Start the LMT Completion Timer and — If FSLMTO=0, then start the LMT defined by 9.1.6.1; or — If FSLMTO=1, then start the LMT defined by 9.1.6.2 and Table 9.2-7. >>
	3176	**TSRAP=E** & CSRAT<>0 & JS=SRAW << Transmission of Remove Alert MAC Frame has not been completed. >> << HMR only. >>	CSRAT=(CSRAT-1); TSRAP=R; TXI_RMV_ALRT << Retransmit Remove Alert MAC Frame. >>
JF0	3192	**TSRAP=E** & CSRAT=0 & JS=SRAW << Transmission of Remove Alert MAC Frame has been completed. >> << HMR only. >>	JS=BP << Enter the Bypass state for reason that started timer TSRAP. >>
JA1A	3120	**TSREQ=E** & CSREQ=0 & FSRC=0 & FSOPO=0 & FIPTXIS=0 & AND(SPV(AP_MASK),0001)=0001 & JS=SREG << C-Port has failed to respond to multiple REG_REQ MAC frames and this Station permits the Emulation of the TKP Access Protocol. >> **<< Note:** FSOPO=1 is required by the HMR. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=LT; FSTXC=FSTI=0; FTI=x; Set_initial_conditions; TEST << DTR Station starts the TKP Access Protocol and exits to 9.6. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
JA1B	3159	**TSREQ=E** & CSREQ=0 & FSRC=0 & FSOPO=0 & FIPTXIS=1 & AND(SPV(AP_MASK),0001)=0001 & JS=SREG << Attached C-Port has failed to respond to multiple REG_REQ MAC frames and the TKP Access Protocol Emulation is permitted by this C-Port. >> **<< Note:** FSOPO=1 is required by the HMR. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=LT; FSTXC=FSTI=0; FTI=x; FIPTXIS=0; FIPTKPS=1; Set_initial_conditions; TEST << C-Port in Station Emulation Mode starts the TKP Access Protocol and exits to 9.5. >>
JA0	3169	**TSREQ=E** & CSREQ=0 & FSRC=0 & FSOPO=1 & JS=SREG << C-Port has failed to respond to multiple REG_REQ MAC frames and TKP Access Protocol Emulation is not permitted by this Station. >>	JS=BP << OPEN ERROR = Protocol Error>>
	3122	**TSREQ=E** & CSREQ>0 & FSRC=0 & JS=SREG << DTR Station makes *another* request for TXI Access Protocol setup by setting subvector values for the REG_REQ_MAC frame, allowing Phantom Drive (4, 16, or 100 Mbit/s) or no Phantom Drive (100 Mbit/s only), and then queues the frame for transmission. >> << Request Trade-up to the HMR if Station's Trade-up policy is enabled, and Media Rate is 4 Mbit/s or 16 Mbit/s. >>	CSREQ=(CSREQ-1); TSREQ=R; TXI_REG_REQ (**If** FSMR>1, then AP_REQ=0002; **If** (FSMR<2 & FSHMRTUA=0), then AP_REQ=0002; **If** (FSMR<2 & FSHMRTUA=1), then AP_REQ=0006; IAC=SPV(IAC); **If** FSPDA=0, then PD=0002; **If** FSPDA=1, then PD=0001) << Transmit Registration Request with the REQ, IAC, and PD Subvector setup. >>
JC0	3144	**TSRHB=E** & JS=SDAC <<TXI Access Protocol has detected absence of the Heart Beat MAC frame prior to Join complete. >>	JS=BP << OPEN ERROR = Protocol Error >>
J9A	6007	**TSRW=E** & FIPTKPS=0 & FSREGO=1 & JS=SRW << One of the Starting Points for the DTR Station using the TXI Access Protocol. >> << This Transition is executed by 9.6.2.1. >> << DTR Station originally opened using the TKP Access Protocol and then recognizes the attached C-Port's request to use the TXI Access Protocol. >> << Registration Query Protocol. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; TSIS=R << For information only. >>

Table 9.2-1—Station Join Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
J9A	6006	**TSRW=E** & FIPTKPS=1 & FSREGO=1 & JS=SRW << One of the Starting Points for the C-Port in Station Emulation Mode using the TXI Access Protocol. >> << This Transition is executed by 9.5.4.2. >> << C-Port in Station Emulation Mode originally opened using the TKP Access Protocol and then recognizes the attached C-Port's request to use the TXI Access Protocol. >> << Registration Query Protocol. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; TSIS=R; FIPTKPS=0; FIPTXIS=1 << For information only. >>
JD0C	3157	**TSWF=E** & FSWFA=1 & FSWF=1 & FSMR<2 & JS=SJC << Occurs only when Phantom Drive is active.>> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP; Remove_station << Wire Fault Detected; caused by Station, Lobe, or Port fault. >>
JDFB	3181	**TSWF=E** & FSWFA=1 & FSWF=1 & FSMR>1 & JS=SJC << Occurs only when Phantom Drive is active.>> << HMR only. >>	JS=SRAW; FSOP=0; CSRAT=n8; TSRAP=R; TXI_RMV_ALRT; Remove_station << Wire Fault Detected; caused by Station, Lobe, or Port fault. Start the Remove Alert process and remove Station. >>

9.2.5.2 Station Transmit—Station Operation Table

Table 9.2-2—Station Transmit Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
TBAA	3207	**CSBTX>SPV(MAX_TX)** & FSMR<2 & FPASO=0 & FIPTXIS=1 & TS=STXD << C-Port in Station Emulation Mode has detected maximum frame size has been exceeded. >> << 4 Mbit/s and 16 Mbit/s only. >>	[TS=STXN; TX_AB; FSTAS=FSTI=1 (optional-unk)] << Terminate the transmission of the frame by transmitting an Abort Sequence. >>
TBAE	3204	**CSBTX>SPV(MAX_TX)** & FSMR<2 & FPASO=1 & FIPTXIS=1 & TS=STXD << C-Port in Station Emulation Mode has detected maximum frame size has been exceeded. >> << 4 Mbit/s and 16 Mbit/s only. >>	[TS=STXN; FSTAS=FSTI=1; TX_INV_FCS; TX_EFS(I=0; E=1) (optional-unk)] << Terminate the transmission of the frame by transmitting an Invalid FCS and setting the E bit to 1. >>

Table 9.2-2—Station Transmit Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
TBAJ	3213	**CSBTX>SPV(MAX_TX)** & FSMR>1 & FIPTXIS=1 & TS=STXD << C-Port in Station Emulation Mode has detected maximum frame size has been exceeded. >> << HMR only. >>	TS=STXN; **If** FPASO=0, then TX_AB; **If** FPASO=1, then [TX_INV_FCS; TX_EFS(E=1) (optional-unk)]; FSTAS=FSTI=1 << Terminate the transmission of the frame by transmitting either an Abort Sequence or an Invalid FCS and setting the E bit to 1. >>
TBAF	3212	**DTU_UNITDATA-STATUS.request(Fail)** & FSMR<2 & FPTX_LTH=0 & FIPTXIS=1 & TS=STXD << Transmit FSM currently transmitting a frame of unknown length. This is an indication that a Cut-through frame is being transmitted. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=STXN; TX_AB; FSTAS=FSTI=1 << The Cut-through frame has completed with a Fail status, and the frame is aborted by transmitting an Abort Sequence. >>
TBAK	3214	**DTU_UNITDATA-STATUS.request(Fail)** & FSMR>1 & FPTX_LTH=0 & FIPTXIS=1 & TS=STXD << Transmit FSM currently transmitting a frame of unknown length. This is an indication that a Cut-through frame is being transmitted. >> << HMR only. >>	TS=STXN; **If** FPASO=0, then TX_AB; **If** FPASO=1, then (TX_INV_FCS; TX_EFS(E=1)); FSTAS=FSTI=1 << Terminate the transmission of the frame by transmitting either an Abort Sequence or an Invalid FCS and setting the E bit to 1. >>
	3208	**EOB** & TS=STXD & FIPTXIS=1 << Occurs *once* for each byte transmitted during the Transmit Data state (TS=STXD). >> << C-Port in Station Emulation Mode support. >>	[CSBTX=(CSBTX+1) (optional-unk)]
TBAB	3205	**EOD** & FSMR<2 & TS=STXD << The last octet of the Frame's Information Field has been transmitted. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=STXN; TX_FCS; TX_EFS(I=E=0); FSTI=1; **If** JS=SDAC, then CSTFQ=(CSTFQ-1)
TBAM	3221	**EOD** & FSMR>1 & TS=STXD << The last octet of the Frame's Information Field has been transmitted. >> << HMR only. >>	TS=STXN; TX_FCS; TX_EFS(E=0); FSTI=1
TABA	3203	**PDU_QUEUED** & FSBPF=0 & FSOP=1 & FIPTXIS=0 & TS=STXN << Queued frame is transmitted by the Station only when FSOP=1. >>	TS=STXD; FSTI=0; TX_SFS(P=x; R=0) << Frame length for a frame in the TXI queue is always known. >>

Table 9.2-2—Station Transmit Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
TABB	3210	**PDU_QUEUED** & FSBPF=0 & FSOP=1 & FIPTXIS=1 & TS=STXN << Queued frame is transmitted by the C-Port only when FSOP=1. >>	TS=STXD; FSTI=0; **If** FR_LTH<=PPV(MAX_TX), then FPTX_LTH=1; **If** FR_LTH=UNK, then FPTX_LTH=0; **If** FSMR=0, then CSBTX=9; **If** FSMR=1, then CSBTX=D; **If** FSMR=2, then CSBTX=14; TX_SFS(P=x; R=0) << The frame length of the queued frame is either unknown or a value less than PPV(MAX_TX). >>
TBAC	3216	**PORT_ERR(correctable)** & FIPTXIS=1 & FPMR<2 & TS=STXD << C-Port could not complete transmission of frame being transmitted; abort frame. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=STXN; TX_AB; FSTAS=FSTI=1; **If** JS=SDAC, then CSTFQ=(CSTFQ-1) << Transmit Abort sequence. >>
TBAG	3215	**PORT_ERR(correctable)** & FIPTXIS=1 & FPMR>1 & TS=STXD << C-Port could not complete transmission of frame being transmitted; abort frame. >> << HMR only. >>	TS=STXN; **If** FPASO=0, then TX_AB; **If** FPASO=1, then (TX_INV_FCS; TX_EFS(E=1)); FSTAS=FSTI=1 << Terminate the transmission of the frame by transmitting either an Abort Sequence or an Invalid FCS and setting the E bit to 1. >>
TBAL	3217	**PORT_ERR(not_correctable)** & FIPTXIS=1 & FPMR<2 & TS=STXD << C-Port could not complete transmission of frame being transmitted. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=STXN; [TX_AB (optional)]; FSBPF=FSTI=1 << Optionally Transmit Abort sequence. >>
TBAH	3218	**PORT_ERR(not_correctable)** & FIPTXIS=1 & FPMR>1 & TS=STXD << C-Port could not complete transmission of frame being transmitted. >> << HMR only. >>	TS=STXN; **If** FPASO=0, then TX_AB; **If** FPASO=1, then (TX_INV_FCS; TX_EFS(E=1)); FSBPF=FSTI=1 << Terminate the transmission of the frame by transmitting either an Abort Sequence or an Invalid FCS and setting the E bit to one, and then force C-Port to the Bypass state. >>
TBAC	3206	**STATION_ERR(correctable)** & FIPTXIS=0 & FSMR<2 & TS=STXD << Station could not complete transmission of frame; enter the Transmit Normal state. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=STXN; TX_AB; FSTAS=FSTI=1; **If** JS=SDAC, then CSTFQ=(CSTFQ-1) << Transmit Abort Sequence. >>

Table 9.2-2—Station Transmit Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
TBAG	3219	**STATION_ERR(correctable)** & FIPTXIS=0 & FSMR>1 & TS=STXD << Station could not complete transmission of frame; enter the Transmit Normal state. >> << HMR only. >>	TS=STXN; **If** FSASO=0, then TX_AB; **If** FSASO=1, then (TX_INV_FCS; TX_EFS(E=1)); FSTAS=FSTI=1 << Terminate the transmission of the frame by transmitting either an Abort Sequence or an Invalid FCS and setting the E bit to 1. >>
TBAD	3209	**STATION_ERR(not_correctable)** & FSMR<2 & FIPTXIS=0 & TS=STXD << Station could not complete transmission of frame; enter the Transmit Normal state. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=STXN; [TX_AB (optional-I)]; FSBPF=FSTI=1 << Optionally Transmit Abort Sequence. Force Join to enter the Bypass state. >>
TBAH	3220	**STATION_ERR(not_correctable)** & FSMR>1 & FIPTXIS=0 & TS=STXD << Station could not complete transmission of frame; enter the Transmit Normal state. >> << HMR only. >>	TS=STXN **If** FSASO=0, then TX_AB; **If** FSASO=1, then (TX_INV_FCS; TX_EFS(E=1)); FSBPF=FSTI=1 << Terminate the transmission of the frame by transmitting an Invalid FCS and setting the E bit to 1, and Force Join to enter the Bypass state. >>
TABA	3202	**TXI_REQ** & FIPTXIS=0 & FSBPF=0 & TS=STXN << SMAC TXI_(frame) is being transmitted. >>	TS=STXD; FSTI=0; TX_SFS(P=x; R=0) << Frame length for a frame in the TXI queue is always known. >>
TABC	3211	**TXI_REQ** & FIPTXIS=1 & FPBPF=0 & TS=PTXN << PMAC TXI_(frame) is being transmitted. >>	TS=STXD; FSTI=0; FPTX_LTH=1; **If** FSMR=0, then CSBTX=9; **If** FSMR=1, then CSBTX=D; **If** FSMR=2, then CSBTX=14; TX_SFS(P=x; R=0) << Frame length for a frame in the TXI queue is always known. >>

9.2.5.3 Station Monitor—Station Operation Table

Table 9.2-3—Station Monitor Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
MAD	3316	**FR_BN(SA=SUA)** & FSJC=1 & MS=SOPT << Station received a Beacon MAC frame from its C-Port and starts Hard Error Recovery by entering the Wire Fault Delay state. >>	MS=SWFD; FSHBA=FSOP=0; TSIT=R; TSLMT=R
MBD	3318	**FR_BN(SA=SUA)** & MS=STBN << Station received a Beacon MAC frame from its C-Port and continues Hard Error Recovery by entering the Wire Fault Delay state. >>	MS=SWFD; TSIT=R; TSLMT=R
MCA	3319	**FR_INS_RSP(DTR_RSP=0000)** & MS=SIT << The Station's Internal Test was successful and it transmitted an Insert Request. This frame's reception indicates the C-Port has authorized Insertion. >>	MS=SOPT
	3323	**FR_PHB(SA=SUA)** & FSHBA=1 << C-Port Heart Beat MAC frame received. >>	TSRHB=R << Reset the Heart Beat timer. >>
MBC	3317	**TSIT=E** & MS=STBN << Station has completed waiting for Wire-Fault Detection. >>	MS=SIT; **If** FSPDA=1, then Remove_station; INT_TEST
MDC	3320	**TSIT=E** & MS=SWFD << Station has completed waiting for Wire-Fault Detection. >>	MS=SIT; **If** FSPDA=1, then Remove_station; INT_TEST
	3322	**TSLMT=E** & MS=SIT << Lobe Test to be executed by the Station. >>	FSBNT=1 << Request Join to execute JS=SLT. >>
	3324	**TSQHB=E** & FSHBA=1 & FSMR<2 << Station's Heart Beat timer causes transmission of SHB_PDU. >> << 4 Mbit/s and 16 Mbit/s only. >>	TSQHB=R; TXI_SHB **If** JS=SDAC, then CSTFQ=(CSTFQ+1)
	3303	**TSQHB=E** & FSHBA=1 & FSMR>1 << Station's Heart Beat timer causes transmission of SHB_PDU. >> << HMR only. >>	TSQHB=R; TXI_SHB
	3313	**TSQP=E** & MS=STBN << Pacing timer for Beacon MAC frames has expired; transmit another Beacon MAC frame. >>	TSQP=R; **If** FSSL=0, then TXI_BN(BN_TYPE=5); **If** FSSL=1, then TXI_BN(BN_TYPE=2) << If Phantom Drive inactive: BN_TYPE=5 for HMR. >> << If Phantom Drive active: BN_TYPE=(2 or 5) for any media rate. >>

Table 9.2-3—Station Monitor Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
MAB	3314	**TSRHB=E** & FSJC=1 & MS=SOPT << Heart Beat Failure detected. Station starts Hard Error Recovery by entering the Beacon Transmit state. >>	MS=STBN; FSHBA=FSOP=0; FSTXC=1; TSIT=R; TSLMT=R; TSQP=R; **If** FSSL=0, then TXI_BN(BN_TYPE=5); **If** FSSL=1, then TXI_BN(BN_TYPE=2) << If Phantom Drive inactive: BN_TYPE=5 for HMR. >> << If Phantom Drive active: BN_TYPE=(2 or 5) for any media rate. >>

9.2.5.4 Station Error Handling—Station Operation Table

Table 9.2-4—Station Error Handling Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3401	**Burst5_error_event** & CSBE<FF & FSJC=1 & FSER=1 & MS=SOPT << 4 Mbit/s and 16 Mbit/s event only. >>	CSBE=(CSBE+1)
	3402	**Burst5_error_event** & FSJC=1 & FSER=0 & MS=SOPT << 4 Mbit/s and 16 Mbit/s event only. >>	FSER=1; TSER=R; CSBE=(CSBE+1)
	3407	**FR_NOT_COPIED** & CSRCE<FF & FSJC=1 & FSER=1 & MS=SOPT	CSRCE=(CSRCE+1)
	3408	**FR_NOT_COPIED** & FSJC=1 & FSER=0 & MS=SOPT	FSER=1; TSER=R; CSRCE=(CSRCE+1)
	3409	**FR_WITH_ERR(E=0)** & CSLE<FF & FSJC=1 & FSER=1 & MS=SOPT	CSLE=(CSLE+1)
	3410	**FR_WITH_ERR(E=0)** & FSJC=1 & FSER=0 & MS=SOPT	FSER=1; TSER=R; CSLE=(CSLE+1)
	3417	**FSTAS=1** & TS=STXN & CSABE<FF & FSJC=1 & FSER=1 & MS=SOPT << Transmitter has released an Abort Sequence. >>	FSTAS=0; CSABE=(CSABE+1)
	3418	**FSTAS=1** & TS=STXN & FSJC=1 & FSER=0 & MS=SOPT	FSTAS=0; FSER=1; TSER=R; CSABE=(CSABE+1)
	3411	**INTERNAL_ERR(correctable)** & CSIE<FF & FSJC=1 & FSER=1 & MS=SOPT	CSIE=(CSIE+1)
	3412	**INTERNAL_ERR(correctable)** & FSJC=1 & FSER=0 & MS=SOPT	FSER=1; TSER=R; CSIE=(CSIE+1)
	3426	**PM_STATUS.indication (Signal_detection=signal_acquired)** & FSSLD=1 << 4 Mbit/s and 16 Mbit/s event only. >>	FSSL=FSSLD=0

Table 9.2-4—Station Error Handling Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3427	**PM_STATUS.indication (Signal_detection=signal_loss)** & FSSLD=0 << 4 Mbit/s and 16 Mbit/s event only. >>	FSSLD=1; TSSL=R
	3428	**PM_STATUS.indication (Wire_fault=Detected)** & FSWFA=1 & FSWF=0 << Occurs only when FSPDA=1. >>	FSWF=1; TSWF=R
	3429	**PM_STATUS.indication (Wire_fault=Not_detected)** & FSWF=1 << Occurs only when FSPDA=1. >>	FSWF=0
	3431	**PS_STATUS.indication(Frequency_error)** & CSFE<FF & FSJC=1 & FSER=1 & MS=SOPT << 4 Mbit/s and 16 Mbit/s event only. >>	CSFE=(CSFE+1)
	3430	**PS_STATUS.indication(Frequency_error)** & FSJC=1 & FSER=0 & MS=SOPT << 4 Mbit/s and 16 Mbit/s event only. >>	FSER=1; TSER=R; CSFE=(CSFE+1)
	3432	**TSER=E** & ERR_SCNTR<>0 & FSJC=1 & FIPTXIS=0 << DTR Station is reporting errors. >>	**If** FSECO=0, then FSER=0; QUE_RPRT_ERR_PDU; SET ERR_SCNTR=0
	3433	**TSER=E** & ERR_SCNTR<>0 & FSJC=1 & FIPTXIS=1 << DTR C-Port is reporting errors. >>	**If** FSECO=0, then FSER=0; MRI_UNITDATA.indication (RPRT_ERR); [QUE_RPRT_ERR_PDU (optional-x)]; SET ERR_SCNTR=0
	3425	**TSER=E** & FSJC=1 & FSECO=1	TSER=R
	3423	**TSSL=E** & FSSLD=1 << Occurs only when FSPDA=1. >>	FSSL=1
	3424	**TSWFD=E** & FSJC=1 & FSWFA=0 & MS=SOPT << Occurs only when FSPDA=1. >>	FSWFA=1

9.2.5.5 Station Interface Signals—Station Operation Table

Table 9.2-5—Station Interface Signals Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3513	**DTU_UNITDATA-STATUS.request(Fail)** & FPTX_LTH=1 & FIPTXIS=1 & TS=STXD << Transmit FSM is currently transmitting a previously queued frame. This is an indication that frame Cut-through is terminating with an error. >>	DISCARD_PDU << The PDU discarded is the frame that was the subject of the previous DTU_UNITDATA.request. >>

Table 9.2-5—Station Interface Signals Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3516	**DTU_UNITDATA-STATUS.request(Fail)** & TS=STXN << Transmit FSM is currently in the normal state. This may occur between frame transmissions. >>	DISCARD_PDU << The PDU discarded is the frame that was the subject of the previous DTU_UNITDATA.request. >>
	3512	**DTU_UNITDATA-STATUS.request(OK)** & FPTX_LTH=0 & FIPTXIS=1 & TS=STXD << Transmit FSM currently transmitting a frame of unknown length. This is an indication that a C-Port Cut-through frame is being transmitted. >>	FPTX_LTH=1 << The Cut-through frame has completed with an OK status; the frame length is now known. >>
	3530	**DTU_UNITDATA.request** & FSJC=1 & FSOP=1 & FR_LTH<=SPV(MAX_TX) & FIPTXIS=1 << C-Port in Station Emulation Mode. >> << A frame of known length is passed to the this C-Port. >>	QUE_PDU
	3531	**DTU_UNITDATA.request** & FSJC=1 & FSOP=1 & FR_LTH=UNK & FIPTXIS=1 << C-Port in Station Emulation Mode. >> << A frame Cut-through operation has started and its frame length is currently not known. The data is optionally placed into the transmit queue and made available for transmission. >>	[QUE_PDU (optional-unk)] << QUE_PDU action allows the PDU_QUEUED event to occur. >>
	3532	**FR** & FPFCO=0 & FSJC=1 & FSOP=1 & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	DTU_UNITDATA.indication; DTU_UNITDATA-STATUS.indication (OK)
	3509	**FR** & FPFCO=1 & FSOP=1 & FSJC=1 & FIPTXIS=1 << Indicates that frame Cut-through has successfully completed. >>	DTU_UNITDATA-STATUS.indication (OK)
	3501	**FR** & FSJC=1 & FSOP=1 & FIPTXIS=0 << DTR Station has received a frame. >>	M_UNITDATA.indication
	3539	**FR_FC** & FPFCO=1 & FSJC=1 & FSOP=1 & FIPTXIS=1 << C-Port in Station Emulation Mode has received a frame. >>	DTU_UNITDATA.indication
	3502	**FR_LLC(DA=any_recognized_address)** & FSJC=1 & FSOP=1 & FIPTXIS=0 << DTR Station. >>	MA_UNITDATA.indication
	3534	**FR_MAC(DA<>any_recognized_address & SC<>0)** & FSJC=1 & FSOP=1 & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	MRI_UNITDATA.indication
	3540	**FR_MAC(DA=any_recognized_address & DC=0 & VI=09)**	DISCARD_PDU
	3503	**FR_MAC(DA=any_recognized_address & DC<>0 & VI<>09)** & FSJC=1 & FSOP=1 & FIPTXIS=0 << DTR Station. >>	MGT_UNITDATA.indication

Table 9.2-5—Station Interface Signals Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3533	**FR_MAC(DC<>0 & DC<>3 & SC=0)** & FSJC=1 & FSOP=1 & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	MRI_UNITDATA.indication
	3510	**FR_WITH_ERR** & FPFCO=1 & FSOP=1 & FSJC=1 & FIPTXIS=1 << C-Port in Station Emulation Mode. >> << Indicates that frame Cut-through has failed due to a frame error. >>	DTU_UNITDATA-STATUS.indication (Fail)
	3504	**FSTI=0** & FIPTXIS=0 << DTR Station. >>	PS_CONTROL.request (Transmit_mode=No_fill)
	3537	**FSTI=0** & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	{PM_CONTROL.request (Transmit_mode=No_fill)} **or** {PS_CONTROL.request (Transmit_mode=No_fill)} **<< An implementation shall take one of these two actions. >>**
	3505	**FSTI=1** & FIPTXIS=0 << DTR Station. >>	PS_CONTROL.request (Transmit_mode=Fill)
	3538	**FSTI=1** & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	{PM_CONTROL.request (Transmit_mode=Fill)} **or** {PS_CONTROL.request (Transmit_mode=Fill)} **<< An implementation shall take one of these two actions. >>**
	3506	**FSTXC=0** << 4 Mbit/s and 16 Mbit/s only >>	PS_CONTROL.request (Crystal_transmit=Not_asserted)
	3507	**FSTXC=1** **<< Note:** When operating at 4 Mbit/s and 16 Mbit/s, Crystal Transmit is controlled by the Join and Monitor Station Operation Tables, and may or may not be asserted. When operating at the HMR, Crystal Transmit shall always be asserted. >>	PS_CONTROL.request (Crystal_transmit=Asserted)
	3508	**M_UNITDATA.request** & FSJC=1 & FSOP=1 & FR_LTH<=SPV(MAX_TX)	QUE_PDU **If** (DA=any_recognized_address), then MA_UNITDATA.indication(PDU) << Support the Loop Back function in the DTR Station if necessary. >>
	3511	**MA_UNITDATA.request** & FSJC=1 & FSOP=1 & FR_LTH<=SPV(MAX_TX)	QUE_PDU **If** (DA=any_recognized_address), then MA_UNITDATA.indication(PDU) << Support the Loop Back function in the DTR Station if necessary. >>

Table 9.2-5—Station Interface Signals Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3514	**MGT_UNITDATA.request(SC<>0)** & FSOP=1 & FR_LTH<=SPV(MAX_TX)	QUE_PDU
	3515	**MGT_UNITDATA.request(SC=0)**	DISCARD_PDU
	3535	**MRI_UNITDATA.request(SC<>0)** & FSJC=1 & FSOP=1 & FR_LTH<=SPV(MAX_TX) & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	QUE_PDU
	3536	**MRI_UNITDATA.request(SC<>0)** & FSJC=1 & FSOP=1 & FR_LTH=UNK & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	[QUE_PDU (optional-unk)]

9.2.5.6 Station Miscellaneous Frame Handling—Station Operation Table

Table 9.2-6—Station Miscellaneous Frame Handling Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3600	**FR_CHG_PARM**	SET APPR_PARMS
	3601	**FR_CHG_PARM(CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=0001)
	3602	**FR_CHG_PARM(CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=0001)
	3603	**FR_INIT**	SET APPR_PARMS
	3604	**FR_INIT(CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RPS; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=0001)
	3605	**FR_INIT(CORR_PRESENT)**	TXI_RSP_PDU(DC=RPS; SC=RS; CORR=RCV_CORR; RSP_TYPE=0001)
	3608	**FR_MAC_INV (ERR_COND=SC_INVALID & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8004)
	3609	**FR_MAC_INV (ERR_COND=SC_INVALID & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8004)
	3610	**FR_MAC_INV (ERR_COND=SHORT_MAC & SC_NOT_PRESENT)**	[TXI_RSP_PDU(DC<>RS; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8001) (optional-x)]
	3630	**FR_MAC_INV (ERR_COND=SHORT_MAC & SC_PRESENT & SC<>RS)**	TXI_RSP_PDU (DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8001)

Table 9.2-6—Station Miscellaneous Frame Handling Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3612	**FR_MAC_INV (ERR_COND=SV_LTH_ERR & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8005)
	3613	**FR_MAC_INV (ERR_COND=SV_LTH_ERR & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8005)
	3614	**FR_MAC_INV (ERR_COND=SV_MISSING & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8007)
	3615	**FR_MAC_INV (ERR_COND=SV_MISSING & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8007)
	3618	**FR_MAC_INV (ERR_COND=VI_LTH_ERR & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8002)
	3619	**FR_MAC_INV (ERR_COND=VI_LTH_ERR & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8002)
	3606	**FR_MAC_INV(ERR_COND=LONG_MAC & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8009)
	3607	**FR_MAC_INV(ERR_COND=LONG_MAC & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8009)
	3616	**FR_MAC_INV(ERR_COND=SV_UNK & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8008)
	3617	**FR_MAC_INV(ERR_COND=SV_UNK & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8008)
	3620	**FR_MAC_INV(ERR_COND=VI_UNK & SC<>RS & CORR_NOT_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8003)
	3621	**FR_MAC_INV(ERR_COND=VI_UNK & SC<>RS & CORR_PRESENT)**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8003)
	3622	**FR_REMOVE(DA=broadcast)**	[TXI_RSP_PDU(DC=RCV_SC; SC=RS; RSP_TYPE=800A) (optional-x)]
	3623	**FR_REMOVE(DA=Non_broadcast)** & FSRRO=1	TXI_RSP_PDU(DC=RCV_SC; SC=RS; RSP_TYPE=800A)
	3624	**FR_RQ_ADDR** & FIPTXIS=0 << DTR Station. >>	TXI_RPRT_ADDR_PDU
	3627	**FR_RQ_ADDR** & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	[TXI_RPRT_ADDR_PDU (optional-x)]
	3625	**FR_RQ_ATTACH** & FIPTXIS=0 << DTR Station. >>	TXI_RPRT_ATTACH_PDU
	3628	**FR_RQ_ATTACH** & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	[TXI_RPRT_ATTACH_PDU (optional-x)]

Table 9.2-6—Station Miscellaneous Frame Handling Station Operation Table for the DTR Station using the TXI Access Protocol (FIPTXIS=0) or the C-Port in Station Emulation Mode using the TXI Access Protocol (FIPTXIS=1)

S/T	REF	Event/Event and conditions	Actions/Outputs
	3626	**FR_RQ_STATE** & FIPTXIS=0 << DTR Station. >>	TXI_RPRT_STATE_PDU
	3629	**FR_RQ_STATE** & FIPTXIS=1 << C-Port in Station Emulation Mode. >>	[TXI_RPRT_STATE_PDU (optional-x)]

9.2.5.7 LMT transitions for FSLMTO=1

The following transitions are used to execute the LMT when FSLMTO=1. This table is *started* [see state transition reference (REF) 3801] when the LMT function is requested and the LMT function is inactive as the result of one of the following two conditions:

a) Initial testing of the lobe when the Join Machine enters the JS=SLT state from the JS=SREG state (see 9.2.5.1, Table 9.2-1, transition 3121).
b) Beacon testing of the lobe when the Join Machine enters the JS=SLT state from the JS=SJC state (see 9.2.5.1, Table 9.2-1, transition 3114).

Table 9.2-7—Station LMT Station Operation Table for the DTR Station when executing the LMT and FSLMTO=1

S/T	REF	Event/Event and conditions	Actions/Outputs
	3806	**FR_TEST** & FSLTA=1 & CSLTF=0 << TEST MAC Frame received without errors and no more Frames to transmit. >>	FSLTA=0; FSLMTS=1; FA(TEST)=0 << Indicate LMT Testing Stage success to Join Station Operation Table 9.2-1. >>
	3805	**FR_TEST** & FSLTA=1 & CSLTF>0 << TEST MAC Frame received without errors; test incomplete. >>	TSLMTP=R; CSLTF=(CSLTF-1); TXI_TEST_PDU << Continue the LMT Testing Stage. >>
	3804	**FR_LMTN** & FSLTA=1 & FSSLMT=1 << LMT Notification MAC Frame received; exit LMT Notification Stage. >>	FSSLMT=0; TSLMTP=R; CSLTF=n7; FSLTFE=0; FA(TEST)=1; TXI_TEST_PDU << Set Station's LMT functional address active and start the LMT Testing Stage. >>
	3808	**FR_WITH_ERR** & FSLTA=1 & FSLTFE=0 & CSLTF=0 << Frame error detected; no other Frame errors present and no more Frames to transmit. >>	FSLTA=0; FSLMTS=1; FA(TEST)=0 << Indicate LMT Testing Stage success to Join Station Operation Table 9.2-1. >>
	3810	**FR_WITH_ERR** & FSLTA=1 & FSSLMT=0 & CSLTF>0 & FSLTFE=0 << Frame error detected; no other Frame errors present and more Frames to transmit. >>	FSLTFE=1; CSLTF=(CSLTF-1); TSLMTP=R; TXI_TEST_PDU << Indicate first failure and continue LMT Testing Stage. >>
	3812	**FR_WITH_ERR** & FSLTA=1 & FSSLMT=0 & FSLTFE=1 << TEST Frame error detected and another Frame error has occurred. >>	FA(TEST)=0; FSLTA=0; FSLMTF=1 << Indicate LMT Testing Stage failure to Join Station Operation Table 9.2-1. >>

Table 9.2-7—Station LMT Station Operation Table for the DTR Station when executing the LMT and FSLMTO=1

S/T	REF	Event/Event and conditions	Actions/Outputs
	3801	**FSRLMT=1** & FSLTA=0 << **Table 9.2-7 Starting Point:** Join Station Operation Table 9.2-7 has requested execution of the LMT (FSLMTO=1 only). >>	FSRLMT=FSLMTS=FSLMTF=0; FSLTA=FSSLMT=1; TSLMTR=R; TSLMTNP=R; TXI_LMTN_PDU << Start the LMT Notification Stage defined in 9.1.6.2 by transmitting the LMT Notification MAC Frame. >>
	3807	**TSLMTP=E** & FSLTA=1 & FSSLMT=0 & CSLTF=0 & FSLTFE=0 << TEST MAC Frame loss detected; no other Frame errors present and no more Frames to transmit. >>	FSLTA=0; FSLMTS=1; FA(TEST)=0 << Indicate LMT Testing Stage success to Join Station Operation Table 9.2-1. >>
	3809	**TSLMTP=E** & FSLTA=1 & FSSLMT=0 & FSLTFE=0 & CSLTF>0 << TEST MAC Frame loss detected; no other Frame errors present and more Frames to transmit. >>	FSLTFE=1; CSLTF=(CSLTF-1); TSLMTP=R; TXI_TEST_PDU << Indicate first failure and continue the LMT Testing Stage. >>
	3811	**TSLMTP=E** & FSLTA=1 & FSSLMT=0 & FSLTFE=1 << TEST Frame loss detected and another Frame error has occurred. >>	FA(TEST)=0; FSLTA=0; FSLMTF=1 << Indicate LMT Testing Stage failure to Join Station Operation Table 9.2-1. >>
	3802	**TSLMTNP=E** & FSLTA=1 & FSSLMT=1 << LMT Notification MAC Frame Pacing timer expired and TSLMTP has not yet expired. >>	TSLMTNP=R; TXI_LMTN_PDU << Continue LMT Notification Stage and retransmit the LMT Notification MAC Frame. >>
	3803	**TSLMTR=E** & FSLTA=1 & FSSLMT=1 << LMT Notification Frame not received before TSLMTR expired. >>	FSLTA=0; FSLMTF=1 << Indicate LMT Notification Stage failure to Join Station Operation Table 9.2-1. >>

9.2.5.8 Precise specification of terms

This subclause provides precise specification of terms used in the “Event/Event and conditions” and the “Actions/Outputs” columns of the Station Operation Tables.

9.2.5.8.1 Precise specification of “Event/Event and conditions”

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
{flag}=0	The specified flag is set to zero (false).
{flag}=1	The specified flag is set to one (true).
{term1} < {term2}	Term 1 is less than term 2.
{term1} <= {term2}	Term 1 is less than or equal to term 2.
{term1} <> {term2}	Term 1 is not equal to term 2.
{term1} = {term2}	Term 1 is equal to term 2.
{term1} > {term2}	Term 1 is greater than term 2.
{term1} >= {term2}	Term 1 is greater than or equal to term 2.
{timer}=E	The specified timer has expired.

The following additional items of relevance are used in the tables:

— **&** means “and”

The following definitions apply to all media rates unless specifically limited to a particular media rate or rates.

Precise specification of “Event/Event and conditions”	
Event or condition term	**Meaning of this term**
AND(x,y)	Bit-wise Logical AND function of binary objects x and y.
AP_RSP=value	The AP_RSP subvector, in the Registration Response MAC frame received, is equal to the hexadecimal value indicated.
Burst5_error_event << Occurs only at 4 Mbit/s and 16 Mbit/s. >>	A PM_STATUS.indication(Burst5_error) has occurred. The conditions under which a Burst5_error is excluded are not uniquely specified by this standard (see Counter Burst Error in 3.6). At a minimum, the Station shall include the first Burst5_error following a valid MAC frame copied by the Station if the Burst5_error occurs within a frame. The Station may include every Burst5_error.
Connect.SMAC	The SMAC receives the command from management to start the process to join the network.
CORR_NOT_PRESENT	The received frame did not contain a correlator subvector.
CORR_PRESENT	The received frame did contain a correlator subvector.
DA<>any_recognized_address	The DA of the received frame does not match any of the Station’s addresses being: (a) Any of the Station’s individual addresses; or (b) Any of the Station’s group addresses; or (c) Any of the Station’s functional addresses; or (d) Any of the broadcast addresses defined in 3.2.4.1.
DA=any_recognized_address	The DA of the received frame matches any of the Station’s addresses being: (a) One of the Station’s individual addresses; or (b) One of the Station’s group addresses; or (c) One of the Station’s functional addresses; or (d) One of the broadcast addresses defined in 3.2.4.1.
DA=MA	The DA of the received frame is equal to the individual address of the Station. If the Station’s individual address is a universally administered address, then all 48 bits must match. If the Station’s individual address is a locally administrated address, then either a hierarchical address match or a 48-bit address match is allowed.
DA=Non_broadcast	The received frame was not sent to a broadcast address, but otherwise addressed to the Station.
DC<>0 & DC<>3	The destination class is not a Ring Station or a C-Port.
Disconnect.SMAC	The request from local management to remove the Station from the ring.
DTR_RSP=value	The DTR Response subvector, contained in the Insert Response MAC Frame, has the indicated hexadecimal value.
DTU_UNITDATA-STATUS.request(Status_Code)	Frame status is reported by the DTU to the PMAC. Status_Code may be one of the following: — OK: The frame has been successfully transferred to the PMAC without error. — Fail: Transfer of the frame to the PMAC has failed due to a frame error.
DTU_UNITDATA.request	The DTU requests a frame be transmitted.

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
EOB	End of byte: This event occurs each time the last bit of an octet has been transmitted in the Transmit Data state (TS=STXD).
EOD	End of data: This event occurs when the last octet of the Information Field has been transmitted in the Transmit Data state (TS=STXD).
ERR_COND=LONG_MAC	MAC frame too long; INFO field larger than maximum allowed VI value (see 10.3.6.5).
ERR_COND=SC_INVALID	Invalid Source Class (see 10.3.6.5).
ERR_COND=SHORT_MAC	MAC frame is not long enough to contain VL, VC, and VI fields (see 10.3.6.5).
ERR_COND=SV_LTH_ERR	Subvector length error (see 10.3.6.5).
ERR_COND=SV_MISSING	Missing Required Subvector (see 10.3.6.5).
ERR_COND=SV_SVV_ERR	A subvector contains an invalid subvector value (see 10.3.6.5).
ERR_COND=SV_UNK	Unknown subvector SVI value (see 10.3.6.5).
ERR_COND=VI_LTH_ERR	Vector length error. VL is not equal to the sum of all the SVL's plus the length of VL, VC, and VI fields, or VL does not agree with the length of the frame (see 10.3.6.5).
ERR_COND=VI_UNK	Unrecognized vector ID value (see 10.3.6.5).
ERR_SCNTR<>0	Any Station error counter is not equal to 0.
FR	A frame has been received and meets the frame receive criteria specified in 4.3.2 (4 Mbit/s and 16 Mbit/s operation only) or 9.1.1.6 (100 Mbit/s operation only).
FR_AC	A bit sequence that indicates — A frame's SD and AC fields at 4 Mbit/s and 16 Mbit/s have been received as specified in 4.3.2; or — A frame's SSD and AC fields at the HMR have been received as specified in 9.1.1.6.
FR_AMP	A verified Active Monitor Present MAC frame (10.3.3.3) is received.
FR_BN(criteria)	A verified Beacon MAC Frame (10.3.6) is received meeting the specified criteria.
FR_CHG_PARM(criteria)	A verified Change Parameters MAC frame (10.3.6) is received meeting the specified criteria.
FR_COPIED(criteria)	The SMAC successfully copied the received frame meeting the specified criteria.
FR_CT	A verified Claim Token MAC frame (10.3.6) is received.
FR_FC	A bit sequence that matches a frame's SD, AC, and FC fields has been received as specified in 9.1.1.6.
FR_INIT	A verified Initialize Station MAC frame (10.3.6) is received.
FR_INIT(criteria)	A verified Initialize Station MAC frame (10.3.6) is received meeting the specified criteria.
FR_INS_RSP(criteria)	A verified Insert Response MAC frame is received meeting the specified criteria.
FR_LLC(criteria)	A valid LLC frame is received meeting the specified criteria.
FR_LMTN	A verified LMT Notification MAC frame (14.1.2) is received.
FR_LTH	The length of the frame to be transmitted. The value for the frame length includes all of the frame format fields, beginning with the starting delimiter (SD) and including the interframe gap (IFG).

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
FR_LTH<=SPV(MAX_TX)	The frame length to be transmitted is less than or equal to the maximum allowed frame length by the Station's selected media rate.
FR_LTH=UNK	The frame length to be transmitted is unknown.
FR_MAC(criteria)	A valid MAC frame is received meeting the specified criteria.
FR_MAC_INV(reason)	A valid MAC frame is received which fails verification (10.3.6) for the reason specified.
FR_NOT_COPIED	The Station detects a frame addressed to one of its recognized addresses, but does not copy the frame.
FR_PHB(criteria)	A verified C-Port Heart Beat MAC frame (10.3.2.3) is received meeting the specified criteria.
FR_REG_RSP(criteria)	A verified Registration Response MAC frame (10.3.2.13) is received meeting the specified criteria.
FR_REMOVE(criteria)	A verified Remove MAC frame (10.3.6) is received meeting the specified criteria.
FR_RMV_ALRT << HMR only. >>	A verified Remove Alert MAC frame (14.3.1.3) is received.
FR_RP	A verified Ring Purge MAC frame (10.3.6) is received.
FR_RQ_ADDR	A verified Request Address MAC frame (10.3.6) is received.
FR_RQ_ATTACH	A verified Request Attachment MAC frame (10.3.6) is received.
FR_RQ_STATE	A verified Request Station State MAC frame (10.3.6) is received.
FR_SHB	A verified Station Heart Beat MAC frame (10.3.2.4) is received.
FR_SMP	A verified Standby Monitor Present MAC frame (10.3.3.4) is received.
FR_TEST	A verified LMT MAC frame (14.3.1.1) is received.
FR_WITH_ERR	A frame is received with errors (see 4.3.2).
FR_WITH_ERR(criteria)	A frame is received with errors (see 4.3.2) meeting the specified criteria.
INTERNAL_ERR	Any internal error occurred that prevented the Station from following the established protocol (e.g., parity error).
INTERNAL_TEST_FAILURE	The Station failed during internal testing.
JS=state	The Join FSM is in the specified state.
M_UNITDATA.request	The Bridge interface requests a frame to be transmitted.
MA_UNITDATA.request	The LLC interface requests a frame to be transmitted.
MGT_UNITDATA.request	The MGT interface requests a frame to be transmitted.
MRI_UNITDATA.request	The MRI requests a frame to be transmitted.
MS=state	The Monitor FSM is in the specified state.
PDU_QUEUED	A frame is queued for transmission.
PM_STATUS.indication (Signal_detection=signal_acquired) << Occurs only at 4 Mbit/s and 16 Mbit/s. >>	The PHY indicates valid receiver signal (see 5.1.4.1).
PM_STATUS.indication (Signal_detection=signal_loss) << Occurs only at 4 Mbit/s and 16 Mbit/s. >>	The PHY indicates loss of valid receiver signal (see 5.1.4.1).
PM_STATUS.indication (Wire_fault=Detected) << Occurs only when FSPDA=1. >>	The PHY indicates the presence of a Wire Fault (see 5.1.4.1).

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
PM_STATUS.indication (Wire_fault=Not_detected) << Occurs only when FSPDA=1. >>	The PHY indicates the absence of a Wire Fault (see 5.1.4.1).
PORT_ERR(criteria)	Any internal condition that prevents successful completion of the PDU transmit operation. The criterion is either correctable (C-Port counts error) or noncorrectable (C-Port closes).
PS_STATUS.indication (Frequency_error) << Occurs only at 4 Mbit/s and 16 Mbit/s. >>	The PHY indicates the frequency of the received data is out of tolerance (see 5.1.2.3).
PS_STATUS.indication (Link_status=Asserted) << Occurs only at the HMR. >>	The 100 Mbit/s PHY indicates that the link is active (9.8.1.1.3).
PS_STATUS.indication (Link_status=Not_asserted) << Occurs only at the HMR. >>	The 100 Mbit/s PHY indicates that the link is inactive (9.8.1.1.3).
SA<>MA	The SA of a received frame is not equal to the individual address of the Station.
SA<>SUA	The SA of a received frame is not equal to the Station's SUA.
SA=MA	The SA of a received frame is equal to the individual address of the Station.
SA=SUA	The SA of a received frame is equal to the SUA.
SC_NOT_PRESENT	The MAC frame is too short to contain the source class.
SC_PRESENT	The MAC frame is long enough to contain the source class.
SC<>RS	The Source Class is not a Ring Station (<>0).
SC=0	The Source Class is a Ring Station.
SC=CRS	The Source Class is 4 (Configuration Report Server).
SC=RPS	The Source Class is 5 (Ring Parameter Server).
SPV(AP_MASK)=value	The value of SPV(AP_MASK) is equal to the hexadecimal value indicated (see 10.5.1.2).
SPV(MAX_TX)	SPV(MAX_TX) is defined in 10.5.1.2.
STATION_ERR	Any internal condition that prevents successful completion of the PDU transmit operation.
SUA	The Stored Upstream Address value.
TEST_FAILURE	The Station failed its self-test.
TEST_OK	The Station passed its self-test.
TS=state	The Transmit FSM is in the specified state.
TXI_REQ	The SMAC requests a frame be transmitted.

9.2.5.8.2 Precise specification of “Actions/Outputs”

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
{counter}=({counter}+1)	Increment the specified counter by one.
{counter}=({counter}-1)	Decrement the specified counter by one.
{counter}=value	Set the specified counter to the specified value.
{flag}=0	Set the value of the specified flag to zero (false).
{flag}=1	Set the value of the specified flag to one (true).
{timer}=R	The specified timer is set to its initial value and started.
Variable=value	Set the variable to the specified value.

The following additional items of relevance are used in the tables:

— **;** means “and”

The following definitions apply to all media rates unless specifically limited to a particular media rate or rates.

Precise specification of “Actions/Outputs”	
Action or output term	**Meaning of this term**
AP_REQ=value	The AP_REQ subvector, in the REG_REQ MAC frame being transmitted, is set to the hexadecimal value indicated.
BN_TYPE=value	The value of the beacon type subvector to be transmitted.
CORR=RCV_CORR	The value of the correlator subvector will be the same value as the received correlator subvector.
CORR=UNK_VALUE (optional-x)	The frame received did not contain a correlator subvector (3.3.4); thus, the value of the correlator subvector to be transmitted is unspecified and the subvector may be omitted. The standard recommends new implementations not transmit the correlator subvector when no correlator subvector was received.
CSBTX=value	The counter CSBTX is set to the hexadecimal value indicated.
DC<>RS	The destination class field DC shall not be 0. Note that the source class field (SC) of the received frame was not present and, thus, the destination class of the response frame is not defined, but shall not be the ring Station class.
DC=CRS	The value of the Destination Class is 4 (Configuration Report Server).
DC=RCV_SC	The destination class field DC shall contain the value of the source class (SC) field of the received frame.
DISCARD_PDU	Discard the PDU.
DTU_UNITDATA-STATUS.indication (Status_Code)	Frame status is indicated by the PMAC to the DTU. Status_Code may be one of the following: — OK: The frame has been successfully transferred to the DTU without error. — Fail: Transfer of the frame to the DTU has failed due to a frame error.
DTU_UNITDATA.indication	The frame is indicated to the DTU.
Flush_transmit_queues	The transmitter is instructed to discard any frames in its transmit queues.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
FR_LTH<=PPV(MAX_TX)	The length of the frame to be transmitted is less than or equal to the C-Port's maximum allowed frame length.
FSRLMT=1	The Station requests the LMT function defined in 9.1.6.2 and specified by Station Operation Table 9.2-7.
FTI=x	The value of FTI is not specified.
IAC=SPV(IAC)	The Station indicates the number of Individual addresses supported, as defined in the Station Policy Variable (SPV) in the REG_REQ MAC frame.
INSERT << Occurs only when FSPDA=1 >>	Request the PHY to physically connect the Station to the network [PM_CONTROL.request(Insert_station) in 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s, and 9.8.1.1.7 for 100 Mbit/s].
INT_TEST	The station starts its internal tests.
JS=state	The Join FSM transitions to the specified state.
M_UNITDATA.indication	The frame is indicated to the bridge interface.
MA_UNITDATA.indication	The frame is indicated to the LLC interface.
MGT_UNITDATA.indication	The frame is indicated to the management interface.
MS=state	The Monitor FSM transitions to the specified state.
P	The value of the P bits in the AC field.
PD=SPV(PD)	The PD subvector, in REG_REQ MAC frame being transmitted, is set to the value of the Station Policy Variable (SPV) (PD).
Pm	The priority of the PDU being queued.
PM_CONTROL.request (Transmit_mode=Fill)	The C-Port PMAC requests the PMC to stop repeat and start sourcing fill (see 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s; not used for 100 Mbit/s).
PM_CONTROL.request (Transmit_mode=No_fill)	The C-Port PMAC requests the PMC to stop sourcing fill and start repeat (see 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s; not used for 100 Mbit/s).
PS_CONTROL.request (Crystal_transmit=Asserted)	The Station SMAC or C-Port PMAC requests Crystal_transmit (see 5.1.2.4 for 4 Mbit/s and 16 Mbit/s operation, or 9.8.1.1.4 for 100 Mbit/s operation.).
PS_CONTROL.request (Initialize, Media_rate=2)	The Station SMAC requests the PSC to initialize the PHY for operation at 100 Mbit/s.
PS_CONTROL.request (Transmit_mode=Fill)	The C-Port PMAC requests the PSC stop repeat and start sourcing fill (see 9.7.2.2 for 4 Mbit/s and 16 Mbit/s, or 9.8.1.1.4 for 100 Mbit/s).
PS_CONTROL.request (Transmit_mode=No_fill)	The C-Port PMAC requests the PMC to stop sourcing fill and start repeat (see 9.7.2.2 for 4 Mbit/s and 16 Mbit/s, or 9.8.1.1.4 for 100 Mbit/s).
PS_CONTROL.request Crystal_transmit=Not_asserted) << Used only by 4 Mbit/s and 16 Mbit/s. >>	The Station SMAC removes the Crystal_transmit request (see 5.1.2.4).
QUE_PDU	Queue the PDU for transmission.
Remove_station	Request the PHY to physically disconnect the Station from the link [PM_CONTROL.request(Remove_station)] in 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s, and 9.8.1.1.7 for 100 Mbit/s.
RSP_TYPE=value	The Response Code subvector shall have the hexadecimal value specified.
SC=RS	The SC field shall contain the value zero (Ring Station).
SET APPR_PARMS	The Station shall set the Station's parameters to the values indicated in the received frame.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
SET ERR_SCNTR=0	Set the values for all of the error counters reported in the Report Error MAC frame to 0.
Set_initial_conditions << 4 Mbit/s and 16 Mbit/s only. >>	The Station SMAC shall set all flags, all counters, and all stored values to 0 and stop all timers. The Monitor and Transmit FSM states are not specified. The PS_CONTROL.request(Medium_rate) and PM_CONTROL.request(Medium_rate) shall indicate to the PHY the value of FSMRO (less than 2).
Set_initial_conditions << HMR only. >>	The Station SMAC shall set all flags, all counters, and all stored values to 0 and stop all timers. The Monitor FSM state is not specified. The PS_CONTROL.request(Medium_rate) and PM_CONTROL.request(Medium_rate) shall indicate to the PHY the value of FSMR (greater than 1).
SUA=SA	Store the value of the source address from the received frame as the Stored Upstream Address.
TEST	Used by the 4.3 Station Operation Table (see 4.3.5.2 for definition).
TS=state	The Transmit FSM transitions to the specified state.
TX_AB	The Station shall transmit an Abort Sequence as follows: — 4 Mbit/s and 16 Mbit/s: A Starting Delimiter immediately followed by an Ending Delimiter. — 100 Mbit/s: A frame abort [PS_CONTROL.request(Abort_frame) as specified in 9.8.1.1.4].
TX_EFS << HMR only. >>	The Station shall transmit an end-of-frame sequence composed of ET, ESD, and IFG fields. The ET E-bit shall be zero.
TX_EFS(I=0) << 4 Mbit/s and 16 Mbit/s only. >>	The Station shall transmit an end-of-frame sequence composed of ED, FS, and IFG fields. The E, I, A, and C bits shall be zero.
TX_EFS(E=1) << HMR only. >>	The C-Port shall transmit an end-of-frame sequence composed of ET, ESD, and IFG fields. The E-bit shall be one.
TX_EFS(I=0, E=1) << 4 Mbit/s and 16 Mbit/s only. >>	The C-Port shall transmit an end-of-frame sequence composed of ED, FS, and IFG fields. The I, A, and C bits shall be zero. The E bit shall be one.
TX_FCS	The Station shall transmit frame check sequence for the frame, as defined in 3.2.7.
TX_SFS(P=value; R=value)	The Station shall transmit the start-of-frame sequence as follows: — 4 Mbit/s and 16 Mbit/s: A Starting Delimiter followed by the AC field as defined below. — 100 Mbit/s: A Start Frame [PS_UNITDATA.request(Start_ stream_delimiter); see 9.8.1.1.2] followed by the AC field as defined below. The AC field's P (priority) and R (reservation) values shall be as specified, and T=1 and M=0.
TXI_BN	The Station shall transmit a Beacon MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
TXI_INS_REQ	The Station shall transmit a Insert Request MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_INV_FCS	The C-Port shall transmit an invalid FCS.
TXI_LMTN_PDU(criteria) << HMR only. >>	The Station shall transmit a LMT Notification MAC frame with the AC field values of P=0, T=1, M=0, R=000 and the criteria specified. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_REG_REQ(criteria)	The Station shall transmit a Registration Request MAC frame with the AC field values of P=x, T=1, M=0, R=000 and the criteria specified. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_RMV_ALRT << HMR only. >>	The Station shall transmit a Remove Alert MAC frame with the AC field values of P=x, T=1, M=0, R=000 and the criteria specified. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_RPRT_ADDR_PDU	The Station shall transmit a Report Station Addresses MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_RPRT_ATTCH_PDU	The Station shall transmit a Report Station Attachment MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_RPRT_ERR_PDU	The Station shall transmit a Report Error MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_RPRT_STATE_PDU	The Station shall transmit a Report Station State MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_RSP_PDU(criteria)	The Station shall transmit a Response MAC frame with the AC field values of P=x, T=1, M=0, R=000 and the criteria specified. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).
TXI_SHB	The Station shall transmit a Station Heart Beat MAC frame with the AC field values of P=x, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
TXI_TEST << This action is *only* executed when FSLMTO=0. >> << 4 Mbit/s and 16 Mbit/s only. >>	The Station shall perform a test of its transmit functions, its receive functions, and the medium between the Station and the C-Port. This test shall complete prior to the expiration of TSLMTC. It is recommended that the data path include the elastic buffer and the fixed latency buffer (5.8). A Station shall fail the test if the sustained bit error rate does not meet the criteria defined in Annex P.
TXI_TEST_PDU(criteria)	The Station shall transmit a LMT MAC frame with the AC field values of P=0, T=1, M=0, R=000 and the criteria specified. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event (see 9.1.8).

Replace 9.3 with the following:

9.3 C-Port Join and TXI Access Protocol Specification

This subclause defines the DTR operation of a C-Port when operating in Port mode. This subclause supports the TXI Access Protocol and includes the Join process of the TKP Access Protocol.

The following configurations (see Figure 9-1) are supported by this subclause:

- Configuration 1, entity A: The TXI Access Protocol for the C-Port when operating in Port mode is fully defined in this subclause.
- Configuration 2, entity C: The TXI Access Protocol for the C-Port when operating in Station Emulation mode is detected by this subclause and uses the Station Operation Tables defined in 9.2.
- Configuration 3, entity E: The TKP Access Protocol for the C-Port when operating in Port mode uses the Join Port Operation Table defined in this subclause and the Transmit, Monitor, Error Handling, Interface, and Miscellaneous Frame Handling Port Operation Tables defined in 9.4.
- Configuration 4, entity G: The TKP Access Protocol for the C-Port when operating in Station Emulation mode is detected by this subclause and uses the Port Operation Tables defined in 9.5.

Six tables called C-Port Operation Tables specify the C-Port's TXI Access Protocol. The C-Port Operation Tables are functionally divided into the Join, Transmit, and Monitor functions, as well as their support functions.

The operation of the Join, Transmit, and Monitor functions is explained using high-level FSM diagrams in 9.3.1.1 through 9.3.1.3.

The C-Port Operation Tables are presented as follows:

- C-Port Join Port Operation Table 9.3-1;
- C-Port Transmit Port Operation Table 9.3-2 for the TXI Access Protocol;
- C-Port Monitor Port Operation Table 9.3-3 for the TXI Access Protocol;
- C-Port Error Handling Port Operation Table 9.3-4 for the TXI Access Protocol;
- C-Port Interface Signals Port Operation Table 9.3-5 for the TXI Access Protocol;
- C-Port Miscellaneous Frame Handling Port Operation Table 9.3-6 for the TXI Access Protocol.

Low-level FSM diagrams representing all state changes in the Join, Transmit, and Monitor Port Operation Tables are presented in Annex M.

9.3.1 FSM overview

This subclause and its figures provide an overview of the C-Port TXI Access Protocol Join, Monitor, and Transmit FSMs. Functions performed by these FSMs are defined in the C-Port Operation Tables defined in 9.3.4. See 9.1.1.4 for a discussion of the interaction between the Join, Transmit, and Monitor FSMs.

9.3.1.1 C-Port Join FSM overview

The C-Port Join FSM overview diagram is shown in Figure 9.3-6. The Join FSM always begins in the Bypass state (JS=BP). C-Port policy flags, set prior to management issuing a Connect.PMAC command, determine the operational characteristics of the C-Port. The C-Port may operate in either Port mode or Station Emulation mode. Station Emulation mode operation is initiated in this subclause and defined in 9.2 and 9.5. Port mode operation is defined in this subclause. This Join FSM is used to support both the TKP and the TXI Access Protocols.

The C-Port participates in the Registration Process when the attached Station initiates registration. The Join process continues with Lobe Test (JS=PLT) where the C-Port supports the Station's actions by providing a repeat path. Once the Station signals that the lobe test has completed, the C-Port reports to the Station the results of the DAC (JS=PDAC). When the DAC is successful, the C-Port completes the Join process by entering Join Complete TXI (JS=PJCI).

When supporting either a Classic Station, or a DTR Station using the TKP Access Protocol, the C-Port supports the Station's LMT while still in Registration (JS=PREG). However, if the C-Port is configured by management to support only the TXI Access protocol (PPV(AP_MASK)=0002), then the C-Port shall not supply a repeat path while in the registration state (JS=PREG). The C-Port exits Registration when the Station's Phantom Drive is detected and starts a Claim Token cycle to minimize the time it will take for a station to join. The Join FSM provides the Registration Query protocol (JS=PRQ) to permit a station to modify its operational mode from TKP to TXI. This Join FSM is used to complete the join process, while the Monitor and Transmit FSMs are defined in 9.4.

The precise definition of the C-Port Join FSM is found in Table 9.3-1.

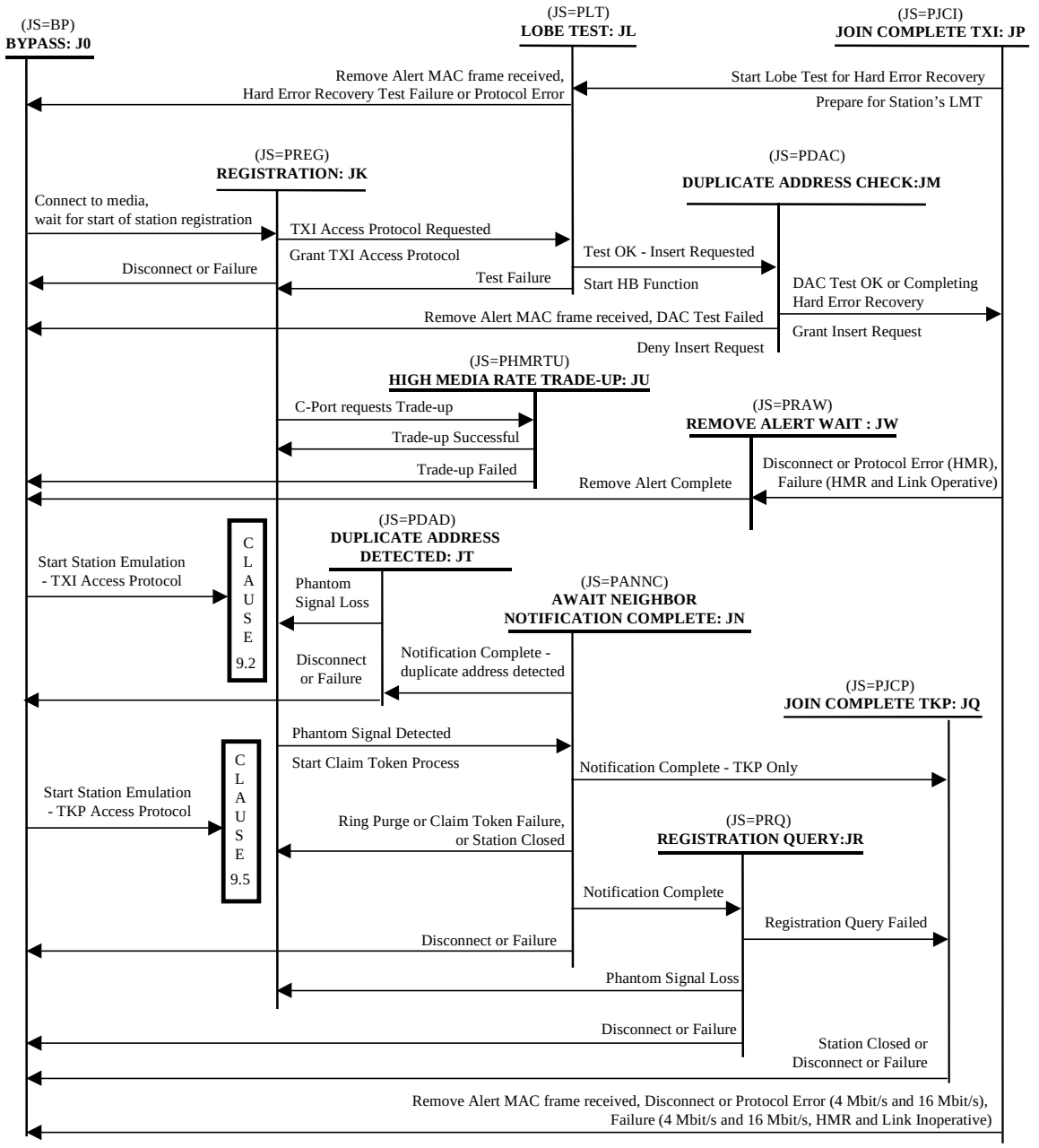

Figure 9.3-6—Overview C-Port Join FSM

9.3.1.2 C-Port Transmit FSM overview

The C-Port Transmit FSM is shown in Figure 9.3-7. The transmit FSM is used to transmit frames as described in 9.1.8 and to supply a repeat path for use by the Station.

The precise definition of the Transmit FSM is found in Table 9.3-2.

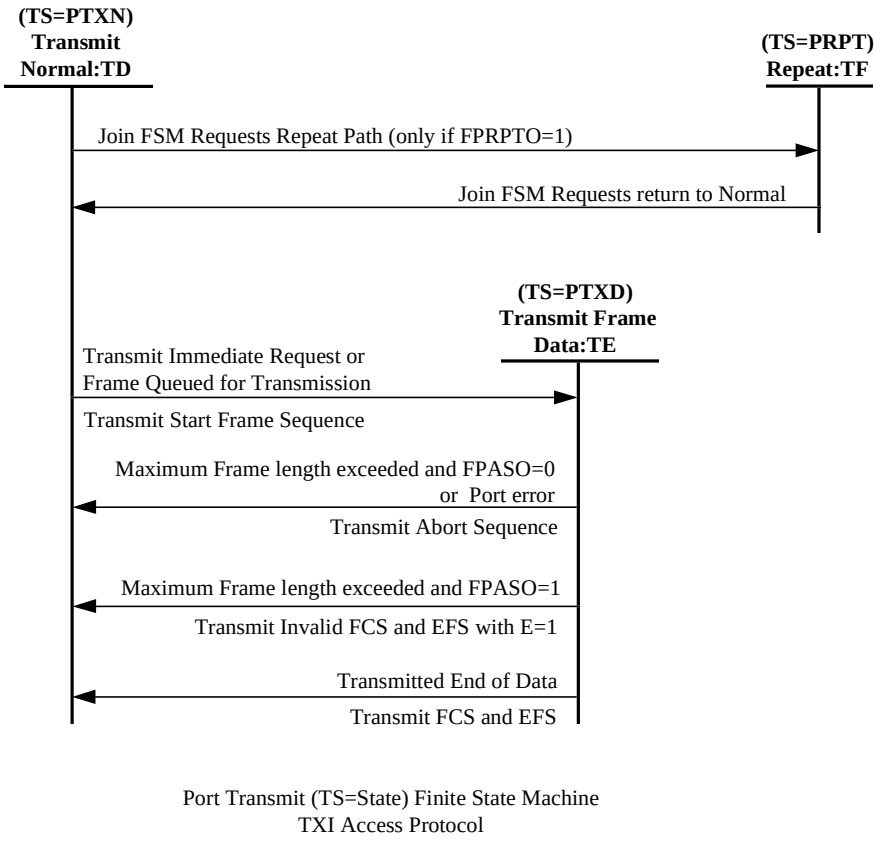

Figure 9.3-7—Overview C-Port Transmit FSM

9.3.1.3 C-Port Monitor FSM overview

The C-Port Monitor FSM is shown in Figure 9.3-8. The monitor FSM supports the Heart Beat, Hard Error Recovery, and Error Reporting functions as described in 9.1.9, 9.1.10, and 9.1.11, respectively.

The precise definition of the Monitor FSM is found in Table 9.3-3 through Table 9.3-6.

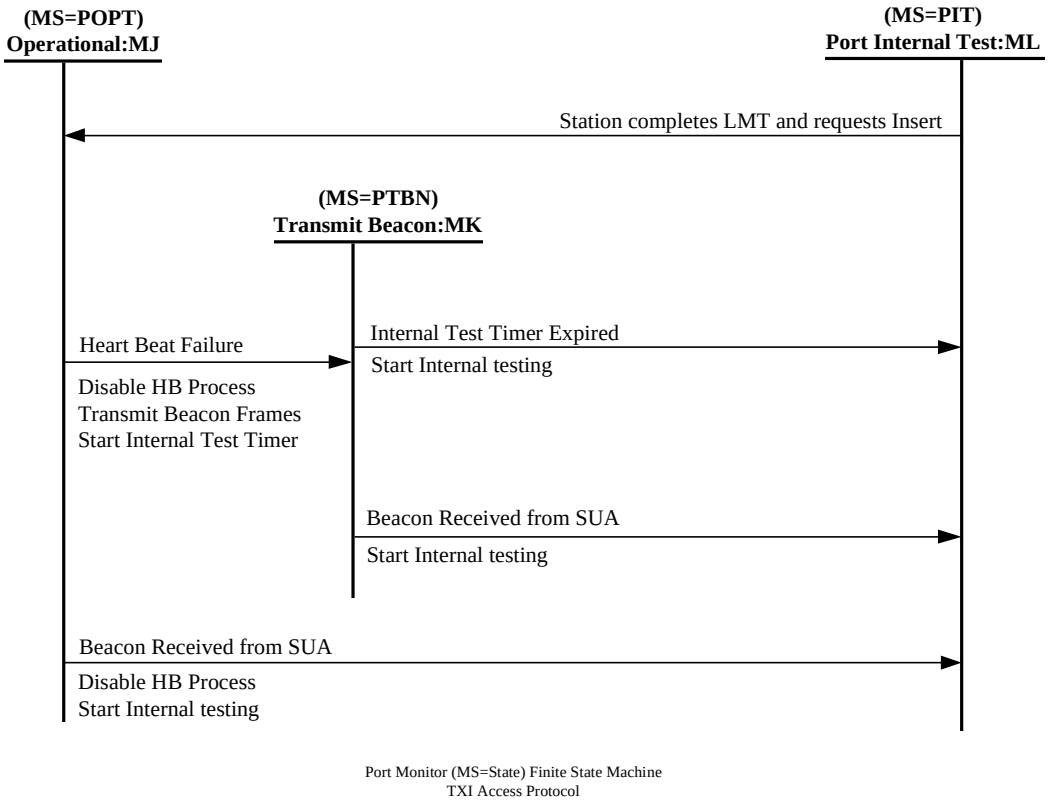

Figure 9.3-8—Overview C-Port Monitor FSM

9.3.2 Abbreviations and notations

The following abbreviations and notations are used in the C-Port Operational Tables and State Machine Descriptions. Additional terms may be found in 4.2.3 and 4.2.4.

TXI C-Port Policy Flag Notations

FPACO = Flag, C-Port AC Repeat Path Option
FPANO = Flag, C-Port Auto-Negotiation Option
FPASO = Flag, C-Port Abort Sequence Option
FPBHO = Flag, C-Port Beacon Handling Option
FPECO = Flag, C-Port Error Counting Option
FPFCO = Flag, C-Port Frame Control Option
FPMRO = Flag, C-Port Medium Rate Option
FPOTO = Flag, C-Port Operation Table Option
FPRPTO = Flag, C-Port Repeat Option

PMAC Policy Variable Notations

PPV(AP_MASK) = Access Protocol Mask
PPV(MAX_TX) = Maximum Octets Transmit
PPV(PD_MASK) = Phantom Subvector Value Mask

PMAC Interface Flag Notations

FIPTKPPE = Flag, Interface C-Port TKP Port Mode Error
FIPTKPP = Flag, Interface C-Port TKP Port Mode
FIPTKPS = Flag, Interface C-Port TKP Station Emulation
FIPTXIS = Flag, Interface C-Port TXI Station Emulation

PMAC Protocol Flag Notations

FPBNT = Flag, C-Port beacon test
FPBLT = Flag, C-Port break lobe test
FPBPF = Flag, C-Port bypass force
FPBPW = Flag, C-Port bypass wait
FPDLT = Flag, C-Port disrupt lobe test
FPDTUREQ = Flag, C-Port DTU request pending
FPEFS = Flag, C-Port ending frame sequence sent
FPER = Flag, C-Port error report
FPHBA = Flag, C-Port heart beat active
FPINSD = Flag, C-Port insert detected
FPINSLE = Flag, C-Port insert loss enabled
FPJC = Flag, C-Port join complete
FPMR = Flag, C-Port media rate
FPOP = Flag, C-Port operational
FPPLD = Flag, C-Port protocol loss detect
FPRPT = Flag, C-Port repeat path enabled
FPSL = Flag, C-Port signal loss
FPSLD = Flag, C-Port signal loss detected
FPTAS = Flag, C-Port Transmit Abort Sequence
FPTI = Flag, C-Port transmit idles
FPTXC = Flag, C-Port transmit from crystal
FPTX_LTH = Flag, C-Port transmit length

PMAC Join State Notations

JS=BP = Bypass
JS=PANNC = C-Port Await Neighbor Notification Complete
JS=PDAC = C-Port DAC
JS=PDAD = C-Port Duplicate Address Detected
JS=PJCI = C-Port Join Complete TXI
JS=PJCP = C-Port Join Complete TKP
JS=PLT = C-Port Lobe Test
JS=PRAW = C-Port Remove Alert Wait
JS=PREG = C-Port Registration
JS=PRQ = C-Port Registration Query

PMAC Transmit State Notations

TS=PRPT = C-Port Repeat
TS=PTXD = C-Port Transmit Frame Data
TS=PTXN = C-Port Transmit Normal

PMAC Monitor State Notations

MS=POPT = C-Port Operational
MS=PIT = C-Port Internal Test
MS=PTBN = C-Port Transmit Beacon

SMAC Protocol Flag Notations

FSMR = Flag, Station media rate

TXI Station Policy Flag Notations

FSMRO = Flag, Station media rate option

PMAC Error Counter Notations

CPABE = Counter, Abort Error
CPBE = Counter, Burst Error
CPFE = Counter, Frequency Error
CPIE = Counter, Internal Error
CPLE = Counter, Line Error
CPRCE = Counter, Receive Congestion Error

PMAC Counter Notations

CPBTX = Counter, C-Port bytes transmitted
CPRAT = Counter, C-Port remove alert transmit
CPRQ = Counter, C-Port registration query

PMAC Stored Value Notations

S_AP = Stored Access Protocol
SDAC_RC = Stored DAC return code
SIAC = Stored individual address count
SPD = Stored phantom subvector value
SUA = Stored upstream address

PMAC Timer Notations

TPBLT = Timer, C-Port break lobe test
TPDLT = Timer, C-Port disrupt lobe test
TPER = Timer, C-Port error report
TPHMRW = Timer, C-Port HMR wait
TPIRD = Timer, C-Port insert response delay
TPIT = Timer, C-Port internal test
TPLMTR = Timer, C-Port LMT running
TPPD = Timer, C-Port phantom detect
TPPLD = Timer, C-Port phantom loss detect
TPQHB = Timer, C-Port queue heart beat
TPQP = Timer, C-Port queue PDU
TPRAP = Timer, C-Port remove alert pace
TPRHB = Timer, C-Port received heart beat
TPRQD = Timer, C-Port registration query delay
TPSL = Timer, C-Port signal loss
TPTUAD= Timer, C-Port Trade-up Assured Delivery

9.3.3 State Machine Elements

The state machines use the following counters, flags, and states to describe the operation of the C-Port. These are logical elements used solely to describe the operation and do not specify an implementation. The value of the flags and counters are only meaningful internally to the state machine definition. Conformance will be based only on the C-Port's ability to perform the protocol, as specified by the C-Port Operation Tables in 9.3, 9.4, and 9.5.

9.3.3.1 PMAC Counters

Unless otherwise specified, all counters are set to 0 by the "Set_initial_conditions" action as the result of the Join FSM transition detecting the Connect.PMAC request.

A counter may be set to a value, incremented, or decremented because of an action specified in the C-Port operation table.

The following C-Port counters are defined.

Counter, C-Port Bytes Transmitted (CPBTX)

The counter CPBTX is used by the Transmit FSM to limit the number of octets that can be transmitted. The CPBTX is compared against PPV(MAX_TX). When CPBTX exceeds PPV(MAX_TX), the Transmit FSM terminates the transmission of the frame and transmits an abort sequence. PPV(MAX_TX) is defined in 10.5.2.2 when operating at 4 Mbit/s and 16 Mbit/s, and 14.5.2.2 when operating at the HMR.

When PPV(MAX_TX) is assigned a value range, a single value within the range is used for the purpose of comparison. An implementation is not required to use the same value of PPV(MAX_TX) for each comparison.

Counter, C-Port Remove Alert Transmit (CPRAT)

The counter CPRAT is used at the HMR to determine the number of Remove Alert MAC Frames yet to be transmitted. Its initial value is specified in 9.3.4 as "n9."

Counter, C-Port Registration Query (CPRQ)

The counter CPRQ is used by the Registration Query protocol to control the number of Registration Query MAC frames that are resent to the Station. The value is initially set to 4 on entry to the Registration Query State (JS=PRQ) and is decremented each time a Registration Query frame is sent.

9.3.3.2 PMAC Protocol Flags

The following C-Port flags, listed alphabetically, are defined.

Flag, C-Port Beacon Test (FPBNT)

The flag FPBNT is used by the Monitor FSM to signal the Join FSM to enter the Lobe Test (JS=PLT) state in order to perform a LMT as part of the Hard Error Recovery Process. The flag is set by the Monitor FSM when loss of Phantom signal is detected by the C-Port. The flag is reset by the Join FSM when entering the Lobe Test state.

Flag, C-Port Break Lobe Test (FPBLT)

If the C-Port is configured by management to support the TXI AP only (AP_MASK=0002), this flag is set to 1 on the receipt of any frame and, optionally, any token. FPBLT set to 1 indicates that the Join FSM is preparing to disrupt the attached station's lobe test.

Flag, C-Port Bypass Force (FPBPF)

FPBPF is set to 1 when a "PORT_ERR(not_correctable)" event is detected. The Join FSM, upon detecting FPBPF=1 and the Transmit Normal state (TS=PTXN), forces the Join FSM to enter the Bypass state (JS=BP).

Flag, C-Port Bypass Wait (FPBPW)

FPBPW is set to 1 by the Join FSM to delay exit to the Bypass state (JS=BP) until the transmission of an Insert Response MAC frame with a DTR_RSP subvector value of 8020 has completed. This prevents the C-Port from closing until the frame has transmitted.

Flag, C-Port Disrupt Lobe Test (FPDLT)

At the expiration of timer TPBLT, this flag is set to 1, timer TPDLT is started, and the repeat path is broken (FPRPT=0). FPDLT set to 1 indicates to the FSM that the attached station's lobe test is in the process of being disrupted.

Flag , C-Port DTU Request Pending (FPDTUREQ)

The flag FPDTUREQ is used by the Join FSM when making a request to the DTU for service (DTU_UNITDATA.indicate). This is used by the PMAC to pass address information during Join to the DTU and is part of the Duplicate Address Function that occurs during the Join process. The value of FPDTUREQ is initially 0. It is set to 1 when a DTU_DAC.request request is issued by the PMAC. It is set to 0 by the Join FSM when a DTU_DAC.response is received by the PMAC.

Flag, C-Port EFS Sent (FPEFS)

The flag FPEFS is used by the Transmit FSM to signal the Join FSM that it has transmitted an EFS. The Join FSM sets up the signaling by setting FPEFS to 0 and queuing a frame for transmission. When the Transmit FSM has transmitted the frame (TX_EFS), it sets FPEFS to 1. The Join FSM detects the event FPEFS=1 and executes the appropriate actions.

Flag, C-Port Error Report (FPER)

The flag FPER is set to 1 when the first reportable error is detected and indicates that subsequent errors should not reset the error timer TPER. Flag FPER is set to 0 when the error timer expires. When TPER expires, the C-Port issues a MRI_UNITDATA.indication containing a Report Error PDU.

Flag, C-Port Heart Beat Active (FPHBA)

The flag FPHBA is used to control the Heart Beat Process defined in 9.1.8. This flag is initially set to 0 and is set to 1 when the Join FSM enters the DAC (JS=PDAC) state. When this flag is set to 1, the Heart Beat process timers are started (TPQHB and TPRHB) and loss of Heart Beat can be detected. The flag is set to 0 when the Beacon Process is started by the Monitor FSM due to either loss of Heart Beat or receipt of a Beacon frame (SA=SUA).

Flag, C-Port Insert Detected (FPINSD)

The flag FPINSD indicates the detection, or the lack thereof, of an insertion request from the phantom-signaling channel. FPINSD is set to 1 upon receiving PM_STATUS.indication(Insert=Detected). FPINSD is set to 0 upon receiving PM_STATUS.indication(Insert=Not_detected).

Flag, C-Port Insert Loss Enabled (FPINSLE)

The flag FPINSLE is used by the PMAC in conjunction with FPINSD to determine that phantom signaling has changed from Insert=Detected to Insert=Not_detected once the C-Port is in Join Complete (JS=PJCI). The flag is set to 1 when the event PM_STATUS.indication(Insert=Detected) occurs. The flag is set to 0 on the transition from JS=PDAC to JS=PJCI.

Flag, C-Port Join Complete (FPJC)

The flag FPJC is set to 1 upon successful completion of the DAC state (JS=PDAC) and entry into the Join Complete TXI state (JS=PJCI). This flag is used by the Join FSM to determine when the transition to Join Complete TXI (JS=PJCI) requires a completed Duplicate Address Test—the difference between an initial joining of the Station and the recovery process.

Flag, C-Port Media Rate (FPMR)

The flag FPMR is used to control the operation of the Port Operation Tables as it relates to the operational speed of the media. It has the same definitions as the FPMRO flag defined in 14.5.2.1.4, except it is set as needed by the C-Port Operation Tables.

Flag, C-Port Operational (FPOP)

The flag FPOP is set to 1 when the C-Port enters the Join Complete TXI state (JS=PJCI). When FPOP is 0, the C-Port will not forward LLC and Management frames, and the Transmit FSM is unable to transmit queued frames (PDU_QUEUED). When FPOP is 1, the C-Port will forward LLC frames to the DTU, Management frames to the MRI, and the Transmit FSM can transmit queued frames.

Flag, C-Port Phantom Detect (FPPD)

The C-Port uses this flag to determine whether phantom has been detected before timer TPPD expires. Phantom has not been detected if the timer TPPD expires when FPPD=1. The flag FPPD is set to 1 when the C-Port enters the Join Complete state (JS=PJCI). The flag FPPD is set to 0 when phantom is detected.

Flag, C-Port Protocol Loss Detect (FPPLD)

The C-Port uses this flag to determine whether the Station is in the correct state prior to starting the Beacon Recovery process. The Station is not in the correct state if the timer TPPLD expires when FPPLD=1. The flag FPPLD is set to 1 when the C-Port enters the Internal Test state (MS=PIT). Flag FPPLD is set to 0 when phantom loss is detected or a valid LMT Notification MAC frame is received.

Flag, C-Port Repeat Path Enabled (FPRPT)

If FPRPTO=1 *or* the C-Port is supporting only 4 Mbit/s and 16 Mbit/s (the C-Port has a PHY path), then the flag FPRPT is used to signal the Transmit FSM to configure into a repeat path. When FPRPT is set to 1, the Transmit FSM sets FPTI=0 for all media rates and FPTXC=0 for the 4 Mbit/s and 16 Mbit/s media rates, creating a repeat path for use by the Station during a LMT. When FPRPT is set to 0, the Transmit FSM will set FPTI=1 for all media rates and FPTXC=1 for the 4 Mbit/s and 16 Mbit/s media rates, returning the Transmit FSM to its normal operating mode for the TXI Access Protocol.

If FPRPTO=0 (there is a C-Port PMAC lobe test repeat mechanism), then the flag FPRPT has no effect upon the C-Port operation.

FPRPT is set and reset only by the Join FSM.

Flag, C-Port Signal Loss (FPSL)

The flag FPSL indicates the presence or absence of a valid signal from the lobe as defined in 5.1.4.1. FPSL is set to 1 to indicate the absence of a valid signal when the PMAC detects PM_STATUS.indication(Signal_detected=Signal_loss) for the entire period of timer TPSL (signal loss is filtered). FPSL is set to 0 to indicate the presence of a valid signal whenever PMAC detects PM_STATUS.indication(Signal_detected=Signal_acquired).

Flag, C-Port Signal Loss Detected (FPSLD)

The flag FPSLD is used to determine whether the PMAC Signal Loss Filtering process is active or inactive. The Signal Loss Filtering process is used to determine whether or not the PHY signal loss event is a steady-state condition. FPSLD is set to 1 to activate the Signal Loss Filtering process if not already active whenever the PMAC detects PM_STATUS.indication(Signal_detected=Signal_loss). FPSLD is set to 0 to deactivate the Signal Loss Filtering process whenever the PMAC detects PM_STATUS.indication (Signal_detected=Signal_acquired).

Flag, C-Port Transmit Abort Sequence (FPTAS)

The flag FPTAS is used to control the counting of Abort Sequences. When the transmitter releases an Abort Sequence, it sets FPTAS to 1. The C-Port Error Handling Station Operation Table detects this condition, sets FPTAS to 0, and takes the appropriate action to increment the counter CPABE.

Flag, C-Port Transmit Idles (FPTI)

The flag FPTI is used to control the transmission of idles (Fill). The TXI Access Protocol normally has the flag FPTI set to 1 [indicates PS_CONTROL.request(Repeat_mode=Fill)], which causes the C-Port to source fill. FPTI is set to 0 [indicates PS_CONTROL.request (Repeat_mode=Repeat)] when

a) The Transmit FSM is transmitting data (TS=PTXD); or
b) The Transmit FSM is supporting LMT by providing a repeat path (TS=PRPT); or
c) The PMAC exits to the TKP Access Protocol; or
d) The PMAC closes by entering the Bypass state (JS=BP).

Flag, C-Port Transmit from Crystal (FPTXC)

The flag FPTXC is used to control whether the C-Port is deriving its transmit timing reference from its crystal or from its received signal. When FPTXC is set to 1, the PMAC is using its crystal as the source of its transmit timing reference [indicates PS_CONTROL.request(Crystal_transmit=Asserted)] and has added the elastic and latency buffers into the data path. When FPTXC is set to 0, the PMAC is using its receiver's clock recovery circuits as the source of its transmit timing reference [indicates PS_CONTROL.request(Crystal_transmit=Not_asserted)] and has removed the elastic and fixed latency buffers from the data path.

Flag, C-Port Transmit Length (FPTX_LTH)

The flag FPTX_LTH is used by the PMAC to determine if the frame length of the currently transmitting frame is known. This flag is part of the notation used in describing cut-through support for a DTU.

FPTX_LTH is set to 1 when the length of the currently transmitting frame is known. FPTX_LTH is set to 0 when the length of the currently transmitting frame is not known.

9.3.3.3 PMAC States

There are a set of states for the Join Ring FSM, the Monitor FSM, and the Transmit FSM. A FSM can be in only one state at any time.

9.3.3.3.1 C-Port Join States

The C-Port Join State (JS=) notation is used to identify the current state of the C-Port Join FSM. The C-Port Join State values are Bypass, Registration, Await Neighbor Notification Complete, Lobe Test, DAC, Join Complete–TXI, Join Complete–TKP, Registration Query, and Duplicate Address Detected. During the Bypass State, normal operation is suspended and no assumptions can be made regarding the transmission or reception of data. Join states, listed by state value, are defined as follows.

Join State J0, Bypass (JS=BP). This is the idle state for the C-Port. In this state, the C-Port waits for the Connect request (Connect.PMAC) and is not required to perform any other functions. The setting of the policy flag FPOTO determines if the C-Port operates in station emulation mode (FPOTO=0), defined in 9.2 and 9.5, or in port mode (FPOTO=1), defined in 9.3 and 9.4.

Join State JK, C-Port Registration (JS=PREG). In this state, the C-Port waits for a station to either send a registration frame or raise Phantom. If the Station sends a Registration Request frame to the C-Port, the C-Port will process this frame and respond with a Registration Response frame. If the TXI Access Protocol is requested, the C-Port will enter the Lobe Test state (JS=PLT).

A Station signals that it is using the TKP Access protocol by raising phantom. When phantom is detected by the C-Port, a Claim Token MAC frame is sent and the C-Port exits to the Await Neighbor Notification Complete state.

Join State JN, C-Port Await Neighbor Notification Complete (JS=PANNC). In this state, the C-Port waits until the Station has completed Neighbor Notification. If the C-Port times out waiting for Neighbor Notification to complete, it will return to Port Registration. During Neighbor Notification, the C-Port determines if the Station's address is a duplicate of the C-Port's address. If the Station's address is a duplicate, the C-Port enters the C-Port Duplicate Address Detected State (JS=PDAD).

If Neighbor Notification completes without a duplicate address being detected, the C-Port enters Registration Query (JS=PRQ) if the C-Port supports the TXI Access Protocol; otherwise, the C-Port enters the Join Complete (JS=PJCP) state.

Join State JL, C-Port Lobe Test (JS=PLT). In this state, the C-Port assists the Station in performing the test on the attached lobe by providing a simple repeat path capable of repeating either frames (any media rate) or tokens (4 Mbit/s and 16 Mbit/s only). The Station is responsible for determining if the lobe passes or fails this test. If the Station determines that the lobe passes the test, the Station will issue an Insert Request. If the C-Port times out during this state (TPLMTR=E), the Station has failed the test, and the C-Port enters the Registration state (JS=PREG).

Join State JM, C-Port DAC (JS=PDAC). In this state, the C-Port responds to the Insert Request frame sent by the Station at the end of the LMT. If the DTU has completed the DAC and returned its response to the MAC, the C-Port will issue an Insert Response with the appropriate DTR Response Code subvector. If the DAC passes, then the C-Port enters the Port Join Complete–TXI state (JS=PJCI). If the check fails, the C-Port enters the Bypass state (JS=BP).

Join State JP, C-Port Join Complete–TXI (JS=PJCI). In this state, the C-Port has completed the join process and is fully operational on a dedicated connection using the TXI Access Protocol. In this state, the C-Port may pass LLC frames to the DTU for forwarding.

Join State JQ, C-Port Join Complete–TKP (JS=PJCP). In this state, the C-Port has completed the join process and is fully operational on a dedicated connection using the TKP Access Protocol. In this state, the C-Port may pass LLC frames to the DTU for forwarding.

Join State JR, C-Port Registration Query (JS=PRQ). In this state, the C-Port transmits Registration Query MAC frames, allowing the Station to decide if it wants to continue using the TKP Access Protocol, or switch to the TXI Access Protocol. The station acknowledges a requested change to the TXI Access Protocol by dropping the phantom signal to the C-Port. When phantom signal is lost, the C-Port returns to the Registration state (JS=PREG). The C-Port exits to Join Complete–TKP (JS=PJCP) if the Station does not drop phantom.

Join State JT, C-Port Duplicate Address Detected (JS=PDAD). In this state, the C-Port is waiting for a station, whose address is a duplicate of the C-Port's, to drop its phantom signal. Once the Station drops its phantom signal, the C-Port enters the Registration State (JS=PREG).

Join State JU, C-Port HMR Trade-up (JS=PHMRTU). This state is entered when the Registration state (JS=PREG) detects the Station supports Trade-up from 4 Mbit/s or 16 Mbit/s operation to the HMR operation. If the HMR link status becomes active, then exit to the Registration state (JS=PREG) to restart the Registration state (JS=PREG) at the HMR. If the link status fails to become active before the timer TPHMRW expires, then exit to the Bypass state (JS=BP).

Join State JW, C-Port Remove Alert Wait (JS=PRAW). This state is entered when the C-Port, in the Join Complete state (JS=PJCI), detects a condition that *allows* the C-Port to notify the Station it is entering the Bypass state. The initial Remove Alert MAC frame is transmitted by detection of the error condition that causes the C-Port to enter the Remove Alert Wait state, while counter CPRAT controls the number of Remove Alert MAC frame transmission retries in the Remove Alert Wait state. When counter CPRAT reaches zero, the C-Port enters the Bypass state (JS=BP).

9.3.3.3.2 C-Port Monitor States

The Monitor State (MS=) notation is used to identify the current state of the C-Port Monitor FSM. The monitor state values are Operational, Transmit Beacon, and Internal Test. Monitor states, listed by state value, are defined as follows.

Monitor State MJ, C-Port Operational (MS=POPT). This is the normal operating state for the C-Port Monitor FSM. In this state, the link is operational and the Heart Beat Function, described in 9.1.9, is used to inform the Station that the PMAC is running.

Monitor State MK, C-Port Transmit Beacon (MS=PTBN). The C-Port enters this state when it detects Loss of Heart Beat on the link. There are two beacon types defined for TXI Access Protocol: Loss of signal and Loss of Heart Beat. The C-Port stays in this state until

— The C-Port receives a beacon frame from the attached Station; or
— The Internal Test Timer (TPIT) has expired.

While in this state, the C-Port issues beacon frames with the appropriate beacon type indicated. The frames are paced by a timer (TPQP). Exit from this state is to Internal Test.

Monitor State ML, C-Port Internal Test (MS=PIT). The Internal Test state is entered from the Transmit Beacon state (MS=PTBN) when timer TPIT expires, or the Operational state (MS=POPT) when a Beacon

frame is received. In this state, the C-Port performs its internal tests, which must be completed within 1.2 s. When the C-Port detects loss of phantom signal, the Internal Test state sets the flag FPBNT=1 to signal the Join FSM to support the Station during its LMT by providing a Repeat path. When FPBNT=1, the Join FSM re-enters its Lobe Test state (JS=PLT), following the same sequence the Join FSM followed during the normal Join process by repeating the transitions from JS=PLT, to JS=PDAC, to JS=PJCI. The only exception is for the DAC, which is not performed. When FPBNT=1 and the Port's internal tests are successful, the C-Port always responds to the Station's Insert Request with a positive (DTR_RSP=0) Insert Response MAC frame. The Monitor FSM enters the Operational state (MS=POPT) when a valid Insert Request MAC frame is received from the attached Station (indicating the Station successfully recovered from its Hard Error Recovery process).

9.3.3.3.3 C-Port Transmit States

The Transmit State (TS=) notation is used to identify the current state of the Transmit FSM. The transmit state values are Transmit Normal, Transmit Data (of a frame), and Repeat. Transmit states are defined as follows.

Transmit State TD, C-Port Transmit Normal (TS=PTXN). Transmit Normal is the rest state for the Transmit FSM. This state services transmit immediate and queued frame requests by first transmitting the SFS field and then entering the Transmit Frame Data State (TS=TPXD).

Queued frames will be serviced only if the C-Port is operational (FPOP=1).

The Join FSM can request that the Transmit FSM enter the Repeat State. This state is used to support the LMT. The flag FPRPT is used to signal this request from the Join FSM.

Transmit State TE, C-Port Transmit Frame Data (TS=PTXD). In this state, the Transmit FSM transmits the data portion [FC, DA, SA, RI (if present), INFO (if present), and FCS fields] of the frame. It then sends the EFS field, sets FPEFS to 1, indicating to the Join FSM that the EFS has been transmitted (see 9.2.2.3), and enters the Transmit Normal State (JS=PTXN).

At 100 Mbit/s, the PS_CONTROL.request(Transmit_mode=No_fill) signal defined in 9.8.1.1.4 turns off the transmission of idles and the frame's data is transmitted, one octet at a time, using the signal PS_UNITDATA.request(Tx_indicator=Data_octet) defined in 9.8.1.1.2.

Transmit State TF, C-Port Repeat (TS=PRPT). The Repeat State is used by the C-Port to support the Station's LMT. Entry and exit to this state is controlled by the Join FSM by either directly forcing a state transition or by use of flag FPRPT.

9.3.4 C-Port Port Operation Tables

This subclause specifies the procedures that are used in the PMAC for the C-Port operating in Port mode. The Join FSM supports both the TXI and the TKP Access Protocols. The remaining tables support only the TXI protocol. These Port Operation Tables use the following terms defined in 9.1.1.2: optional, optional-i, optional-x, optional-unk, and optional-rf.

Each Port Operation Table starting point has its event/condition shaded, and each Port Operation Table exit point has its action/output shaded.

To allow flexibility among station implementations, parameter n9 is used to represent the value of CPRAT.

Parameter	MIN	MAX	Used With	Description
n9	5	10	CPRAT	n9 is the initial setting of CPRAT, which governs the number of Remove Alert MAC Frames transmitted by the C-Port operating at the HMR before exiting to the Bypass state (JS=BP).

9.3.4.1 C-Port Join Port Operation Table

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
J01	1002	**Connect.PMAC** & FPOTO=0 & FSREGO=0 & JS=BP << C-Port Emulation of a DTR Station using the TKP Access Protocol, exit to 9.5. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=LT; Set_initial_conditions; FTI=x; FTXC=1; FIPTKPS=1; TEST; [TLMTR=R (optional-i)]
J0A	1001	**Connect.PMAC** & FPMRO<2 & FPOTO=0 & FSREGO=1 & JS=BP << C-Port Emulation of a DTR Station using the TXI Access Protocol, exit to 9.2. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=FPMRO; FPMR=FPMRO; FIPTXIS=1; TSIS=R
J0A	1107	**Connect.PMAC** & PS_STATUS.indication(Link_status=Asserted) & FPMRO>1 & FPANO=0 & FPOTO=0 & FSREGO=1 & JS=BP << This transition requires Link_status to be active before Connect.PMAC operates. >> << One of the Starting Points for the C-Port in Station Emulation Mode using the TXI Access Protocol without Auto-Negotiation. >> << C-Port Emulation of a DTR Station using the TXI Access Protocol, exit to 9.2. >> << HMR only. >>	JS=SREG; TS=STXN; Set_initial_conditions; FSTXC=FSTI=1; FSMR=FPMRO; FPMR=FPMRO; FIPTXIS=1; TSIS=R
J0KA	1000	**Connect.PMAC** & FPMRO<2 & FPOTO=1 & JS=BP << Starting Point for C-Port Operation. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PREG; TS=PRPT; Set_initial_conditions; FPMR=FPMRO; FPRPT=1 << TXI-only configured C-Port shall cause a lobe test failure in a Station opening with the TKP Access Protocol. >>
J0KB	1108	**Connect.PMAC** & PS_STATUS.indication(Link_status=Asserted) & FPMRO>1 & FPANO=0 & FPOTO=1 & JS=BP << This transition requires Link_status to be active before Connect.PMAC operates. >> << Starting Point for C-Port Operation using the TXI Access Protocol without Auto-Negotiation. >> << HMR only. >>	JS=PREG; TS=PRPT; Set_initial_conditions; FPTXC=1; FPMR=FPMRO; FPRPT=1
JN0	1018	**Disconnect.PMAC** & JS=PANNC	JS=BP

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JM0	1040	**Disconnect.PMAC** & FPMR<2 & JS=PDAC << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP
JM0	1155	**Disconnect.PMAC** & FPMR>1 & FPJC=0 & JS=PDAC << HMR only. >>	JS=BP
JMW	1152	**Disconnect.PMAC** & FPMR>1 & FPJC=1 & JS=PDAC << HMR only. >>	JS=PRAW; CPRAT=n9; TPRAP=R; TXI_RMV_ALRT
JT0	1103	**Disconnect.PMAC** & JS=PDAD	JS=BP
JP0	1056	**Disconnect.PMAC** & FPMR<2 & JS=PJCI << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP
JPW	1118	**Disconnect.PMAC** & FPMR>1 & JS=PJCI << After Join Complete, C-Port told by Port Management to remove from the network. >> << HMR only.>>	JS=PRAW; FPOP=0; CPRAT=n9; TPRAP=R; TXI_RMV_ALRT
JQ0	1061	**Disconnect.PMAC** & JS=PJCP	JS=BP
JL0	1026	**Disconnect.PMAC** & FPMR<2 & JS=PLT << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP
JL0	1156	**Disconnect.PMAC** & FPMR>1 & FPJC=0 & JS=PLT << HMR only. >>	JS=BP
JLW	1153	**Disconnect.PMAC** & FPMR>1 & FPJC=1 & JS=PLT << HMR only. >>	JS=PRAW; CPRAT=n9; TPRAP=R; TXI_RMV_ALRT
JK0	1007	**Disconnect.PMAC** & JS=PREG	JS=BP
JR0	1010	**Disconnect.PMAC** & JS=PRQ	JS=BP
	1037	**DTU_DAC.response(RC)** & JS=PDAC	FPDTUREQ=0; SDAC_RC=RC
	1022	**DTU_DAC.response(RC)** & JS=PLT	FPDTUREQ=0; SDAC_RC=RC
	359	**FDC=1** & FNC=0 & MS=RPT & FAM=1	[FNC=1 (optional)]
	027	**FDC=1** & FNW=1 & FNC=0 & MS=RPT & FAM=0	FNC=1; QUE_SMP_PDU
	028	**FDC=1** & FNW=1 & FNC=0 & MS=RPT & FAM=1	FNC=1
JQ0	1068	**FIPTKPPE=1** & JS=PJCP << Error running Configuration 3, DTR C-Port in Port mode, TKP AP. >>	JS=BP
JNQ	1015	**FNC=1 & AND(PPV(AP_MASK),0002)=0000** & JS=PANNC << The C-Port is not configured by Management to support the TXI Access Protocol, thus must not execute the Registration Query protocol. >>	JS=PJCP; FINS=FJR=FPJC=1 << C-Port Join complete using TKP Access Protocol on a dedicated link. >>
JNR	1085	**FNC=1 & AND(PPV(AP_MASK),0002)=0002** & JS=PANNC <<Neighbor notification complete; ready to start registration query protocol. >>	JS=PRQ; QUE_REG_QRY; CPRQ=4; TPQP=R; **If** FPBHO=0, then FINS=1

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JPLA	1051	**FPBNT=1** & FPMR<2 & JS=PJCI << 4 Mbit/s and 16 Mbit/s only. >>	JS=PLT; FPBNT=0; FPRPT=1; TPLMTR=R << Prepare for Station's LMT by providing a repeat path, and start LMT duration timer. >>
JPLB	1109	**FPBNT=1** & FPMR>1 & JS=PJCI << HMR only. >>	JS=PLT; FPBNT=0; FPRPT=1; **If** FPRPTO=0, then FA(TEST)=1; TPLMTR=R << Prepare for Station's LMT by providing either a PHY repeat path (FPRPTO=1) or a PMAC repeat path (FPRPTO=0), and start LMT duration timer. >>
JM0	1046	**FPBPF=1 & TS=PTXN** & JS=PDAC	JS=BP
JP0	1058	**FPBPF=1 & TS=PTXN** & JS=PJCI	JS=BP
JL0	1032	**FPBPF=1 & TS=PTXN** & JS=PLT	JS=BP
JW0	1154	**FPBPF=1 & TS=PTXN** & JS=PRAW	JS=BP
JK0	1009	**FPBPF=1 & TS=PTXN** & JS=PREG	JS=BP
JN0	1021	**FPBPF=1 & TS=RPT** & JS=PANNC	JS=BP
JQ0	1063	**FPBPF=1 & TS=RPT** & JS=PJCP	JS=BP
JR0	1093	**FPBPF=1 & TS=RPT** & JS=PRQ	JS=BP
	1036	**FPEFS=1** & FPMR<2 & FPBPW=0 & FPRPT=0 & JS=PLT << Signaling from Transmit FSM that data has been transmitted. >> << 4 Mbit/s and 16 Mbit/s only. >>	FPRPT=1 << Signal Transmit FSM to enter Repeat state to support the Station's LMT. >>
	1110	**FPEFS=1** & FPMR>1 & FPBPW=0 & FPRPT=0 & FPRPTO=1 & JS=PLT << Signaling from Transmit FSM that data has been transmitted. >> << HMR only. >>	FPRPT=1 << Signal Transmit FSM to enter Repeat state to support the Station's LMT. >>
JM0	1075	**FPEFS=1** & FPBPW=1 & JS=PDAC	JS=BP << Station rejected by C-Port that closes after INS_RSP has been transmitted. >>
JL0	1083	**FPEFS=1** & FPBPW=1 & JS=PLT	JS=BP << Port closes after sending Registration Response MAC in response to an unexpected Registration Request frame while in Hard Error Recovery. See REF 1092. >>
	1072	**FPEFS=1** & FPRPT=0 & JS=PREG	FPRPT=1 << Re-establish repeat path after transmitting frame. >>
JQ0	1066	**FPINSD=0** & FBR=1 & MS=RBN & JS=PJCP	JS=BP << Station drops phantom for a second time while in Hard Error Recovery. >>

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JQ0	1069	**FPINSD=0** & FBT=1 & MS=TBN & JS=PJCP	JS=BP << Station drops phantom for a second time while in Hard Error Recovery. >>
JP0	1049	**FPINSD=0** & FPINSLE=1 & FPOP=1 & JS=PJCI	JS=BP <<Station deinserted; normal condition. >>
JNK	1017	**FPINSD=0** & JS=PANNC << Station closed; unknown reason >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FIPTKPP=0; FPRPT=1; SUA=0; FA(monitor)=0
JTK	1099	**FPINSD=0** & JS=PDAD	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FIPTKPP=0; FPRPT=1; SUA=0; FA(monitor)=0
JRK	1089	**FPINSD=0** & JS=PRQ << Registration Query Protocol >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FIPTKPP=0; FPRPT=1; FPTXC=0; SUA=0; FA(monitor)=0
JP0	1033	**FPINSD=0** & FPINSLE=1 & MS=PTBN & JS=PJCI	JS=BP << Station Closed >>
JQ0	1012	**FPINSD=0** & MS=RCT & JS=PJCP << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Station Closed >>
JQ0	1071	**FPINSD=0 &** MS=RPT & JS=PJCP << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Station Closed >>
JQ0	1013	**FPINSD=0** & MS=TCT & JS=PJCP << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Station Closed >>
JQ0	1014	**FPINSD=0** & MS=TRP & JS=PJCP << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Station Closed >>
JKN	1006	**FPINSD=1** & AND(PPV(AP_MASK),0001)=0001 & JS=PREG << Classic Station or DTR Station using TKP Access Protocol, where the C-Port supports a station using TKP Access Protocol. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PANNC; MS=TCT; TS=RPT; FPTI=0; fiptkpp=1; FDC=FTI=FOP=FTXC=1; TCT=R; TQP=R; CCT=1; CCR=1; TXI(CT_PDU) << FIPTKPP=1 is used by the C-Port TKP Transmit FSM. >> << C-Port starts up the TKP Access Protocol Monitor and Transmit FSMs (see 9.4). >>
	1105	**FR_AC** & AND(PPV(AP_MASK),0001)=0000 & FPMR<2 & FPBLT=0 & JS=PREG << 4 Mbit/s and 16 Mbit/s only. >>	FPBLT=1; TPBLT=R << Start sequence to break attached station's lobe test. >>
	1101	**FR_AC** & FPDLT=1 & JS=PREG << 4 Mbit/s and 16 Mbit/s only. >>	TPDLT=R << Frame detected during lobe test disruption; extend disruption period by restarting TPDLT. >>
JM0	1044	**FR_AMP** & JS=PDAC	JS=BP << Protocol Error >>
JP0	1052	**FR_AMP** & JS=PJCI	JS=BP << Protocol Error >>

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JL0	1030	**FR_AMP** & JS=PLT	JS=BP << Protocol Error >>
JNT	1097	**FR_AMP(SA=MA)** & FAM=0 & JS=PANNC	JS=PDAD; Set_initial_conditions << Duplicate Address Detected >>
JR0	1065	**FR_BN** & FPBHO=1 & JS=PRQ	JS=BP << Protocol Error >>
JN0	1020	**FR_BN** & JS=PANNC	JS=BP << Protocol Error >>
JM0	1041	**FR_BN** & JS=PDAC	JS=BP << Protocol Error >>
JL0	1027	**FR_BN** & JS=PLT	JS=BP << Protocol Error >>
JM0	1043	**FR_CT** & JS=PDAC	JS=BP << Protocol Error >>
JP0	1053	**FR_CT** & JS=PJCI	JS=BP << Protocol Error >>
JL0	1029	**FR_CT** & JS=PLT	JS=BP << Protocol Error >>
	1074	**FR_INS_REQ(SA=SUA)** & FPJC=0 & FPDTUREQ=0 & JS=PDAC	TPIRD=R; **If** SDAC_RC=8020, then FPHBA=0 << Start timer to send INS_RSP >> << Disable Heart Beat since join will not complete. >>
	1077	**FR_INS_REQ(SA=SUA)** & FPJC=0 & FPDTUREQ=0 & SDAC_RC=0000 & JS=PLT	FPHBA=1; TPRHB=R; TPIRD=R; TPQHB=R << Heart Beat started; start timer to transmit INS_RSP. >>
	1078	**FR_INS_REQ(SA=SUA)** & FPJC=0 & FPDTUREQ=0 & SDAC_RC=8020 & JS=PLT	TPIRD=R << Heart Beat not started since join will not complete; start timer to transmit INS_RSP. >>
	1079	**FR_INS_REQ(SA=SUA)** & FPJC=0 & FPDTUREQ=1 & JS=PLT	FPHBA=1; TPRHB=R; TPQHB=R << Heart Beat started; no response from DTU. >>
JLMa	1023	**FR_INS_REQ(SA=SUA)** & FPJC=0 & JS=PLT << End of LMT—Success! >>	JS=PDAC; MS=POPT; FPRPT=0; **If** FPMR<2, then FPTXC=1; **If** FPRPTO=0, then FA(TEST)=0 << Clock change for 4 Mbit/s and 16 Mbit/s only. >>
JLMb	1073	**FR_INS_REQ(SA=SUA)** & FPMR<2 & FPJC=1 & JS=PLT <<Successful completion of LMT after Hard Error Recovery. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PDAC; FPHBA=FPTXC=1; FPRPT=0; TPRHB=R; TPIRD=R; TPQHB=R << Clock change, Heart Beat started; start timer to transmit INS_RSP. >>

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JLMc	1121	**FR_INS_REQ(SA=SUA)** & FPMR>1 & FPJC=1 & JS=PLT <<Successful completion of LMT after Hard Error Recovery. >> << HMR only. >>	JS=PDAC; FPHBA=1; FPRPT=0; **If** FPRPTO=0, then FA(TEST)=0; TPRHB=R; TPIRD=R; TPQHB=R << If PHY repeat path is active, set inactive; if LMT FA is active, set inactive. Heart Beat started; start timer to transmit INS_RSP. >>
	1050	**FR_INS_REQ(SA=SUA)** & FPOP=1 & JS=PJCI	TPIRD=R << Assured delivery of the Insert Response MAC frame. >>
	1142	**FR_LMTN(DA=broadcast)** & FPRPTO=0 & JS=PLT << PMAC Repeat path is being supported. Station requests the PMAC to support its LMT function. >>	TXI_LMTN_PDU << Return LMT Notification Frame to the Station. >>
JM0	1060	**FR_MAC(DA=any_recognized_address & SA<>SUA & VC=00)** & JS=PDAC	JS=BP << Protocol Check >
JP0	1055	**FR_MAC(DA=any_recognized_address & SA<>SUA & VC=00)** & JS=PJCI	JS=BP << Protocol Check >>
JL0	1059	**FR_MAC(DA=any_recognized_address & SA<>SUA & VC=00)** & JS=PLT	JS=BP << Protocol Check >>
JM0	1082	**FR_MAC(DA=any_recognized_address & SA<>SUA & VC=30)** & JS=PDAC	JS=BP << Protocol Check >>
JP0	1084	**FR_MAC(DA=any_recognized_address & SA<>SUA & VC=30)** & JS=PJCI	JS=BP << Protocol Check >>
JL0	1090	**FR_MAC(DA=any_recognized_address & SA<>SUA & VC=30)** & JS=PLT	JS=BP << Protocol Check >>
	1080	**FR_REG_REQ** & AND(PPV(PD_MASK),PD)=0000 & JS=PREG << Access denied; unsupported out of band signaling. >>	FPBLT=FPEFS=FPRPT=0; TXI_REG_RSP_PDU(AP_RSP=0000)
	1004	**FR_REG_REQ** & AND(PPV(AP_MASK),AP_REQ)=0000 & JS=PREG << Access denied by C-Port; unsupported protocol. >>	FPBLT=FPEFS=FPRPT=0; TXI_REG_RSP_PDU(AP_RSP=0000)
	1092	**FR_REG_REQ** & FPJC=1 & JS=PLT << Unexpected Registration Request received; possible Station error. >>	FPBPW=1; FPEFS=0; TXI_REG_RSP_PDU(AP_RSP=0000) << Reception of this frame may cause the Station to close. >>
JLK	1034	**FR_REG_REQ(AP_REQ<>S_AP)** & FPJC=0 & JS=PLT	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FPRPT=1; SUA=0
	1005	**FR_REG_REQ & AND(AP_REQ,0001)=0001** & JS=PREG << Invalid AP_REQ value. >>	FPBLT=FPEFS=FPRPT=0; TXI_REG_RSP_PDU(AP_RSP=0000)

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JKLA	1003	**FR_REG_REQ(AP_REQ=0002 & PD=0001)** & FPMR<2 & AND(PPV(AP_MASK),AP_REQ)=0002 & AND(PPV(PD_MASK),PD)=0001 & JS=PREG <<Station requesting TXI Access Protocol, which is supported by this C-Port. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PLT; FPDTUREQ=1; FPBLT=FPEFS=FPRPT=0; TPLMTR=R; SPD=PD; S_AP=AP_REQ; SIAC=IAC; SUA=SA; TXI_REG_RSP_PDU(AP_RSP=0002); DTU_DAC.request(SA, SIAC)
JKLB	1113	**FR_REG_REQ(AP_REQ=0002 &PD=0001)** & FPMR>1 & AND(PPV(AP_MASK),AP_REQ)=0002 & AND(PPV(PD_MASK),PD)=0001 & JS=PREG <<Station requesting TXI Access Protocol, which is supported by this C-Port *with* Phantom Drive. >> << HMR only. >>	JS=PLT; FPDTUREQ=1; FPBLT=FPEFS=FPRPT=0; TPLMTR=R; SPD=PD; S_AP=AP_REQ; SIAC=IAC; SUA=SA; **If** FPRPTO=0, then FA(TEST)=1; TXI_REG_RSP_PDU(AP_RSP=0002); DTU_DAC.request(SA, SIAC) << FPRPTO=0: PMAC Repeat path is supported. >>
JKLB	1114	**FR_REG_REQ(AP_REQ=0002 & PD=0002)** & FPMR>1 & AND(PPV(AP_MASK),AP_REQ)=0002 & AND(PPV(PD_MASK),PD)=0002 & JS=PREG <<Station requesting TXI Access Protocol, which is supported by this C-Port *without* Phantom Drive. >> << HMR only. >>	JS=PLT; FPDTUREQ=1; FPBLT=FPEFS=FPRPT=0; TPLMTR=R; SPD=PD; S_AP=AP_REQ; SIAC=IAC; SUA=SA; **If** FPRPTO=0, then FA(TEST)=1; TXI_REG_RSP_PDU(AP_RSP=0002); DTU_DAC.request(SA, SIAC) << FPRPTO=0: PMAC Repeat path is supported. >>
JKLA	1131	**FR_REG_REQ(AP_REQ=0006 & PD=0001)** & FPMR<2 & AND(PPV(AP_MASK),AP_REQ)=0002 & AND(PPV(PD_MASK),PD)=0001 & JS=PREG <<Station operating at the 4 Mbit/s or 16 Mbit/s media rate is requesting TXI Access Protocol for possible Trade-up to 100 Mbit/s, which *is not* supported by this C-Port. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PLT; FPDTUREQ=1; FPBLT=FPEFS=FPRPT=0; TPLMTR=R; SPD=PD; S_AP=0002; SIAC=IAC; SUA=SA; TXI_REG_RSP_PDU(AP_RSP=0002); DTU_DAC.request(SA, SIAC) << C-Port continues to support 4 Mbit/s or 16 Mbit/s request for TXI Access Protocol operation. >>
JKU	1132	**FR_REG_REQ(AP_REQ=0006 & PD=0001)** & FPMR<2 & AND(PPV(AP_MASK),AP_REQ)=0006 & JS=PREG <<Station operating at the 4 Mbit/s or 16 Mbit/s media rate is requesting TXI Access Protocol for possible Trade-up to 100 Mbit/s, which *is* supported by this C-Port. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PHMRTU; FPRPT=0; S_AP=AP_REQ; SPD=PD; TPTUAD=R; TPHMRW=R; TXI_REG_RSP_PDU(AP_RSP=0004) << Respond and enter a wait state in case the Station misses this response and retransmits its request. >>
JUKA	1148	**FR_REG_REQ(AP_REQ<>S_AP)** & JS=PHMRTU << Restart registration; Station has changed its Access Protocol request. >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FPRPT=1; SUA=0
	1149	**FR_REG_REQ(AP_REQ=S_AP & PD=SPD)** & JS=PHMRTU << Handle the assured delivery mechanism while waiting to trade up to HMR. >>	TXI_REG_RSP_PDU(AP_RSP=0004)

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	1025	**FR_REG_REQ(AP_REQ=S_AP & PD=SPD)** & FPJC=0 & JS=PLT	FPEFS=FPRPT=0; TPLMTR=R; TXI_REG_RSP_PDU(AP_RSP=S_AP) << Assured delivery of Registration Response Frame. >>
	1067	**FR_REG_REQ(AP_REQ>0006)** & AND(PPV(AP_MASK),AP_REQ)>0 & JS=PREG << Access denied by C-Port; invalid AP_REQ. >>	FPBLT=FPEFS=FPRPT=0; TXI_REG_RSP_PDU(AP_RSP=0000)
JLK	1091	**FR_REG_REQ(PD<>SPD)** & FPJC=0 & JS=PLT	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FPRPT=1; SUA=0
JUKA	1151	**FR_REG_REQ(PD<>SPD)** & JS=PHMRTU	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FPRPT=1; SUA=0 << Restart registration; Station has changed its Phantom capability request. >>
	1144	**FR_REG_REQ(PD>0002)** & AND(PPV(PD_MASK),PD)>0 & AND(PPV(AP_MASK),AP_REQ) >0 & JS=PREG	FPBLT=FPEFS=FPRPT=0; TXI_REG_RSP_PDU(AP_RSP=0000)
JM0	1157	**FR_RMV_ALRT(VC=30 & SA=SUA)** & FPMR>1 & JS=PDAC << Received request indicating Station is being removed from the link. >> << HMR only. >>	JS=BP
JP0	1120	**FR_RMV_ALRT(VC=30 & SA=SUA)** & FPMR>1 & JS=PJCI << Received request indicating Station is being removed from the link. >> << HMR only. >>	JS=BP
JL0	1158	**FR_RMV_ALRT(VC=30 & SA=SUA)** & FPMR>1 & JS=PLT << Received request indicating Station is being removed from the link. >> << HMR only. >>	JS=BP
JM0	1042	**FR_RP** & JS=PDAC << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Protocol Error >>
JP0	1054	**FR_RP** & JS=PJCI << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Protocol Error >>
JL0	1028	**FR_RP** & JS=PLT << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Protocol Error >>
JNT	1098	**FR_SMP(SA=MA)** & FAM=1 & JS=PANNC	JS=PDAD; Set_initial_conditions << Duplicate Address Detected. >>
	1143	**FR_TEST(DA=FA(TEST))** & FPRPTO=0 & JS=PLT << PMAC Repeat path being supported. >>	TXI_LMT_PDU << Return TEST Frame to the Station. >>
JR0	1011	**INTERNAL_ERR(not_correctable)** & JS=PRQ	JS=BP
JN0	1019	**INTERNAL_ERR(not_correctable)** & JS=PANNC	JS=BP
JM0	1045	**INTERNAL_ERR(not_correctable)** & JS=PDAC	JS=BP

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JT0	1104	**INTERNAL_ERR(not_correctable)** & JS=PDAD	JS=BP
JP0	1057	**INTERNAL_ERR(not_correctable)** & JS=PJCI	JS=BP
JQ0	1062	**INTERNAL_ERR(not_correctable)** & JS=PJCP	JS=BP
JL0	1031	**INTERNAL_ERR(not_correctable)** & JS=PLT	JS=BP
JK0	1008	**INTERNAL_ERR(not_correctable)** & JS=PREG	JS=BP
JP0	1064	**Internal_Test_Fail** & MS=PIT & JS=PJCI	JS=BP
JUKB	1137	**PS_STATUS.indication (Link_status=Asserted)** & JS=PHMRTU << The 100 Mbit/s link has become active after C-Port and Station Trade-up agreement. >>	JS=PREG; TS=PRPT; Set_initial_conditions; FPTXC=1; FPRPT=1; FPMR=2 << Restart registration as if this is initial entry. >>
JM0	1133	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=PDAC << Station link was operational, but is now not operational. >> << HMR only. >>	JS=BP
JP0	1134	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=PJCI << Station link was operational, but is now not operational. >> << HMR only. >>	JS=BP << Remove Alert MAC frame is not sent because the C-Port-to-Station link is inoperative. >>
JL0	1135	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=PLT << Station link was operational, but is now not operational. >> << HMR only. >>	JS=BP
JW0	1145	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=PRAW << Station link was operational, but is now not operational. >> << HMR only. >>	JS=BP
JK0	1136	**PS_STATUS.indication (Link_status=Not_asserted)** & JS=PREG << Station link was operational, but is now not operational. >> << HMR only. >>	JS=BP
JNK	1070	**TCT=E** & MS=RCT & JS=PANNC << Claim Token failed. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FIPTKPP=0; FPRPT=1; SUA=0; FA(monitor)=0 << C-Port enters Registration as if the Station had not asserted its Phantom signal. >>

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JNK	1081	**TCT=E** & MS=TCT & JS=PANNC << Claim Token failed. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FIPTKPP=0; FPRPT=1; SUA=0; FA(monitor)=0 << C-Port enters Registration as if the Station had not asserted its Phantom signal. >>
	1094	**TK_AC** & AND(PPV(AP_MASK),0001)=0000 & FPMR<2 & FPBLT=0 & JS=PREG << 4 Mbit/s and 16 Mbit/s only. >>	[FPBLT=1; TPBLT=R (optional-i)] << Start sequence to break attached station's lobe test. >>
	1100	**TK_AC** & FPDLT=1 & JS=PREG << 4 Mbit/s and 16 Mbit/s only. >>	[TPDLT=R (optional-i)] << Token detected during lobe test disruption; extend disruption period by restarting TPDLT. >>
	1095	**TPBLT=E** & FPBLT=1 & JS=PREG << 4 Mbit/s and 16 Mbit/s only. >>	FPRPT=0; FPDLT=1; TPDLT=R << Force the Transmit FSM to TS=PTXN by setting FPRPT to zero, and an attached station's lobe test is disrupted. >>
	1096	**TPDLT=E** & FPBLT=1 & JS=PREG << 4 Mbit/s and 16 Mbit/s only. >>	FPRPT=1; FPBLT=FPDLT=0 << Stop transmitting idles by forcing the transmit FSM to TS=PRPT. >>
JU0	1138	**TPHMRW=E** & PS_STATUS.indication(Link_status=Not_asserted) & JS=PHMRTU << C-Port failed to detect link activation. >>	JS=BP << Open Error—Trade-up failure. >>
JMPa	1039	**TPIRD=E** & FPJC=0 & SDAC_RC=0000 & JS=PDAC	JS=PJCI; FPINSLE=0; FPJC=FPOP=1; **If** SPD=0001, then TPPD=R; TXI_INS_RSP_PDU(DTR_RSP=0000); **If** FPECO=1, then (FPER=1; TPER=R) << Station accepted by C-Port. >>
	1038	**TPIRD=E** & FPJC=0 & SDAC_RC=8020 & JS=PDAC	FPBPW=1; FPEFS=0; TXI_INS_RSP_PDU(DTR_RSP=8020) << Station rejected by C-Port. >>
JMPb	1047	**TPIRD=**E & FPJC=1 & JS=PDAC << Hard Error Recovery. >>	JS=PJCI; FPOP=1; FPINSLE=0; **If** SPD=0001, then TPPD=R; TXI_INS_RSP_PDU(DTR_RSP=0000)
	1076	**TPIRD=E** & JS=PJCI	**If** SPD=0001, then TPPD=R; TXI_INS_RSP_PDU(DTR_RSP=0000)
JLK	1024	**TPLMTR=E** & FPJC=0 & JS=PLT <<End of TXI Join LMT; Test Failed. >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FPRPT=1; SUA=0
JL0	1035	**TPLMTR=E** & FPJC=1 & JS=PLT	JS=BP
JP0	1129	**TPPD=E** & FPINSLE=0 & FPMR<2 & JS=PJCI << Station has approval to insert and C-Port supports phantom drive detection, but has failed to provide Phantom in allotted time. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Phantom not detected. >>

Table 9.3-1—C-Port Join Port Operation Table for the TKP or TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
JPW	1147	**TPPD=E** & FPINSLE=0 & FPMR>1 & JS=PJCI << Station has approval to insert, but has failed to provide Phantom in allotted time. >> << HMR only. >>	JS=PRAW; FPOP=0; CPRAT=n9; TPRAP=R; TXI_RMV_ALRT << Expected Phantom presence is not detected. Attempt to notify Station that the C-Port is returning to Bypass. >>
	1088	**TPQP=E** & CPRQ=1 & JS=PRQ << Registration Query Protocol. >>	TPRQD=R; QUE_REG_QRY; CPRQ=0
	1087	**TPQP=E** & CPRQ>1 & JS=PRQ << Registration Query Protocol. >>	TPQP=R; QUE_REG_QRY; CPRQ=(CPRQ-1)
JP0	1146	**TPPLD=E** & FPPLD=1 & FPMR<2 & JS=PJCI << 4 Mbit/s and 16 Mbit/s only. >>	JS=BP << Expected Phantom loss is not detected, thus return to the bypass state. >>
JPW	1130	**TPPLD=E** & FPPLD=1 & FPMR>1 & JS=PJCI << HMR only. >>	JS=PRAW; FPOP=0; CPRAT=n9; TPRAP=R; TXI_RMV_ALRT << Expected Phantom loss or LMTN MAC frame is not detected. Attempt to notify Station that the C-Port is returning to Bypass. >>
	1127	**TPRAP=E** & CPRAT<>0 & JS=PRAW << Transmission of Remove Alert MAC Frame has not been completed. >> << HMR only. >>	CPRAT=(CPRAT-1); TPRAP=R; TXI_RMV_ALRT << Retransmit Remove Alert MAC Frame. >>
JW0	1128	**TPRAP=E** & CPRAT=0 & JS=PRAW << Transmission of Remove Alert MAC Frame has been completed. >> << HMR only. >>	JS=BP << Enter the Bypass state for the reason that started timer TPRAP. >>
JM0	1048	**TPRHB=E** & FPHBA=1 & JS=PDAC << Heart Beat fails prior to join complete, or Heart Beat fails during Hard Error Recovery. >>	JS=BP
JRQ	1086	**TPRQD=E** & JS=PRQ << Registration Query Protocol. >>	JS=PJCP; FINS=FJR=FPJC=1
JNK	1016	**TRP=E** & MS=TRP & JS=PANNC << Ring Purge failed. >> << 4 Mbit/s and 16 Mbit/s only. >>	JS=PREG; MS=x; TS=PRPT; Set_initial_conditions; FIPTKPP=0; FPRPT=1; SUA=0; FA(monitor)=0 << C-Port enters Registration as if the Station had not asserted its Phantom signal. >>
	1150	**TPTUAD=E** & JS=PHMRTU << Assured Delivery timer has expired, so C-Port can now change Media Rate. >>	Flush_transmit_queues; PS_CONTROL.request (Initialize, Media_rate=2) << Switch to the HMR; set the Media Rate flag to 100 Mbit/s and wait for Link Status. >>

9.3.4.2 C-Port Transmit Port Operation Table for the TXI Access Protocol

Table 9.3-2—C-Port Transmit Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
TEDa	1203	**CPBTX>PPV(MAX_TX)** & FPASO=0 & TS=PTXD << Maximum frame size has been exceeded. >>	[TS=PTXN; TX_AB; FPTAS=FPTI=1 (optional-unk)] << Transmit abort sequence. >>
TEDF	1215	**CPBTX>PPV(MAX_TX)** & FPMR>1 & FPASO=1 & TS=PTXD << Maximum frame size has been exceeded. >> << HMR only. >>	[TS=PTXN; TX_INV_FCS; TX_EFS(E=1); FPTAS=FPTI=1 (optional-unk)] << The frame is aborted by transmit of invalid FCS and E=1. >>
TEDb	1210	**CPBTX>PPV(MAX_TX)** & FPMR<2 & FPASO=1 & TS=PTXD << Maximum frame size has been exceeded. >> << 4 Mbit/s and 16 Mbit/s only. >>	[TS=PTXN; FPTAS=FPTI=1; TX_INV_FCS; TX_EFS(I=0, E=1) (optional-unk)] << The frame is aborted by transmit of invalid FCS, I=0, and E=1. >>
TEDH	1209	**DTU_UNITDATA-STATUS.request(Fail)** & FPMR<2 & FPTX_LTH=0 & TS=PTXD << Transmit FSM currently transmitting a frame of unknown length. This is an indication that a cut-through frame is being transmitted. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=PTXN; TX_AB; FPTAS=FPTI=1 << The frame is aborted because the cut-through frame has completed with a Fail status. >>
TEDE	1216	**DTU_UNITDATA-STATUS.request(Fail)** & FPMR>1 & FPTX_LTH=0 & TS=PTXD << Transmit FSM currently transmitting a frame of unknown length. This is an indication that a cut-through frame is being transmitted. >> << HMR only. >>	TS=PTXN; **If** FPASO=0 then TX_AB; **If** FPASO=1 then [TX_INV_FCS; TX_EFS(E=1)]; FPTAS=FPTI=1 << Because the cut-through frame has completed with a Fail status, the frame is aborted as follows: — If FPASO=0, then the frame is aborted using an Abort Sequence. — If FPASO=1, then the frame is aborted using an invalid FCS and E=1. >>
	1200	**EOB** & TS=PTXD <<Occurs once per byte transmission. >>	[CPBTX=(CPBTX+1) (optional-unk)] << Byte count maintained for MAX_TX. >>
TEDc	1204	**EOD** & TS=PTXD << End of frame transmission. >>	TS=PTXN; FPEFS=FPTI=1; TX_FCS; If FPMR<2, then TX_EFS(I=E=0); If FPMR>1, then TX_EFS(E=0)
TFDA	1207	**FPRPT=0** & FPMR<2 & TS=PRPT << 4 Mbit/s and 16 Mbit/s only. >>	TS=PTXN; FPTI=1; **If** FPOP=1, then FPTXC=1
TFDB	1213	**FPRPT=0** & FPMR>1 & TS=PRPT << HMR only. >>	TS=PTXN; FPTI=1
TDFA	1206	**FPRPT=1** & FPMR<2 & TS=PTXN << 4 Mbit/s and 16 Mbit/s only. >>	TS=PRPT; FPTI=FPTXC=0
TDFB	1214	**FPRPT=1** & FPMR>1 & FPRPTO=1 & TS=PTXN << Port supporting a Repeat Path. >> << HMR only. >>	TS=PRPT; FPTI=0

Table 9.3-2—C-Port Transmit Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	1211	**FR(DA=any_recognized_address)** & FPACO=1 & TS=PRPT	Set A=1
	1212	**FR_COPIED(DA=any_recognized_address)** & FPACO=1 & TS=PRPT	Set C=1
TDEa	1202	**PDU_QUEUED** & FPOP=1 & FPRPT=0 & TS=PTXN **<< Queued frames are sent only when FPOP=1. >>**	TS=PTXD; FPBPF=FPTI=0; **If** FR_LTH<=PPV(MAX_TX), then FPTX_LTH=1; **If** FR_LTH=UNK, then FPTX_LTH=0; **If** FPMR=0, then CPBTX=9; **If** FPMR=1, then CPBTX=D; **If** FPMR=2, then CPBTX=14; TX_SFS(P=x; R=0) << The frame length of the queued frame is either unknown or a value less than PPV(MAX_TX). >>
TEDH	1205	**PORT_ERR(Correctable)** & FPMR<2 & TS=PTXD << C-Port could not complete transmission of frame being transmitted; abort frame. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=PTXN; TX_AB; FPTAS=FPTI=1 <<Transmit Abort sequence. >>
TEDe	1218	**PORT_ERR(Correctable)** & FPMR>1 & TS=PTXD << C-Port could not complete transmission of frame being transmitted; abort frame. >> << HMR only. >>	TS=PTXN; **If** FPASO=0, then TX_AB; **If** FPASO=1, then [TX_INV_FCS; TX_EFS(E=1)]; FPTAS=FPTI=1 <<Transmit Abort sequence. >>
TEDd	1208	**PORT_ERR(not_correctable)** & FPMR<2 & TS=PTXD << C-Port could not complete transmission of frame being transmitted. >> << 4 Mbit/s and 16 Mbit/s only. >>	TS=PTXN; [TX_AB (optional)]; FPBPF=FPTI=1 << Transmit Abort sequence—optional. >>
TEDG	1217	**PORT_ERR(not_correctable)** & FPMR>1 & TS=PTXD << C-Port could not complete transmission of frame being transmitted. >> << HMR only. >>	TS=PTXN; **If** FPASO=0, then TX_AB; **If** FPASO=1, then [TX_INV_FCS; TX_EFS(E=1)]; FPBPF=FPTI=1 << The frame is aborted and the C-Port is forced to enter the Bypass state. >>
TDEb	1201	**TXI_REQ** & FPRPT=0 & TS=PTXN	TS=PTXD; FPBPF=FPTI=0; FPTX_LTH=1; **If** FPMR=0, then CPBTX=9; **If** FPMR=1, then CPBTX=D; **If** FPMR=2, then CPBTX=14; TX_SFS(P=x; R=0) << Frame length for a frame in the TXI queue is always known. >>

9.3.4.3 C-Port Monitor Port Operation Table for the TXI Access Protocol

Table 9.3-3—C-Port Monitor Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	1406	FPINSD=0 & FPINSLE=1 & FPBNT=0 & JS=PJCI & MS=PIT << Start-up of LMT support. >>	FPBNT=1; FPPLD=0
MJL	1401	FR_BN(SA=SUA) & FPJC=1 & MS=POPT << Attached station in Beacon Transmit; execute Internal Test. >>	MS=PIT; FPHBA=FPOP=0; TPPLD=R; FPPLD=1; INTERNAL_PTEST << Start protocol loss detect function (TPPLD=R). >>
MKL	1404	FR_BN(SA=SUA) & MS=PTBN << Attached station Beacon received; execute Internal Test. >>	MS=PIT; TPPLD=R; FPPLD=1; INTERNAL_PTEST << Start protocol loss detect function (TPPLD=R). >>
MLJ	1405	FR_INS_REQ(SA=SUA) & MS=PIT	MS=POPT
	1407	FR_LMTN(DA=broadcast) & FPINSLE=0 & MS=PIT & JS=PJCI << The C-Port will establish the repeat path after reception of the first FR_LMTN, if not already established. >>	If FPRPTO=0 then TXI_LMTN_PDU; FPBNT=1; FPPLD=0 << Return this frame only if PMAC repeat path is being used. >>
	1408	FR_SHB(SA=SUA) & FPHBA=1 << Heart Beat has been detected. >>	TPRHB=R << Restart Heart Beat detection process. >>
MKL	1403	TPIT=E & MS=PTBN	MS=PIT; TPPLD=R; FPPLD=1; INTERNAL_PTEST << Start protocol loss detect function (TPPLD=R). >>
	1409	TPQHB=E & FPHBA=1	TPQHB=R; TXI_PHB_PDU << Heart Beat Transmission uses TXI, since this function operates prior to FPOP=1. >>
	1402	TPQP=E & MS=PTBN	TPQP=R; If FPSL=1, then TXI_BN_PDU(BN_TYPE=2); If FPSL=0, then TXI_BN_PDU(BN_TYPE=5)
MJK	1400	TPRHB=E & FPHBA=1 & FPJC=1 & MS=POPT << Loss of TXI Access Protocol Heart Beat. >>	MS=PTBN; FPHBA=FPOP=0; TPIT=R; TPQP=R; If FPSL=1, then TXI_BN_PDU(BN_TYPE=2); If FPSL=0, then TXI_BN_PDU(BN_TYPE=5)

9.3.4.4 C-Port Error Handling Port Operation Table for the TXI Access Protocol

Table 9.3-4—C-Port Error Handling Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	1600	**Burst5_error_event** & CPBE<FF & FPJC=1 & FPER=1 & MS=POPT << Event occurs only at 4 Mbit/s and 16 Mbit/s. >>	CPBE=(CPBE+1)
	1601	**Burst5_error_event** & FPJC=1 & FPER=0 & MS=POPT << Event occurs only at 4 Mbit/s and 16 Mbit/s. >>	FPER=1; TPER=R; CPBE=(CPBE+1)
	1614	**FPTAS=1** & TS=PTXN & CPABE<FF & FPJC=1 & FPER=1 & MS=POPT << Transmitter has released an Abort Sequence. >>	FPTAS=0; CPABE=(CPABE+1)
	1617	**FPTAS=1** & TS=PTXN & FPJC=1 & FPER=0 & MS=POPT << Transmitter has released an Abort Sequence. >>	FPTAS=0; FPER=1; TPER=R; CPABE=(CPABE+1)
	1604	**FR_NOT_COPIED** & CPRCE<FF & FPJC=1 & FPER=1 & MS=POPT	CPRCE=(CPRCE+1)
	1605	**FR_NOT_COPIED** & FPJC=1 & FPER=0 & MS=POPT	FPER=1; TPER=R; CPRCE=(CPRCE+1)
	1606	**FR_WITH_ERR(E=0)** & CPLE<FF & FPJC=1 & FPER=1 & MS=POPT	CPLE=(CPLE+1)
	1607	**FR_WITH_ERR(E=0)** & FPJC=1 & FPER=0 & MS=POPT	FPER=1; TPER=R; CPLE=(CPLE+1)
	1608	**INTERNAL_ERR(correctable)** & CPIE<FF & FPJC=1 & FPER=1 & MS=POPT	CPIE=(CPIE+1)
	1609	**INTERNAL_ERR(correctable)** & FPJC=1 & FPER=0 & MS=POPT	FPER=1; TPER=R; CPIE=(CPIE+1)
	1610	**PM_STATUS.indication (Signal_detection=signal_acquired)** & FPSLD=1 << Event occurs only at 4 Mbit/s and 16 Mbit/s. >>	FPSL=FPSLD=0
	1611	**PM_STATUS.indication (Signal_detection=signal_loss)** & FPSLD=0 << Event occurs only at 4 Mbit/s and 16 Mbit/s. >>	FPSLD=1; TPSL=R
	1613	**PS_STATUS.indication(Frequency_error)** & CPFE<FF & FPJC=1 & FPER=1 & MS=POPT << Event occurs only at 4 Mbit/s and 16 Mbit/s. >>	CPFE=(CPFE+1)
	1612	**PS_STATUS.indication(Frequency_error)** & FPJC=1 & FPER=0 & MS=POPT << Event occurs only at 4 Mbit/s and 16 Mbit/s. >>	FPER=1; TPER=R; CPFE=(CPFE+1)
	1618	**TPER=E** & FPJC=1 & FPECO=1	TPER=R
	1616	**TPSL=E** & FPSLD=1	FPSL=1

9.3.4.5 C-Port Interface Signals Port Operation Table for the TXI Access Protocol

Table 9.3-5—C-Port Interface Signals Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	1819	**DTU_UNITDATA-STATUS.request(Fail)** & FPTX_LTH=1 & TS=PTXD << Transmit FSM is currently transmitting a previously queued frame. This is an indication that frame cut-through is terminating with an error. >>	DISCARD_QUEUED_PDU << The PDU discarded is the frame that was the subject of the previous DTU_UNITDATA.request. >>
	1820	**DTU_UNITDATA-STATUS.request(Fail)** & TS=PTXN << Transmit FSM is currently in the normal state. This may occur between frame transmissions. >>	DISCARD_QUEUED_PDU << The PDU discarded is the frame that was the subject of the previous DTU_UNITDATA.request. >>
	1818	**DTU_UNITDATA-STATUS.request(OK)** & FPTX_LTH=0 & TS=PTXD << Transmit FSM is currently transmitting a frame of unknown length. This is an indication that a cut-through frame is being transmitted. >>	FPTX_LTH=1 << The cut-through frame has completed with an OK status; the frame length is now known. >>
	1800	**DTU_UNITDATA.request** & FPJC=1 & FPOP=1 & FR_LTH<=PPV(MAX_TX) << A frame of known length is passed to the C-Port. >>	QUE_PDU
	1801	**DTU_UNITDATA.request** & FPJC=1 & FPOP=1 & FR_LTH=UNK << A frame cut-through operation has started. The frame length is currently not known. The data is optionally placed into the transmit queue and made available for transmission. (QUE_PDU action allows the PDU_QUEUED event to occur.) >>	[QUE_PDU (optional-i)]
	1802	**FPTI=0**	{PM_CONTROL.request (Transmit_mode=No_fill)} ***or*** {PS_CONTROL.request (Transmit_mode=No_fill)} << An implementation shall take one of these two actions. >>
	1803	**FPTI=1**	{PM_CONTROL.request (Transmit_mode=Fill)} ***or*** {PS_CONTROL.request (Transmit_mode=Fill)} << An implementation shall take one of these two actions. >>
	1804	**FPTXC=0** << 4 Mbit/s and 16 Mbit/s only. >>	PS_CONTROL.request (Crystal_transmit=Not_asserted)

Table 9.3-5—C-Port Interface Signals Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	1805	**FPTXC=1** << Note: When operating at 4 Mbit/s or 16 Mbit/s, Crystal Transmit is controlled by the Join and Monitor Port Operation Tables and may or may not be asserted. When operating at the HMR, Crystal Transmit shall always be asserted. >>	PS_CONTROL.request (Crystal_transmit=Asserted)
	1806	**FR** & FPFCO=0 & FPJC=1 & FPOP=1 << Indicates that a complete frame is passed to the DTU. >>	DTU_UNITDATA.indication; DTU_UNITDATA-STATUS.indication (OK)
	1816	**FR** & FPFCO=1 & FPOP=1 & FPJC=1 << Indicates that frame cut-through has completed. >>	DTU_UNITDATA-STATUS.indication (OK)
	1814	**FR_FC** & FPFCO=1 & FPJC=1 & FPOP=1 << Indicates that Frame cut-through has started. >>	DTU_UNITDATA.indication
	1808	**FR_MAC(DA<>any_recognized_address & SC<>0)** & FPJC=1 & FPOP=1	MRI_UNITDATA.indication
	1807	**FR_MAC(DC<>0 & DC<>3 & SC=0)** & FPJC=1 & FPOP=1	MRI_UNITDATA.indication
	1815	**FR_RSP_PDU(SC=RS)**	MGT_UNITDATA.indication
	1817	**FR_WITH_ERR** & FPFCO=1 & FPOP=1 & FPJC=1 << Indicates that frame cut-through has failed due to a frame error. >>	DTU_UNITDATA-STATUS.indication (Fail)
	1809	**MRI_UNITDATA.request** & FPJC=1 & FPOP=1 & FR_LTH<=PPV(MAX_TX)	QUE_PDU
	1810	**MRI_UNITDATA.request** & FPJC=1 & FPOP=1 & FR_LTH=UNK	[QUE_PDU (optional-i)]
	1812	**PM_STATUS.indication(Insert=Detected)** << Phantom signaling indicated inserted. >>	FPINSD=FPINSLE=1
	1813	**PM_STATUS.indication(Insert=Not_detected)** << Phantom signaling indicated deinserted. >>	FPINSD=0 << Indicates Station has been removed from the C-Port's lobe. >>
	1811	**TPER=E** & FPOP=1 & ERR_PCNTR<>0	**If** FPECO=0, then FPER=0; MRI_UNITDATA.indication (RPT_ERR_PDU); SET_ERR_PCNTR=0

9.3.4.6 C-Port Miscellaneous Frame Handling Port Operation Table for the TXI Access Protocol

Table 9.3-6—C-Port Miscellaneous Frame Handling Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	2000	**FR_CHG_PARM**	[SET APPR_PARMS (optional-x)]
	2001	**FR_CHG_PARM**(CORR_NOT_PRESENT)	[TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=0001) (optional-x)]
	2002	**FR_CHG_PARM**(CORR_PRESENT)	[TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=0001) (optional-x)]
	2003	**FR_INIT**	[SET APPR_PARMS (optional-x)]
	2004	**FR_INIT**(CORR_NOT_PRESENT)	[TXI_RSP_PDU(DC=RPS; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=0001) (optional-x)]
	2005	**FR_INIT**(CORR_PRESENT)	[TXI_RSP_PDU(DC=RPS; SC=RS; CORR=RCV_CORR; RSP_TYPE=0001) (optional-x)]
	2006	**FR_MAC_INV**(ERR_COND=LONG_MAC & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8009)
	2007	**FR_MAC_INV**(ERR_COND=LONG_MAC & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8009)
	2008	**FR_MAC_INV**(ERR_COND=SC_INVALID & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8004)
	2009	**FR_MAC_INV**(ERR_COND=SC_INVALID & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8004)
	2010	**FR_MAC_INV**(ERR_COND=SHORT_MAC & SC_NOT_PRESENT)	[TXI_RSP_PDU(DC<>RS; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8001) (optional-x)]
	2011	**FR_MAC_INV**(ERR_COND=SHORT_MAC & SC_PRESENT & SC<>RS)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_ (optional-x)]; RSP_TYPE=8001)
	2012	**FR_MAC_INV**(ERR_COND=SV_LTH_ERR & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8005)
	2013	**FR_MAC_INV**(ERR_COND=SV_LTH_ERR & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8005)
	2014	**FR_MAC_INV**(ERR_COND=SV_MISSING & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8007)
	2015	**FR_MAC_INV**(ERR_COND=SV_MISSING & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8007)
	2016	**FR_MAC_INV**(ERR_COND=SV_UNK & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8008)
	2017	**FR_MAC_INV**(ERR_COND=SV_UNK & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8008)

Table 9.3-6—C-Port Miscellaneous Frame Handling Port Operation Table for the TXI Access Protocol

S/T	REF	Event/Event and conditions	Actions/Outputs
	2018	**FR_MAC_INV**(ERR_COND=VI_LTH_ERR & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8002)
	2019	**FR_MAC_INV**(ERR_COND=VI_LTH_ERR & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8002)
	2020	**FR_MAC_INV**(ERR_COND=VI_UNK & SC<>RS & CORR_NOT_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; [CORR=UNK_VALUE (optional-x)]; RSP_TYPE=8003)
	2021	**FR_MAC_INV**(ERR_COND=VI_UNK & SC<>RS & CORR_PRESENT)	TXI_RSP_PDU(DC=RCV_SC; SC=RS; CORR=RCV_CORR; RSP_TYPE=8003)
	2022	**FR_REMOVE**	TXI_RSP_PDU(DC=RCV_SC; SC=RS; RSP_TYPE=800A)
	2024	**FR_RQ_ADDR**	[TXI_RPRT_ADDR_PDU (optional-x)]
	2025	**FR_RQ_ATTACH**	[TXI_RPRT_ATTACH_PDU (optional-x)]
	2026	**FR_RQ_STATE**	[TXI_RPRT_STATE_PDU (optional-x)]

9.3.4.7 Precise specification of terms

This subclause provides precise specification of terms used by the C-Port's Operation Tables. These specifications are for the "Event/Event and conditions" and "Actions/Outputs" columns.

9.3.4.7.1 Precise specification of "Event/Event and conditions"

The following definitions are applied to the terms used for events in the FSMs and C-Port Operation Tables.

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
{flag}=0	The specified flag is set to zero (false).
{flag}=1	The specified flag is set to one (true).
{term1} < {term2}	Term 1 is less than term 2.
{term1} <= {term2}	Term 1 is less than or equal to term 2.
{term1} <> {term2}	Term 1 is not equal to term 2.
{term1} = {term2}	Term 1 is equal to term 2.
{term1} > {term2}	Term 1 is greater than term 2.
{term1} >= {term2}	Term 1 is greater than or equal to term 2.
{timer}=E	The specified timer has expired.

The following additional items of relevance are used in the tables:

— Values are in hexadecimal notation unless otherwise indicated.
— **&** means "and."
— | means "or."

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
A=0	Both the A bits in the received frame's FS field (bits 0 and 4) are 0.
AND(x,y)	Bit-wise logical AND function of binary objects x and y.
AP_MASK	Option mask for Access Protocol. Bit significant mask used by the C-Port. One bit is defined for each access protocol supported.
AP_REQ=value	Access Protocol Request subvector is received with the specified value.
Burst5_error_event	A PM_STATUS.indication(Burst5_error) has occurred. The conditions under which a Burst5_error is excluded are not uniquely specified by this standard (see Counter Burst Error in 10.6.2.2).
C=0	Both C bits in the received frame's FS field (bits 1 and 5) are 0.
Connect.PMAC	The PMAC receives this command from local management to start the process of joining the network.
DA<>any_recognized_address	The DA of the received frame does not match any of the C-Port's addresses being: (a) Any of the C-Port's individual addresses; or (b) Any of the C-Port's group addresses; or (c) Any of the C-Port's functional addresses; or (d) Any of the broadcast addresses defined in 3.2.4.1.
DA=any_recognized_address	The DA of the received frame matches any of the C-Port's addresses being: (a) One of the C-Port's individual address; or (b) One of the C-Port's group addresses; or (c) One of the C-Port's functional addresses; or (d) One of the broadcast addresses defined in 3.2.4.1.
DA=MA	The DA of the received frame is equal to the individual address of the C-Port. If the C-Port's individual address is a universally administered address, then all 48 bits must match. If the C-Port's individual address is a locally administrated address, then either a hierarchical address match or a 48-bit address match is allowed.
DA=Non_broadcast	The received frame was not sent to a broadcast address, but was otherwise addressed to the C-Port.
DC<>0	Destination Class is not MAC.
Disconnect.PMAC	The request from local management to close the C-Port.
DTU_DAC.response(RC)	Response to the C-Port's request (DTU_DAC.request). RC uses the same values as the DTR_RSP subvector defined in Table 10-6 of Amd. 1.
DTU_UNITDATA.request	The DTU requests a frame to be transmitted.
DTU_UNITDATA-STATUS.request (Status_Code)	Frame status is reported by the DTU to the PMAC. The Status_Code may be one of the following: — OK: The frame has been successfully transferred to the PMAC without error. — Fail: Transfer of the frame to the PMAC has failed because of a frame error.
EOB	End of byte: The last bit of an octet has been transmitted, excluding octets representing SD, AC, FCS, ED, FS, and IFG.
EOD	End of data: The last octet of the information field has been transmitted.
ERR_CNTR<>0	Any error counter is non-zero.
FR	A frame has been received that meets the criteria specified in 4.3.2 (4 Mbit/s or 16 Mbit/s only) or 9.1.1.6 (HMR only).
FR(criteria)	A frame has been received that meets the specified criteria and the criteria specified in 4.3.2 (4 Mbit/s or 16 Mbit/s only) or 9.1.1.6 (HMR only).

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
FR_AC	A bit sequence that indicates — A frame's SD and AC fields at 4 Mbit/s and 16 Mbit/s have been received as specified in 4.3.2; *or* — A frame's SSD and AC fields at the HMR have been received as specified in 9.1.1.6.
FR_AMP	A verified Active Monitor Present frame (10.3.6) is received.
FR_BN(criteria)	A verified Beacon frame (10.3.6) is received that meets the specified criteria.
FR_CHG_PARM(criteria)	A verified Change Parameters MAC frame (10.3.6) is received that meets the specified criteria.
FR_COPIED(criteria)	The PMAC successfully copied the received frame that meets the specified criteria.
FR_CT << 4 Mbit/s and 16 Mbit/s only. >>	A Claim Token MAC frame (3.3.5.2) is received.
FR_FC	A frame has been received through the FC field (see 9.1.1.6).
FR_INIT	A verified Initialize Station MAC frame (10.3.6) is received.
FR_INS_REQ(criteria)	A verified Insert Request MAC frame (10.3.6) that meets the specified criteria is received.
FR_LLC(criteria)	An LLC frame is received that meets the specified criteria and the criteria specified in 4.3.2.
FR_LMTN(DA=broadcast) << Only if Station is using LMT defined by 9.1.6.2. >>	A verified LMT Notification MAC frame addressed to the broadcast address (12.3.1) is received.
FR_LTH	The length of the frame to be transmitted. The value for the frame length includes all of the frame format fields, beginning with the starting delimiter (SD) and including the interframe gap (IFG).
FR_LTH<=PPV(MAX_TX)	The length of the frame to be transmitted is less than or equal to the C-Port's maximum allowed frame length.
FR_LTH=UNK	The length of the frame to be transmitted is unknown.
FR_MAC(criteria).	A valid MAC frame is received that meets the specified criteria and the criteria specified in 10.3.6.
FR_MAC_INV(reason)	FR_MAC_INV(reason). A valid (4.3.2) MAC frame is received that fails verification (10.3.6.5) for the reason specified.
FR_NOT_COPIED	The C-Port recognizes a valid frame to be copied, but is unable to copy the frame.
FR_REG_REQ(criteria)	A verified Registration Request MAC frame (10.3.6) is received that meets the specified criteria.
FR_REMOVE(criteria)	A verified Remove MAC frame (10.3.6) is received that meets the specified criteria.
FR_REQ_ADDR	A verified Request Address MAC frame (10.3.6) is received.
FR_RMV_ALRT **(VC=30 & SA=SUA)** << HMR only. >>	A verified Remove Alert MAC frame (12.3.1) is received.
FR_RP << 4 Mbit/s and 16 Mbit/s only. >>	A verified Ring Purge MAC frame (10.3.6) is received.
FR_RQ_ATTACH	A verified Request Attachment MAC frame (10.3.6) is received.
FR_RQ_STATE	A verified Request Station State MAC frame (10.3.6) is received.

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
FR_RSP_PDU(criteria)	A verified Response MAC frame (10.3.6) is received that meets the specified criteria.
FR_SHB(criteria)	A verified SHB MAC frame (10.3.6) that meets the specified criteria is received.
FR_SMP	A verified SMP MAC frame (10.3.6) is received.
FR_TEST(DA=FA(TEST)) << Only if Station is using LMT defined by 9.1.6.2. >>	A verified LMT MAC frame addressed to the TEST functional address (12.3.1) is received.
FR_WITH_ERR	A frame is received with errors (see 9.1.1.6).
INTERNAL_ERR	Any internal error occurred that prevented the C-Port from following the established protocol (i.e., parity error, etc.).
Internal_Test_Failure	The C-Port failed during internal testing.
JS=state	The Join FSM is in the specified state.
MRI_UNITDATA.request	The MRI requests a frame be transmitted.
MS=state	The Monitor FSM is in the specified state.
PDU_QUEUED(criteria)	A frame is queued for transmission that meets the specified criteria.
PM_STATUS.indication (Insert=Detected)	The PHY indicates an insert request is received via the phantom-signaling channel (see 9.7.1.2.1 for 4 Mbit/s or 16 Mbit/s, and 9.7.2.2.1 for 100 Mbit/s).
PM_STATUS.indication (Insert=Not_detected)	The PHY indicates the absence of an insert request on the phantom-signaling channel (see 9.7.1.2.1 for 4 Mbit/s or 16 Mbit/s, and 9.7.2.2.1 for 100 Mbit/s).
PM_STATUS.indication (Signal_detection=signal_acquired)	The PHY indicates valid receiver signal (see 5.1.4.1).
PM_STATUS.indication (Signal_detection=signal_loss)	The PHY indicates loss of valid receiver signal (see 5.1.4.1).
PORT_ERR	Any internal C-Port condition that prevents the successful completion of the PDU transmit operation.
PS_STATUS.indication (Frequency_error)	The C-Port indicates the frequency of the received data is out of tolerance (see 5.1.2.3).
PS_STATUS.indication(Burst4_error)	The C-Port indicates the received data contains a Burst4_error (see 5.1.2.3).
PS_STATUS.indication(Burst5_error)	The C-Port indicates the received data contains a Burst5_error (see 5.1.2.3).
PS_STATUS.indication (Link_status=Asserted) << Occurs only at the HMR. >>	The 100 Mbit/s PHY indicates that the link is active (9.8.1.1.3).
PS_STATUS.indication (Link_status=Not_asserted) << Occurs only at the HMR. >>	The 100 Mbit/s PHY indicates that the link is inactive (9.8.1.1.3).
SA<>MA	The source address (SA) of the received frame is not equal to the individual address of the C-Port.
SA<>SUA	The SA of the received frame is not equal to the address stored as the upstream neighbor's address (SUA).
SA=MA	The SA of the received frame is equal to the individual address of the C-Port.
SA=SUA	The SA of the received frame is equal to the address stored as the upstream neighbor's address (SUA).

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
SC<>0	Source class is not MAC.
SDAC_RC=value	The stored DAC return code is equal to the designated value.
TK_AC << 4 Mbit/s and 16 Mbit/s only. >>	A Token is received that meets the criteria specified in 4.3.1.
TS=state	The Transmit FSM is in the specified state.
TXI_REQ	A frame is to be transmitted immediately.
UNA	The Upstream Neighbor's Address (UNA) subvector in the received frame.
UNA<>MA	The UNA in the received frame is not equal to the C-Port's individual address.
UNA<>SUA	The UNA in the received frame is not equal to the Stored Upstream Address (SUA).
UNA=MA	The UNA in the received frame is equal to the C-Port's individual address.
UNA=SUA	The UNA is equal to the SUA.

9.3.4.7.2 Precise specification of "Actions/Outputs"

The following definitions are applied to the terms used for actions and outputs in the FSMs and C-Port Operation Tables. Actions and outputs are separated by a semicolon (**;**).

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
{counter}=({counter}+1)	Increment the specified counter by one.
{counter}=({counter}-1)	Decrement the specified counter by one.
{counter}=value	Set the specified counter to the specified value.
{flag}=0	Set the value of the specified flag to zero (false).
{flag}=1	Set the value of the specified flag to one (true).
{timer}=R	The specified timer is set to its initial value and started.
variable = value	Set the variable to the specified value.

The following additional items of relevance are used in the tables:

— Values are in hexadecimal notation unless otherwise indicated.
— **;** means "and."

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
AP_RSP=value	The AP_RSP subvector, in the Registration Response MAC frame being transmitted, takes on the indicated value.
BN_TYPE=value	The value of the beacon type subvector to be transmitted.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
CORR=UNK_VALUE (optional-x)	The frame received did not contain a correlator subvector (3.3.4); thus, the value of the correlator subvector to be transmitted is unspecified and the subvector may be omitted. The standard recommends new implementations not transmit the correlator subvector when no correlator subvector was received.
DISCARD_QUEUED_PDU	The C-Port removes the frame from the transmit queue that was the subject of the previous DTU_UNITDATA.request.
DTU_DAC.request (starting_address, individual_address_count)	Indication to the DTU entity, requesting a check of the addressing of the connected Station.
DTU_UNITDATA.indication	The frame is indicated to the DTU interface.
DTU_UNITDATA-STATUS.indication (Status_Code)	Frame status is indicated by the PMAC to the DTU. The Status_Code may be one of the following: — OK: The frame has been successfully transferred to the DTU without error. — Fail: Transfer of the frame to the DTU has failed due to a frame error.
FA(address)=0	Disable the indicated functional address.
FA(address)=1	Enable the indicated functional address.
Flush_transmit_queues	The transmitter is instructed to discard any frames in its transmit queues.
FR_LTH<=PPV(MAX_TX)	The length of the frame to be transmitted is less than or equal to the C-Port's maximum allowed frame length.
FTI=x	The value of FTI is not specified.
INSERT	Request the PHY to physically connect the Station to the network [PM_CONTROL.request(Insert_station)] in 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s, and 9.8.1.1.7 for 100 Mbit/s.
INTERNAL_PTEST	Internal C-Port diagnostic testing. Specification of this diagnostic test is beyond the scope of this standard.
JS=state	The Join FSM is changed to the specified state.
MRI_UNITDATA.indication	The frame is indicated to the MRI.
MRI_UNITDATA.indication (RPT_ERR_PDU)	A Report Error PDU is indicated to the MRI.
MS=state	The Monitor FSM is changed to the specified state.
MS=x	The Monitor FSM state is changed to unspecified (not running).
P	The value of the P bits in the AC field.
PM_CONTROL.request (Transmit_mode=Fill)	The C-Port PMAC requests the PMC stop repeat and start sourcing fill (see 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s; not used for 100 Mbit/s).
PM_CONTROL.request (Transmit_mode=Repeat)	The C-Port PMAC requests the PMC stop sourcing fill and start repeat (see 9.7.1.2.2 for 4 Mbit/s or 16 Mbit/s; not used for 100 Mbit/s).
PS_CONTROL.request (Crystal_transmit=Asserted)	The C-Port PMAC requests Crystal_transmit (see 5.1.2.4 for 4 Mbit/s and 16 Mbit/s, or 9.8.1.1.4 for 100 Mbit/s operation).
PS_CONTROL.request (Crystal_transmit=Not_asserted)	The C-Port PMAC removes the Crystal_transmit request (see 5.1.2.4). This signal is not used in the HMR operation.
PS_CONTROL.request (Transmit_mode=Fill)	The C-Port PMAC requests the PSC stop repeat and start sourcing fill (see 9.7.2.2 for 4 Mbit/s and 16 Mbit/s, or 9.8.1.1.4 for 100 Mbit/s).
PS_CONTROL.request (Transmit_mode=Repeat)	The C-Port PMAC requests the PSC stop sourcing fill and start repeat (see 9.7.2.2 for 4 Mbit/s and 16 Mbit/s, or 9.8.1.1.4 for 100 Mbit/s).
QUE_PDU	Queue the PDU for transmission.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
QUE_RPRT_ADDR_PDU	Queue a Report Station Address MAC PDU (3.3.5.1) for transmission.
QUE_RPRT_ATTACH_PDU	Queue a Report Station Attachment MAC PDU (3.3.5.1) for transmission.
QUE_RPRT_ERR_PDU	Queue a Report Error MAC PDU (as defined in 3.3.5.1) for transmission.
QUE_RPRT_STATE_PDU	Queue a Report Station State MAC PDU (3.3.5.1) for transmission.
QUE_RSP_PDU	Queue a Response MAC PDU (as defined in 3.3.5.1) for transmission.
S_AP=AP_REQ	Store the value of the Access Protocol Request subvector (AP_REQ) from the received frame.
SDAC_RC=RC	Store the value of the DAC return code from the DTU_DAC.response.
Set A=1	Both A bits in the FS field shall be set to one as the frame is repeated.
Set C=1	Both C bits in the FS field shall be set to one as the frame is repeated.
SET_APPR_PARMS	The C-Port sets its parameters to the values indicated in the received frame.
SET_ERR_PCNTR=0	Set the values for all of the error counters reported in the Report Error MAC frame to zero.
Set_initial_conditions << 4 Mbit/s and 16 Mbit/s only. >>	The C-Port PMAC shall set all flags to zero, set all counters to zero, set all stored values to zero, and stop all timers. The states of the Monitor FSM and Transmit FSM are not specified. The PS_CONTROL.request(Medium_rate) and PM_CONTROL.request(Medium_rate) are asserted according to the value of FPMRO (less than 2).
Set_initial_conditions << HMR only. >>	The C-Port PMAC shall set all flags to zero, set all counters to zero, set all stored values to zero, and stop all timers. The Monitor FSM state is not specified. The PS_CONTROL.request(Initialize) shall indicate to the local PHY to activate prior to the Connect.PMAC and become active with the remote PHY according to the value of FPMRO (greater than 1).
SIAC=IAC	Store the value of the Individual Address Count subvector from the received frame.
SPD=PD	Store the value of the Phantom subvector (PD) from the received frame.
SUA=SA	Store the value of the source address (SA) from the received frame as the C-Port's upstream neighbor address (SUA).
TEST	The C-Port shall perform a test of its transmit functions, its receive functions, and the medium between the C-Port and the TCU. It is recommended that the data path includes the elastic buffer and the fixed latency buffer (5.8). A C-Port shall fail the test if the sustained bit error rate does not meet the criteria specified in Annex P. A C-Port shall only transmit valid frames, tokens, and fill during the test, and shall only count errors in frames and tokens.
TS=state	The Transmit FSM is changed to the specified state.
TX_AB	The C-Port shall transmit an abort sequence as follows. — 4 Mbit/s and 16 Mbit/s: A Starting Delimiter immediately followed by an Ending Delimiter. — 100 Mbit/s: A frame abort [PS_CONTROL.request(Abort_frame) as specified in 9.8.1.1.4].
TX_EFS << HMR only. >>	The C-Port shall transmit an end-of-frame sequence composed of ET, ESD, and IFG fields. The ET E bit shall be zero.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
TX_EFS(E=1) << HMR only. >>	The C-Port shall transmit an end-of-frame sequence composed of ET, ESD, and IFG fields. The E bit shall be one.
TX_EFS(I=0) << 4 Mbit/s and 16 Mbit/s only. >>	The C-Port shall transmit an end-of-frame sequence composed of ED, FS, and IFG fields. The E,I,A, and C bits shall be zero.
TX_EFS(I=0, E=1) << 4 Mbit/s and 16 Mbit/s only. >>	The C-Port shall transmit an end-of-frame sequence composed of ED, FS, and IFG fields. The I, A, and C bits shall be zero. The E bit shall be one.
TX_FCS	The C-Port shall transmit a frame check sequence for the frame as defined in 3.2.7.
TX_SFS(P=value; R=value)	The C-Port shall transmit the start-of-frame sequence as follows. — 4 Mbit/s and 16 Mbit/s: A Starting Delimiter followed by the AC field, as defined below. — 100 Mbit/s: A Start Frame [PS_UNITDATA.request(Start_ stream_delimiter) - see 9.8.1.1.2] followed by the AC field, as defined below. The AC field's P (priority) and R (reservation) values shall be as specified, and T=1 and M=0.
TXI_BN_PDU	The C-Port shall transmit a Beacon MAC frame. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event.
TXI_INS_RSP_PDU()	The C-Port shall transmit an Insert Response MAC frame. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event.
TXI_INV_FCS	The C-Port shall transmit an invalid FCS.
TXI_PHB_PDU	The C-Port shall transmit a C-Port Heart Beat MAC frame. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event.
TXI_REG_RSP_PDU()	The C-Port shall transmit a Registration Response MAC frame. The frame shall contain all of the required subvectors. The transmission of the frame occurs at the earliest opportunity. This action generates the TXI_REQ event.
TXI_RP_PDU << 4 Mbit/s and 16 Mbit/s only. >>	The station shall transmit a Ring Purge MAC frame with the AC fields of P=000, T=1, M=0, R=000. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity (after completion of any transmission in progress) and not wait for a token. This action generates the TXI_REQ event.

Replace 9.7 with the following:

9.7 C-Port specific components and specifications

9.7.1 4 and 16 Mbit/s operation

9.7.1.1 C-Port Repeat Path (for 4 and 16 Mbit/s)

The C-Port shall support the station LMT. The configuration for such support is implementation dependent. Figure 9.7-1 illustrates two repeat paths: one in the PSC and one in the PMC. When repeat paths are

available in both the PSC and the PMC, one and only one repeat path shall be active at any time. A disabled repeat path shall neither repeat symbols nor insert fill into the transmit path. Availability of any repeat path when the C-Port is in the Bypass state (JS=BP) is not defined.

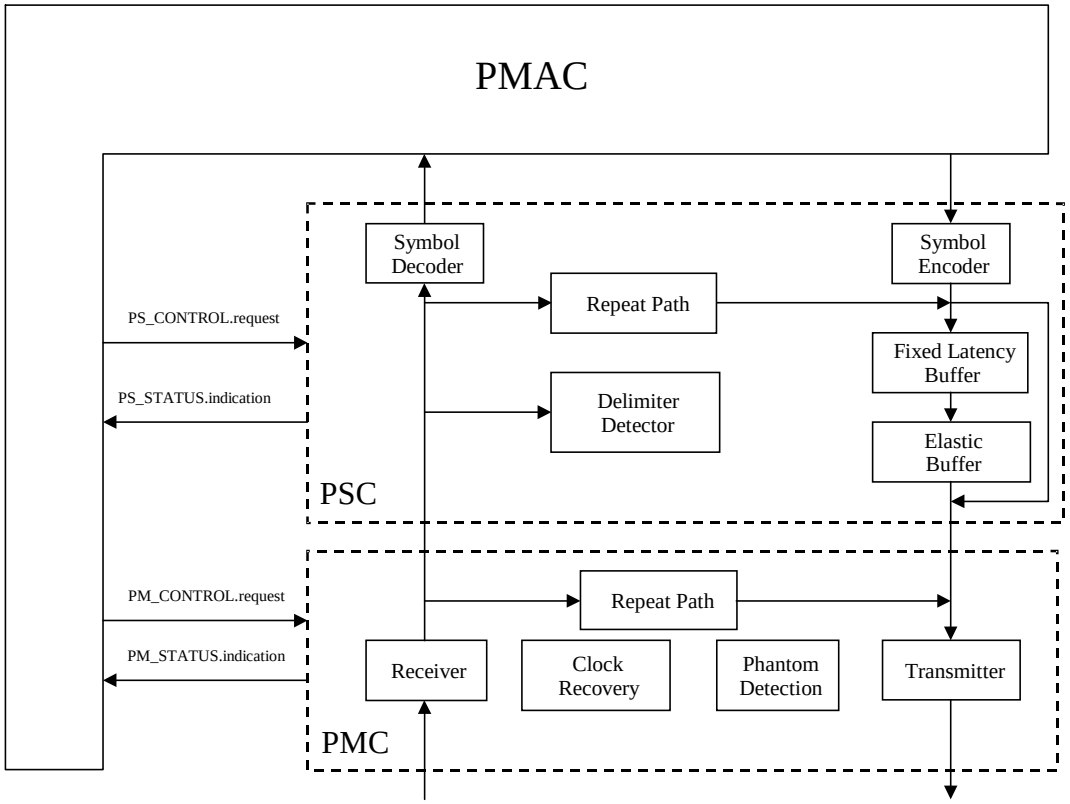

Figure 9.7-1—C-Port Repeat Paths (one shall be supplied to support Station LMT)

A C-Port provides a repeat path with the following characteristics:

a) A C-Port repeat path shall include a transmitter, including all circuitry in the transmission path between the data retiming (latching) mechanism and the MIC transmit connections.

b) A C-Port repeat path shall include a receiver, including all circuitry between the MIC connections and the recovered clock used to latch the data.

c) A C-Port repeat path shall repeat DATA_ZEROs and DATA_ONEs unaltered between the SD and the ED field inclusive when repeating a frame.

d) A C-Port repeat path shall use the recovered clock.

e) To ensure C-Ports do not introduce excessive latency, the average repeat path latency shall not exceed 100 symbols.

f) A C-Port repeat path shall modify the A and C bits only if the frames destination address is recognized by the C-Port MAC, and FPACO is set to 1.

g) A C-Port repeat path may optionally set the E bit when a frame with an error is detected.

h) A C-Port repeat path may optionally correct a Burst-5 error to Burst-4.

i) A C-Port repeat path may optionally cause a polarity inversion of the data stream.

9.7.1.2 C Interface service specification (for 4 and 16 Mbit/s)

The following service primitives specify the required information that is passed between the PMAC and the PMC. This service specification is solely for the purpose of explaining C-Port operation and does not imply any particular implementation. This service specification is in addition to the service specification defined for Stations in 5.1.2 and 5.1.3.

9.7.1.2.1 PM_STATUS.indication

This primitive is used by the PMC to inform the PMAC of the following:

— The state of the phantom signaling channel;
— Errors;
— Significant status changes.

This primitive is in addition to the service specification found in 5.1.4.1.

PM_STATUS.indication[Insert]

Insert indicates the state of the phantom signaling channel and is specified as one of the following:

Detected
Not_detected

When generated: The PMC generates the appropriate PM_STATUS.indication upon detection of the change of the state of phantom drive, as described in 7.2.1.

Effect of receipt: These signals are processed by the PMAC protocol.

9.7.1.2.2 PM_CONTROL.request

This primitive is used by the PMAC to request certain actions of the PMC.

PM_CONTROL.request[Insert_station (5.9),
Remove_station (5.9),
Media_rate (5.2)
Transmit_mode(5.4.1)]

Media_rate is specified as one of the following:
4 Mbit/s
16 Mbit/s

Transmit_mode is specified as one of the following:
Repeat
Fill

When generated: The PMAC generates a PM_CONTROL.request for each action request.

Effect of receipt: The PHY performs the appropriate action.

9.7.1.3 C-Port PMC specification (for 4 and 16 Mbit/s)

When the PMAC option flag FPOTO is set to 0, the C-Port is emulating a station and shall provide a PMC with the characteristics defined in Clause 7.

When the PMAC option flag FPOTO is set to 1, the C-Port shall provide a PMC with the characteristics defined in Clause 7, with the following modifications:

a) Phantom Signaling and Wire Fault Detection are not included (7.2.1).
b) MIC contact specifications for a concentrator are used (8.1).
c) Phantom channel signal detection, defined for the RAC (8.3), may optionally be included.
d) Provide for station confirmation of TCU presence and support of station detection of an open wire condition and certain short circuit conditions in the lobe cabling (8.3.3).
e) Provide a repeat path for station LMT use within 190 ms of the detection of insert dropping during Beacon Test while supporting the TKP Access Protocol (8.3.2).

9.7.2 100 Mbit/s operation

9.7.2.1 C-Port Repeat Path (for 100 Mbit/s)

The C-Port shall support the station LMT. The configuration for such support is implementation dependent. Activation and deactivation of the repeat path (entrance and exit from LMT) is described in 9.3. When multiple repeat paths are available, one and only one repeat path shall be active at any time. Availability of any repeat path when the C-Port is in the Bypass state (JS=BP) is not defined. Where there is uncertainty in the specification of repeat paths, interoperability with the Station join function, as defined in State Table 9.2-1, shall be the final arbiter.

Figure 9.7-2 illustrates the repeat path for a C-Port operating over twisted pair. The repeat path for a C-Port operating over a fibre optic medium appears in the same place.

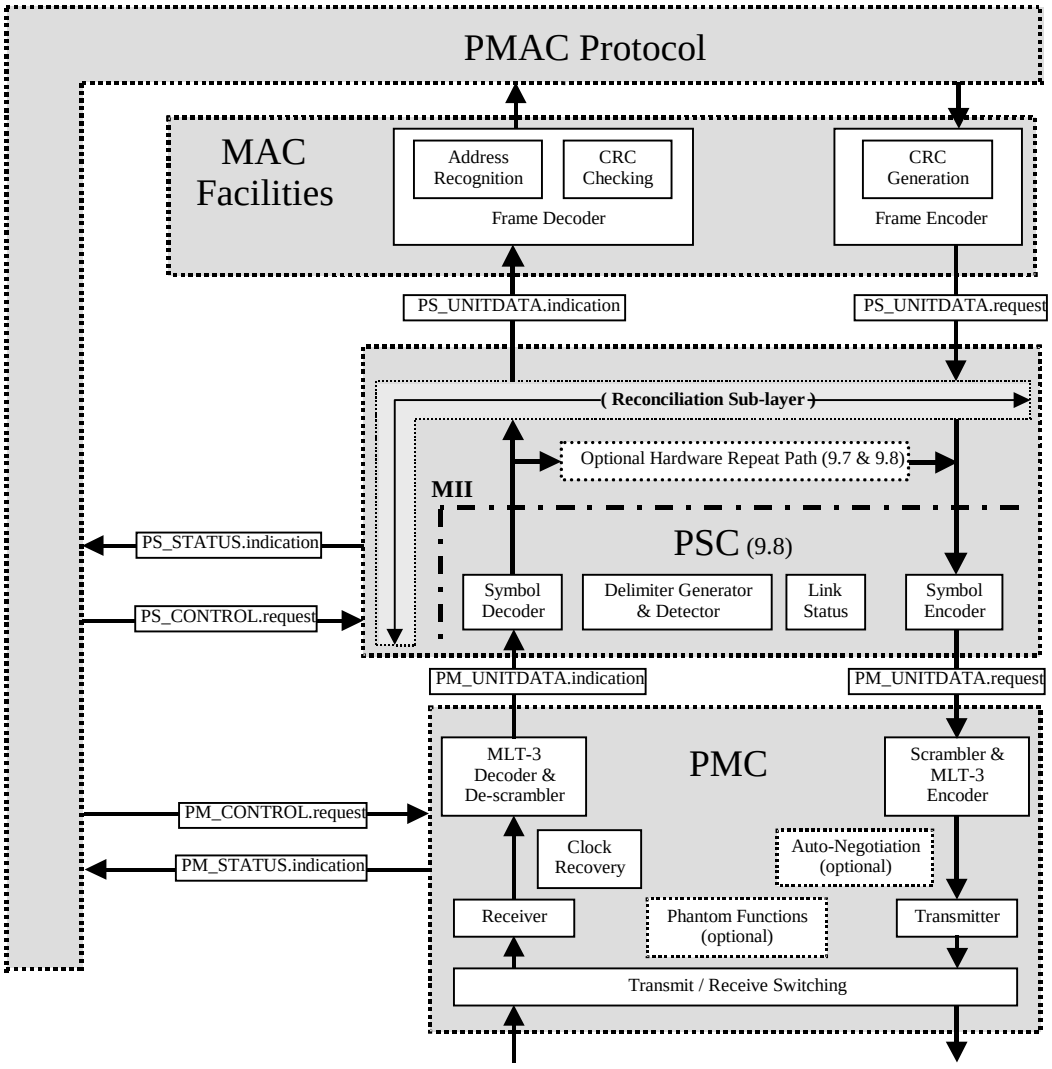

Figure 9.7-2—C-Port Repeat Path (a repeat path shall be supplied to support Station LMT)

A C-Port provides a repeat path with the following characteristics:

a) The C-Port repeat path shall correctly transmit exactly one valid LMT frame for each valid received LMT frame.
b) The C-Port repeat path may respond to other received frames, as appropriate.
c) The C-Port repeat path shall not introduce any code violations into the data stream.
d) The C-Port repeat path shall meet the LMT timing constraints discussed in Annex X.

9.7.2.2 MAC interface service specification (for 100 Mbit/s)

The following service primitives specify the required information that is passed between the PMAC and the PMC. This service specification is solely for the purpose of explaining C-Port operation and does not imply any particular implementation. This service specification is in addition to the service specification defined for stations in 5.1.2 and 5.1.3.

9.7.2.2.1 PM_STATUS.indication

This is an optional primitive to be used by the PMC to inform the PMAC of the state of the phantom signaling channel. This primitive is in addition to the service specification found in 9.8.

PM_STATUS.indication[Insert]

Insert indicates the state of the phantom signaling channel and is specified as one of the following:

Detected
Not_detected

When generated: The PMC generates the appropriate PM_STATUS.indication upon detection of the change of the state of phantom drive, as described in 7.2.1.

Effect of receipt: These signals are processed by the PMAC protocol.

9.7.2.3 C-Port PMC specification (for 100 Mbit/s)

If FPOTO is set to 0, the C-Port is emulating a station and shall provide a PMC with the characteristics defined in 9.8.

If FPOTO is set to 1, the C-Port shall provide a PMC with the characteristics defined in 9.8, with the following modifications:

a) Phantom Signaling and Wire Fault Detection are not included (7.2.1).
b) MIC contact specifications for a concentrator are used (8.1).
c) Phantom channel signal detection, defined for the RAC (8.3), may optionally be included.
d) Optionally provide for station confirmation of TCU presence and support of station detection of an open wire condition and certain short circuit conditions in the lobe cabling (8.3.3).

9.7.3 1000 Mbit/s operation

Operation for 1000 Mbit/s is to be determined.

Add 9.8:

9.8 PHY definition for HMR

This clause defines the PHY to be used for the HMR option. This definition applies to both the Station and the C-Port. Operation at 100 Mbit/s is described in 9.8.1. Subclause 9.8.2 is reserved for the description of operation at 1000 Mbit/s.

9.8.1 100 Mbit/s PHY

This subclause defines the PHY to be used for 100 Mbit/s transmission for both the Station and C-Port. This PHY is divided into two sublayers: PSC and PMC. The PSC is identical for both twisted pair and optical fibre media. The PMCs for both media types are defined separately in the following paragraphs. This subclause replaces Clause 5, Station specific components; Clause 7, Station attachment specifications; and Clause 8, Concentrator specifications, for 100 Mbit/s operation.

The 100 Mbit/s PSC is specified by incorporating portions of IEEE Std 802.3-1998, by reference, (hereafter [802.3]) with the modifications noted below. The PSC sublayer is analogous to the combination of the PCS

and PMA sublayers of [802.3] 22 and 24, together with a new Reconciliation Sublayer (RS), which provides an interface to the MAC.

The 100 Mbit/s PMC for twisted pair (hereafter [TP-PMC]) is specified by incorporating the FDDI TP-PMD standard, ANSI X3.263-1995, by reference, (hereafter [TP-PMD]) with the modifications noted in 9.8.1.3.5 through 9.8.1.3.18.

The 100 Mbit/s PMC for optical fibre (hereafter [FO-PMC]) is specified by incorporating the FDDI PMD standard, ISO/IEC 9314-3: 1990, by reference, (hereafter [FO-PMD]) with the modifications noted in 13.9.

The PMC sublayer is analogous to the PMD sublayer of [802.3] 25 and 26.

The interface between the MAC and PHY is precisely defined by the primitives described below. These primitives are defined in terms of the 100 Mbit/s Media Independent Interface (MII), as specified in [802.3] 22, Reconciliation Sublayer (RS) and Media Independent Interface (MII). Note that although the MII is exactly as specified in [802.3] 22, there is a new RS that maps the MII signals to the 802.5 MAC primitives. An explicit embodiment of the MII is not required. If a physical embodiment of the MII is not present, then the implementation shall provide control and status mechanisms equivalent to those described in [802.3] 22. If an exposed MII does exist, it shall meet all requirements of [802.3] 22. Note that the RS is not as defined in [802.3] 22.

The clauses listed above may reference other portions of the subject standards. Requirements placed by reference shall be met by the 100 Mbit/s PHY wherever applicable.

Objectives

a) Define the PHY compatible with standardized and implemented versions of 100BASE-X and FDDI PMDs.
b) Define a simple mapping of MII signals into MAC primitives.
c) Maintain the equivalent of the existing 4/16 Mbit/s 802.5 signaling interface.
d) Provide a low-cost physical connection for switched token ring by using a predefined transceiver.
e) Provide a standard interface, capable of being extended to additional media types, such as optical fibre.

9.8.1.1 100 Mbit/s service primitives (common)

The following service primitives specify the required information that is passed between the PMC, the PSC, the MAC, and the PMAC/SMAC. The service primitives are shown in Figures 2.2-1 and 2.2-2. The PS_UNITDATA.indication and PS_UNITDATA.request primitives can be considered to map onto physical [802.3] MII signals, which may optionally be exposed. This MII is a 4-bit data interface, with 4 bits transferred in a 40 ns time interval. The nibble clock shall have a tolerance of plus or minus 50 ppm or better.

9.8.1.1.1 PS_UNITDATA.indication

This primitive defines the transfer of data from the PSC to the MAC. This is described in terms of [802.3] MII signals. This primitive is derived from the MII signals RX_DV and RXD0..3 via the RS. A PS_UNITDATA.indication is synchronous to the MII RX_CLK rising edge.

PS_UNITDATA.indication[Rcv_Indicator]

The Rcv_Indicator specified is one of the following:

— Idle;
— Start_stream_delimiter;
— Data_octet;
— End_stream_delimiter;
— Non_octet_end_stream_delimiter.

Idle is used only between frames. The Rcv_Indicator indicates an Idle on every rising edge of MII RX_CLK in which the MII signal RX_DV was not asserted at the previous MII RX_CLK rising edge. Idle is used for Fill.

Start_stream_delimiter indicates the reception of the beginning of a valid stream. This indication is generated on the second rising edge of MII RX_CLK in which RX_DV is asserted. A start_stream_delimiter indication may only follow an Idle. The start_stream_delimiter is not necessarily octet aligned to previous streams.

Data_octet indications are generated on alternate rising edges of MII RX_CLK. A data_octet is indicated when RX_DV remains asserted for a further two rising edges of MII RX_CLK, immediately following a start_stream_delimiter or a prior data_octet. Data shall be latched from the MII RXD signals on each MII RX_CLK rising edge and assembled into MAC octets, as shown in Table 9.8-1. The MAC octet D0..D7, where D0 is MSB, shall have its first 4 bits (D0..D3) translated from the previous nibble, RXD0..RXD3; then the second 4 bits (D4..D7) shall be translated from the current nibble, RXD0..RXD3. Note that this data is invalid and will be treated as non-data when a PS_STATUS.indication[frame_violation] is simultaneously indicated.

Table 9.8-1—Bit/Nibble ordering

MAC OCTET DESCRIPTION:							
1st Bit Received							Last Bit Received
D0 (MSB)	D1	D2	D3	D4	D5	D6	D7 (LSB)
RXD0	RXD1	RXD2	RXD3	RXD0	RXD1	RXD2	RXD3
1st Nibble Received				2nd Nibble Received			
MII OCTET DESCRIPTION							

End_stream_delimiter indicates the end of a data stream. An end_stream_delimiter is indicated on the first rising edge of MII RX_CLK, in which RX_DV is sampled deasserted. An end_stream_delimiter may only be generated if a complete Data_octet or Start_stream_delimiter was indicated on the previous MII RX_CLK rising edge. If the previous MII RX_CLK rising edge latched only the least significant nibble of a data octet, then the stream end is misaligned and a Non_octet_end_stream_delimiter is indicated instead.

Non_octet_end_stream_delimiter indicates to the MAC that the stream ended, but not on a data_octet boundary. A non_octet_end_stream_delimiter is indicated on the MII RX_CLK rising edge, in which RX_DV is deasserted from the asserted state, but a complete Data_octet was not indicated on the previous rising edge of MII RX_CLK.

9.8.1.1.2 PS_UNITDATA.request

This primitive defines the transfer of data from the MAC to the PSC. This is described in terms of [802.3] MII signals. This primitive is mapped to the MII signals TX_EN and TXD0..3 via the RS. A PS_UNITDATA.request is synchronous to the MII TX_CLK rising edge.

PS_UNITDATA.request[Tx_Indicator]

The Tx_Indicator specified is one of the following:

— Idle;
— Start_stream_delimiter;
— Data_octet;
— End_stream_delimiter.

Idle is used only between frames. When Tx_Indicator requests an Idle, the MII signal TX_EN will be deasserted.

Start_stream_delimiter is used to request the beginning of a valid stream. This causes the assertion of TX_EN for two nibble periods. A start_stream_delimiter can only follow an Idle Indicator. The value presented on TXD0..3 during these two nibble periods is not defined and is ignored by the PSC.

Data_octet is a two-nibble value containing the data to be transmitted on the medium. Tx_Indicator Data_octets are requested on alternate rising edges of MII TX_CLK, starting two rising edges after the Start_stream_delimiter has been requested up until the End_stream_delimiter has been transmitted (i.e., while TX_EN remains asserted). At all other times, the TXD0..3 pattern shall be ignored by the PSC. Data shall be translated between the MAC and the MII signals, as shown in Table 9.8-2. The MAC octet D0..D7, where D0 is MSB, shall have its first 4 bits (D0..D3) translated to TXD0..TXD3; the second 4 bits (D4..D7) shall be translated to the nibble, TXD0..TXD3.

Table 9.8-2—Bit/Nibble ordering

MAC OCTET DESCRIPTION:							
1st Bit Transmitted						Last Bit Transmitted	
D0 (MSB)	D1	D2	D3	D4	D5	D6	D7 (LSB)
TXD0	TXD1	TXD2	TXD3	TXD0	TXD1	TXD2	TXD3
1st Nibble Transmitted				2nd Nibble Transmitted			
MII OCTET DESCRIPTION:							

End_stream_delimiter is used to request the end of a valid stream. This causes the deassertion of TX_EN. An End_stream_delimiter can only be generated after a completed start_stream_delimiter or a completed data_octet request.

9.8.1.1.3 PS_STATUS.indication

This primitive is used by the PSC to inform the MAC of errors and significant status changes. This primitive is derived from the MII signals RX_DV and RX_ER via the RS.

PS_STATUS.indication[Frame_violation,
Abort_frame,
Link_status]

Frame_violation is an indication of a coding error received inside frame boundaries. Frame_violation shall be defined as the logical AND of RX_ER with RX_DV and with NOT Abort_frame. Note that in generating the Frame_violation indication, a pipeline delay is required to ensure that the assertion of RX_ER does not form part of an Abort_frame indication.

Abort_frame indicates that an abort signal has been received. Abort_frame shall be asserted only if both of the last two nibbles of the frame in which RX_DV is asserted also have RX_ER asserted.

Link_status indicates that the PHY is receiving signal from the remote PHY. Link_status is equivalent to the state of the MII status register, bit 1.2.

— Link_status equals Asserted when the bit was last read as a logic one.
— Link_status equals Not_asserted when the bit was last read as a logic zero.

Link_status shall be updated (read) at least every 500 ms.

9.8.1.1.4 PS_CONTROL.request

This primitive is used by the MAC to request certain actions of the PSC.

PS_CONTROL.request[Initialize,
Transmit_mode,
Remove_phy,
Report_capabilities,
Media_rate,
Crystal_transmit,
Abort_frame]

Initialize is used to restart normal PHY operation from a removed state. Initialize shall be defined as setting the [802.3] 22 Control register (register 0) to the values shown in Table 9.8-3.

Table 9.8-3—Initialization State

Address	Value
0.15	1 (SC)[a]
0.14	0
0.13	1 (FxMR=2)[b]
0.12	0 (FxANO=1)[c]
0.11	0
0.10	1
0.9	0
0.8	1
0.7	0
0.6	0 (FxMR=2)[b]
0.5:0.0	Reserved

[a]SC = self-clearing. This bit will be set to zero when the reset process is complete; during reset, writes to other bits in this and other registers may have no effect.
[b]The state of this bit is undefined for FxMR=0 or 1.
[c]The state of this bit is undefined for FxANO=0 or 1.

Transmit_mode is used by the MAC to control the data path through the PHY.

Transmit_mode has three states:

— Fill;
— No_fill;
— Repeat (C-Port only).

For 100 Mbit/s operation, the provision of a PHY hardware repeat path is optional.

If no PHY hardware repeat path is provided, then Transmit_mode has no effect on the PHY.

If a PHY hardware repeat path is provided, then when Transmit_mode is Repeat, the received MII signals, RX_DV, RX_ER, and RXD 3..0, from the PSC should be retransmitted back to the PSC unchanged on the transmit MII signals TX_EN, TX_ER, and TXD 3..0, respectively. When Transmit_mode is Fill, then TX_EN should be deasserted. The values driven on TX_ER and TXD3..0 during Fill are not defined. When Transmit_mode is No_fill, then the transmit MII signals are driven by the MAC through the RS as defined by the PS_UNITDATA.request[Tx_Indicator] primitive.

Remove_phy is intended to halt operation of the PHY. The exact state of the PHY after Reset is asserted is undefined. Suggested actions are setting the Reset (0.15) or Power Down (0.11) bits of the [802.3] 22 Control register (register 0).

Report_capabilities is a request from the MAC for the PHY to generate a report of its capabilities. When issued, the PHY shall respond with the settings of the [802.3] 22 Status register (register 1).

Media_rate is a request from the PMAC or SMAC for the PHY to operate at a specified rate. Media_rate has the following values:

— Media_rate=2;
— Other values reserved.

Media_rate=2 causes the PHY to operate at 100 Mbit/s. The 100 Mbit/s rate is supported by setting bit 0.13 of the [802.3] 22 Control register (register 0) to a logical one, bit 0.6 of the same Control register (register 0) to a logical zero, and bit 0.12 of the same Control register to logical zero.

See PS_CONTROL.request [Initialize].

Crystal_transmit is used to control the clock source of the PHY’s transmitter. The 100 Mbit/s PHY only supports transmission from its local crystal; therefore, Crystal_transmit is always asserted.

Crystal_transmit reflects the FSTXC or FPTXC flag.

Abort_frame is an indication that the current frame is to be discarded. The Abort_frame signal shall cause the MII TX_ER signal to be asserted on the last two nibbles prior to deassertion of TX_EN.

9.8.1.1.5 PM_UNITDATA.indication

This primitive defines the transfer of data from the PMC to the PSC.

PM_UNITDATA.indication[Rcv_NRZI_bit]

The Rcv_NRZI_bit is an NRZI bit which has been received by the PMC and is passed to the PSC to be deserialized and decoded in accordance with [802.3].

9.8.1.1.6 PM_UNITDATA.request

This primitive defines the transfer of data from the PSC to the PMC.

PM_UNITDATA.request[Tx_NRZI_bit]

The Tx_NRZI_bit is an NRZI bit which has been encoded and serialized by the PSC in accordance with [802.3] and is passed to the PMC to be transmitted.

9.8.1.1.7 PM_CONTROL.request

This is an optional primitive to be used by the SMAC to request certain actions of the PMC.

PM_CONTROL.request [Insert_station (5.9),
Remove_station (5.9)]

When generated: The SMAC generates a PM_CONTROL.request for each action request.

Effect of receipt: The PHY performs the appropriate action.

9.8.1.2 Media independent PHY specifications (PSC)

The PSC shall meet all requirements of [802.3] 24, Physical coding sublayer (PCS) and physical medium attachment sublayer (PMA), type 100BASE-X. The MII, if exposed, shall meet all applicable requirements of [802.3] 22, Reconciliation sublayer and media independent interface, with the exceptions as listed below. In [802.3], informative Annexes 22A, 22B, and 22C, with exceptions listed below, provide additional information useful to PSC sublayer implementers. Where there is conflict between specifications in [802.3] and those in this standard, those of this standard shall prevail.

9.8.1.2.1 Exception to [802.3] 22.2.2.1, “TX_CLK (transmit clock)”

The TX_CLK shall have a tolerance of plus or minus 50 ppm or better.

9.8.1.3 Twisted-pair media dependent specifications (TP-PMC)

The TP-PMC shall meet all requirements of the [TP-PMD] 7, 8, 9, 10, and 11, and Annex A, with exceptions listed below. In [TP-PMD], Annexes B, C, E, F, G, I, and J, with exceptions listed below, provide additional information useful to PMC sublayer implementers. Where there is conflict between specifications in [TP-PMD] and those in this standard, those in this standard shall prevail.

9.8.1.3.1 MAC issues

The scope and general description discussed in [TP-PMD] 1 and 5 relate to the use of those standards with an FDDI PHY and MAC. These sections are not relevant to the use of the PMC with 100 Mbit/s Token Ring.

9.8.1.3.2 References

For the purposes of this standard, the normative references, definitions, and conventions contained in [TP-PMD] 2, 3, and 4 have relevance only as informative material, which may be necessary to interpret the applicable sections referenced in this clause.

9.8.1.3.3 Service specifications

The PMD service specifications of [TP-PMD] 6 are replaced by those specified in 9.8.1.1.5, 9.8.1.1.6, and 9.8.1.1.7, which are a proper subset of the PMD service specification in [TP-PMD].

9.8.1.3.4 Terminology

There are minor terminology differences between this standard and [TP-PMD], which do not cause ambiguity. The terminology used in this standard was chosen to be consistent with other IEEE 802 standards, rather than with FDDI. Terminology is both defined and consistent within each standard. Special note should be made of the interpretations shown in Table 9.8-4.

Table 9.8-4—Interpretation of general FDDI terms and concepts

FDDI term or concept	Interpretation for 100 Mbit/s Token Ring
Bypass	<Unused>
Connection Management (CMT)	<No comparable entity>
Frame	Frame
Halt Line State (HLS)	<Unused>
Hybrid mode	<No comparable entity>
MAC (or MAC-2)	MAC
Master Line State (MLS)	<Unused>
Maximum frame size = 9000 symbols[a]	Maximum frame size = 18207 octets[a]
PHY (or PHY-2)	PSC
PHY Service Data Unit (SDU)	Stream
PM_SIGNAL.indication (Signal_Detect)	<Unused>
PM_UNITDATA.indication(PM_Indication)	PM_UNITDATA.indication [Rcv_NRZI_bit]
PM_UNITDATA.request(PM_Request)	PM_UNITDATA.request [Tx_NRZI_bit]
Preamble	Interframe gap (IFG)
Quiet Line State (QLS)	<Unused>
SM_PM_BYPASS.request(Control_Action)	Assume: SM_PM_BYPASS.request(Control_Action=Insert)
SM_PM_CONTROL.request(Control_Action)	Assume: SM_PM_CONTROL.request(Control_Action=Transmit_Enable)
SM_PM_SIGNAL.indication(Signal_Detect)	<Unused>
Station Management (SMT)	<No comparable entity>
Symbol	5 bit code-group (see [802.3])

[a]Note that the definition of “frame size” for [TP-PMD] is different from that in this standard. These are not equivalent terms.

9.8.1.3.5 Exception to [TP-PMD] 7.2.3.1.1, “Line state patterns”

Descrambler synchronization on the Quiet Line State (QLS), Halt Line State (HLS), and Master Line State (MLS) patterns cited in [TP-PMD] 7.2.3.1.1 is optional.

9.8.1.3.6 Exception to [TP-PMD] 7.2.3.3, "Loss of synchronization"

The synchronization error triggered by PH_Invalid as defined in [TP-PMD] 7.2.3.3 (a) is not applicable.

NOTE—Conditions (e), (f), and (g) will limit support of the maximum 100 Mbit/s Token Ring frame length of 18207 octets. The PHY shall support the maximum 100 Mbit/s Token Ring frame length of 18207 octets.

9.8.1.3.7 Exception to [TP-PMD] 8.1, Table 1—UTP-MIC contact assignments

100 Mbit/s Token Ring for unshielded twisted pair (UTP) adopts the contact assignments of 4/16 MIC_U. Therefore, the contact assignments shown in [TP-PMD] 8.1, Table 1 shall instead be as depicted in 7.2, Table 15, for the Station and the C-Port in Station Emulation mode, and as depicted in 8.1.1, Table 33, for the C-Port in Port mode.

9.8.1.3.8 Exception to [TP-PMD] 8.1, Table 2—STP-MIC contact assignments

100 Mbit/s Token Ring for shielded twisted pair (STP) adopts the contact assignments of the 4/16 MIC_S. Therefore, the contact assignments shown in [TP-PMD] 8.1, Table 2 shall instead be as depicted in 7.2, Table 15, for the Station and the C-Port in Station Emulation mode, and as depicted in 8.1.1, Table 33, for the C-Port in Port mode.

9.8.1.3.9 Exception to [TP-PMD] 8.3, "Station labeling"

Subclause 8.3 of [TP-PMD] shall not be applied to 100 Mbit/s Token Ring.

9.8.1.3.10 Exception to [TP-PMD] 8.4, "Isolation requirements"

Subclause 8.4 of TP-PMD shall not be applied to the 100 Mbit/s Token Ring PHY. Requirements for isolation are addressed by Annex E.

9.8.1.3.11 Exception to [TP-PMD] 9, "Media signal interface"

In addition to [TP-PMD] 9, Media signal interface, note that the direct connection of 100 Mbit/s, 100 Ω compliant transmitters and receivers through the UTP-MIC to Category 5, and 120 Ω or 150 Ω cabling (as specified in IS 11801 and/or EIA/TIA 568A) is allowed by this standard subject to the following conditions.

When measured in an impedance environment of 150+/-1.5 Ω, the AOI return loss and Active Input Interface differential input impedance shall conform to the following limits:

— Greater than 11 dB from 2 MHz to 30 MHz;
— Greater than [11 – 6.67 log(f/30MHz)] dB from 30 MHz to 60 MHz;
— Greater than 9 dB from 60 MHz to 80 MHz.

The STP transmit levels as defined in [TP-PMD] 9.1.1.2 STP, Differential output voltage; [TP-PMD] 9.1.10, Characteristics of active output interface; and as referenced in [TP-PMD] Annex J, Table 3, shall not apply.

A connection meeting these conditions easily supports the recommended 100 m cabling limits specified within those cabling standards. However, such connections may not support the full attenuation limits for Class D cabling, as specified in IS 11801. For such interconnections, look for manufacturer's guidance on maximum drive distances supported.

9.8.1.3.12 Exception to [TP-PMD] 9.1.5, "Return loss"

The impedance environment for the measurement of the UTP AOI return loss shall be 100±1 Ω; the environment for the STP AOI return loss shall be 150±1.5 Ω. A single measurement in each impedance environment shall be sufficient to demonstrate compliance. The impedance environment shall be nominally resistive.

9.8.1.3.13 Exception to [TP-PMD] 9.2.2, "Differential input impedance"

The impedance environment for the measurement of the UTP Active Input Interface return loss shall be 100 ±1 Ω; the environment for the STP Active Input Interface return loss shall be 150±1.5 Ω. A single measurement in each impedance environment shall be sufficient to demonstrate compliance. The impedance environment shall be nominally resistive.

9.8.1.3.14 Exception to [TP-PMD] 9.1.9, "Jitter"

The jitter measurement specified in [TP-PMD] 9.1.9 may be performed using scrambled IDLEs.

9.8.1.3.15 Exception to [TP-PMD] 11.2, "Crossover Function"

The crossover function connects the local transmitter to the remote receiver, and vice-versa. Token ring implements crossover internal to the concentrator, not in the patch cables. For information about these connections, see 7.2, Table 15, for the Station and for the C-Port in Station Emulation mode, and 8.1.1, Table 33, for the C-Port in Port mode.

9.8.1.3.16 Exception to [TP-PMD] Annex A, "DDJ test pattern for baseline wander measurements"

The length of the test pattern specified in [TP-PMD] Annex A (A.2) may be changed to accommodate feasible 100 Mbit/s Token Ring measurements.

9.8.1.3.17 Exception to [TP-PMD] Annex G, "Stream cipher scrambling function"

An example of a stream cipher scrambling implementation is shown in [TP-PMD] Annex G. This may be modified to allow synchronization solely on the IDLE sequence between packets.

9.8.1.3.18 Exception to [TP-PMD] Annex I, "Common mode cable termination"

The contact assignments shown in [TP-PMD] Figure I-1 and Figure I-2 shall instead comply with those depicted in 7.2, Table 15, for the Station and for the C-Port in Station Emulation mode, and with 8.1.1, Table 33, for the C-Port in Port mode.

9.8.1.3.19 Full duplex capability

The physical layer device shall support full duplex transmission.

9.8.1.3.20 Auto-negotiation

The TP-PMC shall not support auto-negotiation.

NOTE—The use of auto-negotiation for High-speed Token Ring is under study. For further information about auto-negotiation for High-speed Token Ring, refer to Annex Z.

9.8.1.4 Fibre optic media dependent specifications (FO-PMC)

Specification of the FO-PMC is contained under 13.9.

9.8.2 1000 Mbit/s PHY

Operation for 1000 Mbit/s is to be determined.

Replace Clause 11 with the following:

11. DTR Station and C-Port Management

This clause specifies the Layer Management for DTR Stations and C-Ports (in Port mode and in Station Emulation mode) when operating using the TXI or TKP Access Protocol specified in Clause 9. This clause supplements the information provided in Clause 6.

The relationship between the SMAC, PMAC, and other layer entities is illustrated in Figure 11-1. The boxed numbers in this figure give the subclause number or annex letter specifying the interface between adjacent sublayers. The circled numbers in the figure give the subclause specifying that sublayer's management definitions.

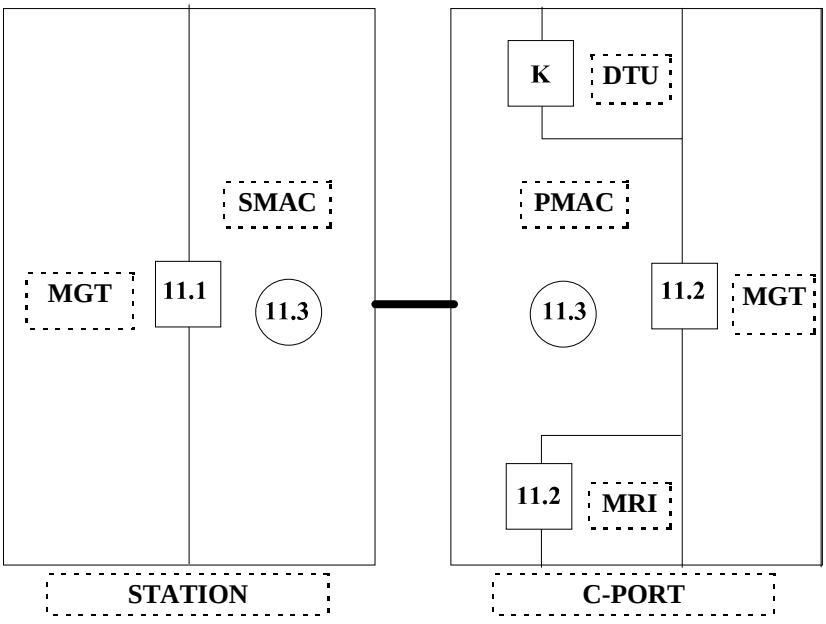

Figure 11-1—Layer Management organization

11.1 DTR Station management

11.1.1 Introduction

DTR Station management specifies the interface between the SMAC sublayer and the system management entity (MGT). The interface between the SMAC and MGT is defined using service primitives that specify management operations used to configure and monitor the operation of the SMAC. The parameters

associated with each service primitive allow the exchange of information between the SMAC and MGT. Together, the services and parameters are defined in an SNMP management information base (MIB), using the notation and guidelines specified in IETF RFC1902.

11.1.2 DTR Station services

This subclause specifies the management services provided by the SMAC, which are categorized into operational services and notification services.

Operational services are specified in terms of primitives and can be regarded as commands to the SMAC to perform a specific function. The operational services specified in this subclause are as follows:

— MGT_ACTION;
— MGT_SET;
— MGT_GET.

Notification services are used by the SMAC to notify management when an event has occurred. The notification services specified in this subclause are as follows:

— MGT_EVENT_REPORT;
— MGT_UNITDATA.

Management services operate in either a confirmed or nonconfirmed mode. When management services operate in a confirmed mode, a reply is expected by the requester. The requester expects no reply to nonconfirmed services. Table 11-1 specifies the confirmation mode of the services specified for a DTR SMAC.

Table 11-1—DTR services confirmation mode

Service	Confirmed mode
MGT_ACTION	Yes
MGT_SET	Yes
MGT_GET	Yes
MGT_EVENT_REPORT	No
MGT_UNITDATA	No

The SMAC is required to implement the MGT_ACTION and MGT_UNITDATA services. Remaining services and parameters are defined only for interoperability with other standards, and are required only as specified by other applications.

Service primitives can optionally pass parameters when invoked. Parameters for service primitives are sets of elements, with each parameter set containing either a null, single, or multiple elements. Elements in a parameter set are specified as either mandatory or conditional.

11.1.2.1 MGT_ACTION

An MGT_ACTION.request service is invoked by the management entity when requesting the SMAC to either start the Join FSM or enter into the Bypass state. This service is always confirmed with an MGT_ ACTION.response action.

11.1.2.1.1 MGT_ACTION.request

The semantics for the MGT_ACTION.request service primitives are defined as follows:

```
MGT_ACTION.request {    actionRequestType,
                        actionRequestParameters    }
```

The parameters for MGT_ACTION.request are defined below.

actionRequestType

The values for the actionRequestType parameter are defined as follows:

— **Open.** The Open action is used by management to request the SMAC to start the Join FSM. This action issues the Connect.MAC event to the SMAC.
— **Close.** The Close action is used by management to request the SMAC to enter into the Bypass state. This action issues the Disconnect.MAC event to the SMAC.

The actionRequestType is a mandatory parameter.

actionRequestParameters

Table 11-2 specifies the set of elements of the actionRequestParameters.

Table 11-2—actionRequestParameters

actionRequestParameters	Mandatory/conditional
RequestAccessProtocol	Conditional
RequestIndividualAddress	Conditional
RequestMediumRate	Conditional
RequestAccessProtocolMask	Conditional
RequestPhantomSupport	Conditional
RequestCapabilitiesMask	Conditional

RequestAccessProtocol

The RequestAccessProtocol parameter specifies the access protocol to be requested during the SMAC registration process. The only value of this parameter is TXI. This parameter, combined with the Request-CapabilitiesMask parameter, determines the value of the access protocol request subvector, X'0E', transmitted in the Registration Request MAC frame. The RequestAccessProtocol parameter can only be set using the MGT_ACTION.request(Open) primitive. This parameter cannot be changed while the SMAC is active.

The RequestAccessProtocol parameter is a conditional parameter and is not required when invoking MGT_ACTION.request(Open) service. When this parameter is not specified, the SMAC determines which access protocol is requested during the registration process.

When the MGT_ACTION.request(Open) service is successful, the MGT_ACTION.response(Open) service primitives include the ResponseStatus parameter, indicating success, and the ResponseAccessProtocol parameter, indicating TXI Access Protocol. When the MGT_ ACTION.request(Open) is unsuccessful, the MGT_ACTION.response(Close) service primitive includes the ResponseStatus parameter indicating the reason for failure.

RequestIndividualAddress

The RequestIndividualAddress parameter specifies the individual address to be used in the source address field of MAC frames originated by the SMAC. The individual address may be a locally administered address assigned by a system administrator or a UniversallyAdministeredAddress assigned by a manufacturer. This parameter may be set only by the MGT_ACTION.request(Open) primitive and cannot be changed while the SMAC is active.

The RequestIndividualAddress parameter is a conditional parameter whose use is not required to be specified when this service is invoked. When this is not used, the SMAC will use the UniversallyAdministeredAddress MAC address, if one has been assigned by the manufacturer.

If the action completes successfully, the individual address in use by the SMAC will be returned by the MGT_ACTION.response service primitive in the ResponseIndividualAddress parameter.

RequestMediumRate

The RequestMediumRate parameter specifies the medium data rate to be used by the SMAC as either 4 Mbit/s, 16 Mbit/s, 100 Mbit/s, or 1000 Mbit/s. This parameter may be set only by the MGT_ACTION.request(Open) service and is used to set the value of the FSMRO flag. This parameter cannot be changed while the SMAC is active.

The RequestMediumRate parameter is a conditional parameter and is not required to be specified when invoking the MGT_ACTION.request(OPEN) service.

When the MGT_ACTION.request(OPEN) service completes successfully, the value returned in the MGT_ACTION.response parameter ResponseMediumRate indicates the current media rate.

RequestAccessProtocolMask

The RequestAccessProtocolMask parameter specifies the access protocols allowed to be registered by the SMAC. This parameter is used to set the value of the SPV(AP_MASK) variable. The value of this parameter is either TKP, TXI, or TKPAndTXI, as defined in 11.3. The RequestAccessProtocolMask parameter can only be set by the MGT_ACTION.request(Open) service and cannot be changed while the SMAC is active.

The RequestAccessProtocolMask parameter is a conditional parameter and is not required to be specified when invoking this service and, when not supplied, the SMAC will select the access protocol to be used.

When the MGT_ACTION.request(Open) service completes successfully, the value of the access protocol mask used by the SMAC will be returned by the MGT_ACTION.response service primitive in the ResponseAccessProtocolMask parameter.

RequestPhantomSupport

The RequestPhantomSupport parameter specifies the Station’s phantom support to be signalled to the C-Port during the SMAC registration process. The value of this parameter may be phantomSupported or phantomNotSupported. This parameter determines the value of the phantom subvector X'0C' transmitted in the Registration Request MAC frame. The RequestPhantomSupport parameter can only be set using the MGT_ACTION.request(Open) primitive; this parameter cannot be changed while the SMAC is active.

The RequestPhantomSupport parameter is a conditional parameter and is not required when invoking MGT_ACTION.request(Open) service. When this parameter is not specified, the SMAC determines what phantom support is requested during the registration process.

RequestCapabilitiesMask

The RequestCapabilitiesMask parameter specifies additional Station capabilites to be signalled to the C-Port during the SMAC registration process. The only value of this parameter is 100Capable. This parameter, combined with the RequestAccessProtocol parameter, determines the value of the access protocol request subvector X'0E' transmitted in the Registration Request MAC frame. The RequestCapabilitiesMask parameter can only be set using the MGT_ACTION.request(Open) primitive; this parameter cannot be changed while the SMAC is active.

The RequestCapabilitiesMask parameter is a conditional parameter and is not required when invoking MGT_ACTION.request(Open) service. When this parameter is not specified, the SMAC determines what capabilities are signalled during the registration process.

11.1.2.1.2 MGT_ACTION.response

This service is invoked by the SMAC to notify management that a MGT_ACTION.request has completed.

The semantics for the MGT_ACTION.response service primitives are defined as follows:

```
MGT_ACTION.request {   actionRequestType,
                       actionRequestParameters    }
```

The parameters for MGT_ACTION.response are defined below.

actionResponseType

The values for the actionResponseType parameter are defined as follows:

— **Open.** The Open action is used to indicate that this is a response to a MGT_ACTION.request(Open) service request. This action is indicated after the SMAC has completed the Join process and is in the Join Complete state.
— **Close.** This action indicates that this is a response to a MGT_ACTION.request(Close) service request. This action is indicated after the SMAC has entered the Bypass state.

The actionResponseType parameter is a mandatory parameter.

actionResponseParameters

Table 11-3 specifies the set of elements of the actionResponseParameters.

Table 11-3—actionResponseParameters

actionResponseParameters	Mandatory/conditional
ResponseStatus	Mandatory
ResponseAccessProtocol	Conditional
ResponseIndividualAddress	Conditional
ResponseMediumRate	Conditional
ResponseUNA	Conditional
ResponseAccessProtocolMask	Conditional
ResponsePhantomSupport	Conditional
ResponseCapabilitiesMask	Conditional

ResponseStatus

The values for the ResponseStatus parameter are defined in Table 11-4. The ResponseStatus parameter is mandatory and must always be present. The return value of the ResponseStatus when ResponseAction is Close is always sSuccess.

Table 11-4—ResponseStatus parameter

Status	Definition
sSuccess	Successful
sInvalidAddress	MAC address is invalid (group or not specified)
sRateNotSupported	The requested data rate is not supported
sStandbyReceived	Standby frame received
sBeaconReceived	Beacon frame received
sClaimReceived	Claim frame received
sProtocolNotSupported	Requested Access Protocol rejected
sRemoveReceived	Remove frame received
sPurgeReceived	Purge frame received
sInternalError	Internal error
sStationError	Station error
sRegistrationTimeout	Registration request timeout, TSREQ=E
sLobeTestFailure	Lobe test failure
sLobeTestTimeout	Lobe test timeout, TSLMC=E
sHeartBeatReceived	Premature or SA<>SUA Heart Beat frame received
sDuplicateAddressFailure	DAC failure
sJoinTimeout	Join complete timeout, TSJC=E
sHeartBeatTimeout	No heart beat, TSRHB=E
sInvalidSourceAddress	Protocol check; SUA mismatch (see 9.1.2)
sRemoveAlertReceived	Remove Alert frame received
sLink_statusDeasserted	Link_status deasserted

ResponseAccessProtocol

The ResponseAccessProtocol parameter is a conditional parameter that is returned only when the value of the ResponseStatus parameter is either sSuccess or sProtocolNotSupported. The values defined for AccessProtocolResponse are TXI or access denied. The ResponseAccessProtocol parameter can be set only by the SMAC, and contains the same value as the Access Protocol response subvector X'0F' in the Registration Response MAC frame received by the SMAC.

When the ResponseStatus is sSuccess, the ResponseAccessProtocol parameter value indicates that the TXI access protocol, phantom signaling, and wire fault support methods were accepted. If the ResponseStatus is sProtocolNotSupported, then the ResponseAccessProtocol parameter value indicates the access protocol was rejected during registration.

ResponseIndividualAddress

The ResponseIndividualAddress parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. The value of this parameter may be a locally administered address assigned by a system administrator, or a UniversallyAdministeredAddress assigned by a manufacturer. This parameter specifies the individual address used in the source address field of MAC frames originated by the SMAC.

If a locally administered address was specified in the RequestIndividualAddress parameter of the MGT_ ACTION.request service, the same value is returned in the ResponseIndividualAddress parameter.

When the address specified in the RequestIndividualAddress in the MGT_ACTION.request is not a locally administered address, then the value returned in the ResponseStatus parameter is sInvalidAddress.

When the RequestIndividualAddress parameter is not specified in the MGT_ACTION.request service and a universal address has been assigned by the manufacturer, the value returned in the ResponseIndividualAddress is the universally assigned address. When no universal address has been assigned by the manufacturer, then the value returned in the ResponseStatus parameters is sInvalidAddress.

ResponseMediumRate

The ResponseMediumRate parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. This parameter specifies the medium rate as either 4 Mbit/s, 16 Mbit/s, 100 Mbit/s, or 1000 Mbit/s. When returned, the value of the ResponseMediumRate parameter indicates the current operating data rate of the SMAC.

When the value of the ResponseStatus parameter is sSuccess and no RequestMediumRate was specified in the MGT_ACTION.request service, then the value returned in the ResponseMediumRate is the current operating data rate.

When the RequestMediumRate specified in the MGT_ACTION.request service is not supported by the SMAC, then the status returned in the MGT_ACTION.response is sRateNotSupported.

ResponseUNA

The ResponseUNA parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When returned, the value of the ResponseUNA parameter indicates the SMAC upstream neighbor’s address (UNA) and is derived from the source address of the Registration Response MAC frame received by the SMAC. The value of this parameter is stored by the SMAC as the stored upstream address.

ResponseAccessRequestMask

The ResponseAccessRequestMask parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When the MGT_ACTION.request(Open) service completes successfully, the value of the access protocol mask used by the SMAC will be returned by the MGT_ACTION.response service primitive in the ResponseAccessProtocolMask parameter.

ResponsePhantomSupport

The ResponsePhantomSupport parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When the MGT_ACTION.request(Open) service completes successfully, the value of the phantom support used by the SMAC will be returned by the MGT_ACTION.response service primitive in the ResponsePhantomSupport parameter.

ResponseCapabilitiesMask

The ResponseCapabilitesMask parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When the MGT_ACTION.request(Open) service completes successfully, the value of the capabilites mask used by the SMAC will be returned by the MGT_ACTION.response service primitive in the ResponseCapabilitiesMask parameter.

11.1.2.2 MGT_EVENT_REPORT

This service is invoked by the SMAC to notify management that a significant change in the operational state of the SMAC has occurred. This service operates as a nonconfirmed service.

11.1.2.2.1 MGT_EVENT_REPORT.request

The semantics for the MGT_EVENT_REPORT.request service primitive are defined as follows:

```
MGT_EVENT_REPORT.request {    eventRequestType,
                              eventRequestParameters    }
```

eventRequestType

The eventRequestType parameter is a mandatory parameter. The values for the eventRequestType parameter are defined as follows:

- **StationOperational.** This event is indicated when the SMAC transitions from a nonoperational to an operational state.
- **StationNonOperational.** This event is indicated when the SMAC transitions from an operational to a nonoperational state. When this event occurs, the SMAC is attempting to recover from an operational error.
- **StationFailure.** This event is indicated by the SMAC to notify Management that a fault has occurred, causing the Station to return to the Bypass state.
- **ProtocolError.** This event is indicated by the SMAC to notify Management that the Station, while operating using the TXI Access Protocol, has detected a MAC frame that is used only by the TKP Access Protocol.

eventRequestParameters

Table 11-5 specifies the set of elements of the eventRequestParameters.

Table 11-5—eventRequestParameters

eventRequestParameters	Mandatory/conditional
EventStatus	Mandatory
BeaconInfo	Conditional
ErrorCounters	Conditional

EventStatus

The values for the EventStatus parameter are defined in Table 11-6.

Table 11-6—EventStatus parameter

EventStatus	Definition
sMACInsertRSPReceived	nStationOperational
sReportError	nStationOperational
sHeartBeatLost	nStationNonOperational
sSignalLoss	nStationNonOperational
sBeaconReceived	nStationNonOperational
sRemove	nStationFailure
sInternalError	nStationFailure
sStationError	nStationFailure
sWireFault	nStationFailure
sRemoveAlertReceived	nStationFailure
sLink_statusDeasserted	nStationFailure
sClaimReceived	nProtocolError
sPurgeReceived	nProtocolError
sStandbyReceived	nProtocolError
sInvalidSourceAddress	nProtocolError

BeaconInfo

The BeaconInfo parameter is a conditional parameter used only when the value of the EventStatus parameter is either sHeartBeatLost, sSignalLoss, or sBeaconReceived, and contains the information provided in Table 11-7.

Table 11-7—BeaconInfo parameter

BeaconInfo parameter	Mandatory/conditional
BeaconSA	Mandatory
BeaconType	Mandatory
BeaconUNA	Mandatory
BeaconPDN	Mandatory

When the EventStatus is sHeartBeatLost or sSignalLoss, the values in the BeaconInfo parameter represent those of the last transmitted Beacon MAC frame.

If the EventStatus is sBeaconReceived, the values in the BeaconInfo parameter represent those contained in the last received Beacon MAC frame.

This parameter indicates the following information contained in the last Beacon MAC frame transmitted or received:

— The SA used in the Beacon MAC frame;
— The value of the Beacon Type subvector X'01' used in the Beacon MAC frame;
— The value of the UNA subvector X'02' used in the Beacon MAC frame;
— The value of the Physical Drop Number subvector X'0B' used in the Beacon MAC frame.

ErrorCounters

The ErrorCounters parameter is a conditional parameter that is used only when the value of the EventStatus parameter is sReportErrors. This parameter contains the sequence of information depicted in Table 11-8.

Table 11-8—ErrorCounters parameter

ErrorCounters parameter	Mandatory/conditional
AbortErrorCounter	Mandatory
BurstErrorCounter	Mandatory
FrequencyErrorCounter	Mandatory
InternalErrorCounter	Mandatory
LineErrorCounter	Mandatory
ReceiveErrorCounter	Mandatory
OverlengthFrameCounter	Mandatory

11.1.2.3 MGT_SET

The MGT_SET service modifies variable values. The parameters used with this service indicate the variables to be changed and the desired values of the variables. Conditional variables specified as read-write may not be present and, therefore, may not change. This service always operates in a confirmed mode.

11.1.2.3.1 MGT_SET.request

The semantics for the MGT_SET.request service primitive are defined as follows:

MGT_SET.request { objectName, objectValue }

objectName

The objectName parameter specifies the object name to be modified. The object names and values that can be specified as parameters are defined in 11.3.1.

objectValue

The objectValue parameter contains the object value following the modification. The object names and values that can be specified as parameters are defined in 11.3.1.

11.1.2.3.2 MGT_SET.response

The MGT_SET.response is issued in reply to a MGT_SET.request.

The semantics for the MGT_SET.response service primitive are defined as follows:

MGT_SET.response{ objectName, objectValue }

objectName

The objectName parameter contains the object name that was modified. The object names and values that can be specified as parameters are defined in 11.3.1.

objectValue

The objectValue parameter contains the object value following the modification. The object names and values that can be specified as parameters are defined in 11.3.1.

11.1.2.4 MGT_GET

The MGT_GET service requests the value of a variable. The parameters used with this service indicate the variables whose values are to be returned in the response. Conditional parameters specified as read-only may not be present and, therefore, may not be returned. This service always operates in a confirmed mode.

11.1.2.4.1 MGT_GET.request

The semantics for the MGT_GET.request service primitive are defined as follows:

MGT_GET.request { objectNameList }

objectNameList

The objectNameList parameter specifies the set of object names for which variable values are to be returned. The object names that can be specified as parameters are defined in 11.3.1.

11.1.2.4.2 MGT_GET.response

The MGT_GET.response is issued in reply to a MGT_GET.request.

The semantics for the MGT_GET.response service primitive are defined as follows:

MGT_GET.response { objectList }

objectList

The objectList parameter contains the set of object names and values that are returned in response to a MGT_GET.request service. The object names and values that can be specified as parameters are defined in 11.3.1.

11.1.2.5 MGT_UNITDATA

The MGT_UNITDATA service primitive specifies the services and interfaces provided by the SMAC to the management entity for transmitting and receiving management MAC frames.

11.1.2.5.1 MGT_UNITDATA.request

This service is invoked by the management entity to request the SMAC to compose and transmit a MAC frame using the information provided in the parameters. The SMAC will only transmit frames through this interface that have a source class not equal to zero (REF 3514). When the source class is zero, the SMAC will discard the frame and not transmit it (REF 3515).

The semantics for the MGT_UNITDATA.request service primitive are defined as follows:

```
MGT_UNITDATA.request {    macFrameControl,
                          destinationAddress,
                          sourceAddress,
                          routingInformation,
                          macInformation,
                          frameCheckSequence    }
```

macFrameControl

The macFrameControl parameter specifies the value to be used in the frame control field by the SMAC when composing the MAC frame for transmission. The structure and content of this field shall conform to the FC field specified in 3.2.3.

destinationAddress

The destinationAddress parameter is any valid individual, group, functional, or broadcast address. The structure and contents of this parameter shall conform to the DA field specified in 3.2.4.1.

sourceAddress

The sourceAddress parameter specifies the individual address to be used in the source address field by the SMAC when composing the MAC frame for transmission. The structure and contents of this parameter shall conform to the SA field specified in 3.2.4.2.

routingInformation

The routingInformation parameter is optional and used only when the routing information indicator is set in the sourceAddress parameter. When used, the structure and contents of this parameter shall conform to the RI field specified in 3.2.5.

macInformation

The structure and contents of the macInformation parameter shall conform to the MAC frame information field format specified in 3.3.2, as modified by 10.3.

frameCheckSequence

The frameCheckSequence parameter is optional. When used, the frameCheckSequence parameter specifies the value to be used in the FCS by the SMAC when composing the MAC frame for transmission. When unspecified, the SMAC shall calculate and transmit a valid FCS field as specified in 3.2.7.

11.1.2.5.2 MGT_UNITDATA.indication

This service is invoked by the SMAC to notify the management entity that it has received a MAC frame which has a destination address that matches either an individual address, group address, or functional

address active in the SMAC, and has a destination class not equal to zero in the Vector Class field (REF 3503).

The semantics for the MGT-EVENT.indication service primitive are defined as follows:

```
MGT_UNITDATA.request {   macFrameControl,
                         destinationAddress,
                         sourceAddress,
                         routingInformation,
                         macInformation,
                         frameCheckSequence   }
```

macFrameControl

The macFrameControl parameter indicates the value of the frame control field of the received MAC frame. The structure and contents of this field shall conform to the FC field specified in 3.2.3.

destinationAddress

The destinationAddress parameter is any valid individual, group, functional, or broadcast address. The structure and contents of this parameter shall conform to the DA field specified in 3.2.4.1.

sourceAddress

The sourceAddress parameter is the individual address of the MAC that originated the frame. The structure and contents of this parameter shall conform to the SA field specified in 3.2.4.2.

routingInformation

The routingInformation parameter is optional and used only when the routing information indicator is set in the sourceAddress parameter. When used, the structure and contents of this parameter shall conform to the RI field specified in 3.2.5.

macInformation

The structure and contents of the macInformation parameter shall conform to the MAC frame information field format specified in 3.3.2, as modified by 10.3.

frameCheckSequence

The frameCheckSequence parameter specifies the frame-check sequence value of the received MAC frame. The structure and content of this parameter shall conform to the FCS field specified in 3.2.7.

11.2 C-Port management

11.2.1 Introduction

C-Port management specifies the management objects and interfaces between the PMAC sublayer, and the MGT and MRI entity. The interface between the PMAC and other sublayer entities is defined using service primitives. Service primitives define management operations used to configure and monitor the operation of the PMAC. Associated with each service primitive are parameters that allow the exchange of information between entities. Together, the services and parameters are defined in an SNMP MIB, defined using the notation and guidelines specified in IETF RFC1902.

11.2.2 C-Port services

The management services provided by the PMAC are specified in this subclause. Management services are categorized into operational services and notification services.

Operational services are specified in terms of primitives and can be regarded as commands to the PMAC to perform a specific function. The operational services specified in this subclause are as follows:

— MGT_ACTION;
— MGT_SET;
— MGT_GET.

Notification services are used by the PMAC to notify management when an event has occurred. The notification services specified in this subclause are as follows:

— MGT_EVENT_REPORT;
— MRI_UNITDATA.

Management services operate in either a confirmed or nonconfirmed mode. When the service is operating as a confirmed service, a reply is expected by the requester. The services MGT_ACTION, MGT_GET, and MGT_SET always operate in a confirmed mode, while MGT_EVENT_REPORT and MRI_UNITDATA always operate in a nonconfirmed mode. Table 11-9 specifies the confirmation mode of the services specified for a DTR PMAC.

Table 11-9—DTR services confirmation mode

Service	Confirmed mode
MGT_ACTION	Yes
MGT_SET	Yes
MGT_GET	Yes
MGT_EVENT_REPORT	No
MRI_UNITDATA	No

The MGT_ACTION service is the only service required to be implemented by the PMAC. The remaining services, and the objects associated with their parameters, are only defined for interoperability with other standards and are required only as specified by other applications.

Service primitives can optionally pass parameters when invoked. Each parameter in a service primitive specifies a set of parameters to be used in the operation. Each parameter set can contain either the null element, a single element, or multiple elements. Each element in a parameter set is specified as either mandatory or conditional.

11.2.2.1 MGT_ACTION

A MGT_ACTION.request service is invoked by the management entity when requesting the PMAC to either start the Join FSM or enter the Bypass state. This service is always confirmed with a MGT_ACTION.response action.

11.2.2.1.1 MGT_ACTION.request

The semantics for the MGT_ACTION.request service primitives are defined as follows:

```
MGT_ACTION.request {   actionRequestType,
                       ActionRequestParameters   }
```

The parameters for MGT_ACTION.request are defined below.

actionRequestType

The values for the actionRequestType parameter are defined as follows:

— **Open.** The Open action is used by Management to request the PMAC to start the Join FSM. This action issues the Connect.PMAC event to the PMAC.
— **Close.** The Close action is used by Management to request the PMAC to enter the Bypass state. This action issues the Disconnect.PMAC event to the PMAC.

The actionRequestType is a mandatory parameter.

actionRequestParameters

Table 11-10 specifies the set of elements of the actionRequestParameters.

Table 11-10—actionRequestParameters

actionRequestParameters	Mandatory/conditional
RequestAccessProtocolMask	Conditional
RequestIndividualAddress	Conditional
RequestMediumRate	Conditional
RequestPhantomSupportMask	Conditional
RequestCapabilitiesMask	Conditional

RequestAccessProtocolMask

The RequestAccessProtocolMask parameter specifies the access protocols allowed to be registered by the PMAC. This parameter, in conjunction with the RequestCapabilitiesMask, is used by the PMAC to set the value of the PPV(AP_MASK) variable. The value of this parameter is either TKP, TXI, or TKPAndTXI. This parameter cannot be changed while the PMAC is active.

The RequestAccessProtocolMask parameter is a conditional parameter and is not required to be specified when invoking the MGT_ACTION.request(Open) service. When this parameter is not specified, the PMAC determines the Access Protocol mask.

If the MGT_ACTION.request(Open) service is successful, the MGT_ACTION.response(Open) service primitive includes the ResponseStatus parameter indicating success, and the ResponseAccessProtocolMask parameter indicating the selected access protocol. When the MGT_ACTION.request(Open) is unsuccessful, the MGT_ACTION.response(Close) service primitive includes the ResponseStatus parameter, indicating the reason for failure.

RequestIndividualAddress

The RequestIndividualAddress parameter specifies the individual address to be used in the SA field of MAC frames originated by the PMAC. The individual address may be a locally administered address assigned by a system administrator, or a UniversallyAdministeredAddress assigned by a manufacturer. This parameter may only be set by the MGT_ACTION.request(Open) primitive and cannot be changed while the PMAC is active.

The RequestIndividualAddress parameter is a conditional parameter whose use is not required to be specified when invoking this service. When this is not used, the PMAC uses the UniversallyAdministeredAddress MAC address, if one has been assigned by the manufacturer.

If the action completes successfully, the individual address in use by the PMAC will be returned by the MGT_ACTION.response service primitive in the ResponseIndividualAddress parameter.

RequestMediumRate

The RequestMediumRate parameter specifies the medium data rate to be used by the PMAC as either 4 Mbit/s, 16 Mbit/s, 100 Mbit/s, or 1000 Mbit/s. This parameter may only be set by the MGT_ACTION.request(Open) service and is used to set the value of the FPMRO flag. This parameter cannot be changed while the PMAC is active.

The RequestMediumRate parameter is a conditional parameter and is not required to be specified when the MGT_ACTION.request(OPEN) service is invoked.

When the MGT_ACTION.request(OPEN) service completes successfully, the value returned in the MGT_ACTION.response parameter ResponseMediumRate indicates the current media rate.

RequestPhantomSupportMask

The RequestPhantomSupportMask parameter specifies the phantom support capabilities of the C-Port. This parameter is used by the PMAC to set the value of the PPV(PD_MASK) variable. The value of this parameter is NoSupport, LoadSupport, or LoadAndDetectSupport. This parameter cannot be changed while the PMAC is active.

The RequestPhantomSupportMask parameter is a conditional parameter and is not required to be specified when invoking the MGT_ACTION.request(Open) service. When this parameter is not specified, the PMAC determines the phantom support capabilities.

RequestCapabilitiesMask

The RequestCapabilitiesMask parameter specifies additional C-Port capabilites to be checked during the PMAC registration process. This parameter, in conjunction with the RequestAccessProtocolMask, is used by the PMAC to set the value of the PPV(AP_MASK) variable. The only value of this parameter is 100 Mbit/s. The RequestCapabilitiesMask parameter can only be set using the MGT_ACTION.request(Open) primitive; this parameter cannot be changed while the PMAC is active.

The RequestCapabilitiesMask parameter is a conditional parameter and is not required when invoking MGT_ACTION.request(Open) service. When this parameter is not specified, the PMAC determines the phantom support capabilities.

11.2.2.1.2 MGT_ACTION.response

This service is invoked by the PMAC to notify Management that a MGT_ACTION.request has completed.

The semantics for the MGT_ACTION.response service primitives are defined as follows:

```
MGT_ACTION.response {   actionResponseType,
                        actionResponseParameters    }
```

The parameters for MGT_ACTION.response are defined below.

actionResponseType

The values for the actionResponseType parameter are defined as follows:

— **Open.** The Open action is used to indicate that this is a response to a MGT_ACTION.request(Open) service request. This action is indicated after the PMAC has completed the Join process and is in a Join Complete state.
— **Close.** This action indicates that this is a response to a MGT_ACTION.request(Close) service request. This action is indicated after the PMAC has entered the Bypass state.

The actionResponseType parameter is a mandatory parameter.

actionResponseParameters

Table 11-11 specifies the set of elements of the actionResponseParameters.

Table 11-11—actionResponseParameters

actionResponseParameters	Mandatory/conditional
ResponseStatus	Mandatory
ResponseAccessProtocolMask	Conditional
ResponseIndividualAddress	Conditional
ResponseMediumRate	Conditional
ResponseUNA	Conditional
ResponsePhantomSupportMask	Conditional
ResponseCapabilitiesMask	Conditional

ResponseStatus

The values for the ResponseStatus parameter are defined in Table 11-12. The ResponseStatus parameter is mandatory and must always be present. The return value of the ResponseStatus when ActionResponseType = Close is always sSuccess.

Table 11-12—ResponseStatus parameter

Status	Definition
sSuccess	Successful
sInvalidAddress	MAC address is invalid (group or not specified)
sRateNotSupported	The requested data rate is not supported
sBeaconReceived	Beacon frame received
sClaimReceived	Claim frame received
sPurgeReceived	Purge frame received
sInternalError	Internal error
sCPortError	C-Port error
sActiveMonitorReceived	Active monitor present frame received
sInvalidSourceAddress	SA<>SUA prior to Join complete
sHeartBeatTimeout	No heart beat, TPRHB=E

ResponseAccessProtocolMask

The ResponseAccessProtocol parameter is a conditional parameter that is returned only when the value of the ResponseStatus parameter is sSuccess.

When the ResponseStatus is sSuccess, the value returned in the ResponseAccessProtocolMask parameter indicates the Access Protocol mask that will be used by the PMAC.

ResponseIndividualAddress

The ResponseIndividualAddress parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. The value of this parameter may be a locally administered address assigned by a system administrator or a UniversallyAdministeredAddress assigned by a manufacturer. This parameter specifies the individual address that is used in the SA field of MAC frames originated by the PMAC.

If a locally administered address was specified in the RequestIndividualAddress parameter of the MGT_ACTION.request service, the same value is returned in the ResponseIndividualAddress parameter.

If the address specified in the RequestIndividualAddress in the MGT-ACTION.request is not a locally administered address, then the value returned in the ResponseStatus parameter is sInvalidAddress.

When the RequestIndividualAddress parameter is not specified in the MGT_ACTION.request service and a universal address has been assigned by the manufacturer, the value returned in the ResponseIndividualAddress is the universally assigned address. When no universal address has been assigned by the manufacturer, then the value returned in the ResponseStatus parameters is sInvalidAddress.

ResponseMediumRate

The ResponseMediumRate parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. This parameter specifies the medium rate as either 4 Mbit/s, 16 Mbit/s, 100 Mbit/s, or 1000 Mbit/s. When returned, the value of the ResponseMediumRate parameter indicates the current operating data rate of the PMAC.

When the value of the ResponseStatus parameter is sSuccess and no RequestMediumRate was specified in the MGT_ACTION.request service, then the value returned in the ResponseMediumRate is the current operating data rate.

When the RequestMediumRate specified in the MGT_ACTION.request service is not supported by the PMAC, then the status returned in the MGT_ACTION.response is sRateNotSupported.

ResponseUNA

The ResponseUNA parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When returned, the value of the ResponseUNA parameter indicates the PMAC UNA and is derived from the source address of the Registration Request MAC frame received by the PMAC. The value of this parameter is stored by the PMAC as the SUA.

ResponsePhantomSupportMask

The ResponsePhantomSupportMask parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When the MGT_ACTION.request(Open) service completes successfully, the value of the phantom support mask used by the PMAC will be returned by the MGT_ACTION.response service primitive in the ResponsePhantomSupportMask parameter.

ResponseCapabilitiesMask

The ResponseCapabilitesMask parameter is a conditional parameter that may be returned only when the value of the ResponseStatus parameter is sSuccess. When the MGT_ACTION.request(Open) service completes successfully, the value of the capabilites mask used by the PMAC will be returned by the MGT_ACTION.response service primitive in the ResponseCapabilitiesMask parameter.

11.2.2.2 MGT_EVENT_REPORT

This service is invoked by the PMAC to notify management that a significant change in the operational state of the PMAC has occurred. This service operates as a nonconfirmed service.

11.2.2.2.1 MGT_EVENT_REPORT.request

The semantics for the MGT_EVENT_REPORT.request service primitive are defined as follows:

```
MGT_EVENT_REPORT.request {    eventRequestType,
                              eventRequestParameters    }
```

eventRequestType

The eventRequestType parameter is a mandatory parameter. The values for the eventRequestType parameter are defined as follows:

- **CPortOperational.** This event is indicated when the PMAC transitions from a nonoperational to an operational state.
- **CPortNonOperational.** This event is indicated when the PMAC transitions from an operational to a nonoperational state. When this event occurs, the PMAC is attempting to recover from an operational error.
- **CPortFailure.** This event is indicated by the PMAC to notify management that a fault has occurred, causing the C-Port to return to the Bypass state.
- **ProtocolError.** This event is indicated by the PMAC to notify management that the C-Port has detected a MAC frame that is used only when operating under the TKP access protocol.

eventRequestParameters

Table 11-13 specifies the set of elements of the eventRequestParameters.

Table 11-13—eventRequestParameters

eventRequestParameters	Mandatory/conditional
EventStatus	Mandatory
BeaconInfo	Conditional
ErrorCounters	Conditional

EventStatus

The values for the EventStatus parameter are defined in Table 11-14.

Table 11-14—EventStatus parameter

EventStatus	Definition
sMACInsertREQReceived	nCPortOperational
sReportError	nCPortOperational
sHeartBeatLost	nCPortNonOperational
sSignalLoss	nCPortNonOperational
sBeaconReceived	nCPortNonOperational
sInvalidSourceAddress	nCPortNonOperational
sInternalError	nCPortFailure
sCPortError	nCPortFailure
sPhantomNotDetected	nCPortFailure
sRecoveryProtocolError	nCPortFailure
sRemoveAlertReceived	nCPortFailure
sLink_statusDeasserted	nCPortFailure
sClaimReceived	nProtocolError
sPurgeReceived	nProtocolError
sActiveMonitorReceived	nProtocolError
sPhantomLoss	nCPortNonOperational
sDuplicateAddressDetected	nCPortNonOperational

BeaconInfo

The BeaconInfo parameter is a conditional parameter that may be used only when the value of the Event-Status parameter is either sHeartBeatLost, sSignalLoss, or sBeaconReceived and contains the information in Table 11-15.

Table 11-15—BeaconInfo parameter

BeaconInfo parameter	Mandatory/conditional
BeaconSA	Mandatory
BeaconType	Mandatory
BeaconUNA	Mandatory
BeaconPDN	Mandatory

When the EventStatus is sHeartBeatLost or sSignalLoss, the values in the BeaconInfo parameter represent those of the last transmitted Beacon MAC frame.

If the EventStatus is sBeaconReceived, the values in the BeaconInfo parameter represent those contained in the last received Beacon MAC frame.

This parameter specifies the following information contained in the last Beacon MAC frame transmitted or received:

— The SA used in the Beacon MAC frame;
— The value of the Beacon Type subvector X'01' used in the Beacon MAC frame;
— The value of the UNA subvector X'02' used in the Beacon MAC frame;
— The value of the Physical Drop Number subvector X'0B' used in the Beacon MAC frame.

ErrorCounters

The ErrorCounters parameter is a conditional parameter that may be used only when the value of the EventStatus parameter is sReportErrors. This parameter contains the sequence of information shown in Table 11-16.

Table 11-16—ErrorCounters parameter

ErrorCounters parameter	Mandatory/conditional
AbortErrorCounter	Mandatory
BurstErrorCounter	Mandatory
FrequencyErrorCounter	Mandatory
InternalErrorCounter	Mandatory
LineErrorCounter	Mandatory
ReceiveErrorCounter	Mandatory
OverlengthFrameCounter	Mandatory

11.2.2.3 MGT_SET

The MGT_SET service modifies variable values. The parameters used with this service indicate the variables to be changed and the desired values of the variables. Conditional variables specified as read-write may not be present and, therefore, may not change. This service always operates in a confirmed mode.

11.2.2.3.1 MGT_SET.request

The semantics for the MGT_SET.request service primitive are defined as follows:

MGT_SET.request { objectName, objectValue }

objectName

The objectName parameter specifies the object name to be modified. The object names and values that can be specified as parameters are defined in 11.3.1.

objectValue

The objectValue parameter contains the requested value of the object name. The object names and values that can be specified as parameters are defined in 11.3.1.

11.2.2.3.2 MGT_SET.response

The MGT_SET.response is issued in reply to a MGT_SET.request.

The semantics for the MGT_SET.response service primitive are defined as follows:

MGT_SET.response{ objectName, objectValue }

objectName

The objectName parameter specifies the object name to be modified. The object names and values that can be specified as parameters are defined in 11.3.1.

objectValue

The objectValue parameter contains the object value that was modified. The object names and values that can be specified as parameters are defined in 11.3.1.

11.2.2.4 MGT_GET

The MGT_GET service requests the value of a variable. The parameters used with this service indicate the variables whose values are to be returned in the response. Conditional variables specified as read-only may not be present and, therefore, may not be returned. This service always operates in a confirmed mode.

11.2.2.4.1 MGT_GET.request

The semantics for the MGT_GET.request service primitive are defined as follows:

MGT_GET.request { objectNameList }

objectNameList

The objectNameList parameter contains the set of object names for which values are to be returned. The object names that can be specified as parameters are defined in 11.3.1.

11.2.2.4.2 MGT_GET.response

The MGT_GET.response is issued in reply to a MGT_GET.request.

The semantics for the MGT_GET.response service primitive are defined as follows:

MGT_GET.response { objectList }

objectList

The objectList parameter contains the set of object names and values that are returned in response to a MGT_GET.request service. The object names and values that can be specified as parameters are defined in 11.3.1.

11.2.3 MRI management

11.2.3.1 MRI services

The MRI specifies the services and interfaces provided by the DTR concentrator for routing management MAC frames to management servers, such as the CRS, REM, or RPS.

The service primitives required to exchange information between the PMAC and MRI sublayers are defined in this subclause. These service primitives are MRI_UNITDATA.request and MRI_UNITDATA.indication.

11.2.3.1.1 MRI_UNITDATA.request

This service is invoked by the MRI to request the PMAC to compose and transmit a MAC frame using the information provided in the parameters.

The semantics for the MRI_UNITDATA.request service primitive are defined as follows:

```
MRI_UNITDATA.request {    macFrameControl,
                          destinationAddress,
                          sourceAddress,
                          routingInformation,
                          macInformation,
                          frameCheckSequence    }
```

macFrameControl

The macFrameControl parameter specifies the value to be used in the frame control field by the PMAC when composing the MAC frame for transmission. The structure and content of this field shall conform to the FC field format specified in 3.2.3.

destinationAddress

The destinationAddress parameter is any valid individual, group, functional, or broadcast address. The structure and contents of this parameter shall conform to the DA field specified in 3.2.4.1.

sourceAddress

The sourceAddress parameter specifies the individual address to be used in the source address field by the PMAC when composing the MAC frame for transmission. The structure and contents of this parameter shall conform to the SA field specified in 3.2.4.2.

routingInformation

The routingInformation parameter is optional and used only when the routing information indicator is set in the sourceAddress parameter. When used, the structure and contents of this parameter shall conform to the RI field specified in 3.2.5.

macInformation

The structure and contents of the macInformation parameter shall conform to the MAC frame information field format specified in 3.3.2, as modified by 10.3.

frameCheckSequence

The frameCheckSequence parameter is optional and may not be specified. When used, the frameCheckSequence parameter specifies the value to be used in the FCS by the PMAC when composing the MAC frame for transmission. When unspecified, the PMAC shall calculate and transmit a valid FCS as specified in 3.2.7.

11.2.3.1.2 MRI_UNITDATA.indication

This service is invoked by the PMAC to notify the MRI that it has received a MAC frame that has a destination class of neither 0 nor 3 when the source class is 0 (REF 1807), or when the source class is not zero (REF 1808). This service is also invoked by the PMAC when an error report must be forwarded to the REM function (REF 1811).

The semantics for the MRI_UNITDATA.indication service primitive are defined as follows:

```
MRI_UNITDATA.indication {     macFrameControl,
                              destinationAddress,
                              sourceAddress,
                              routingInformation,
                              macInformation,
                              frameCheckSequence }
```

macFrameControl

The macFrameControl parameter indicates the value of the FC field of the received MAC frame. The structure and content of this field shall conform to the FC field specified in 3.2.3.

destinationAddress

The destinationAddress parameter is any valid individual, group, functional, or broadcast address. The structure and contents of this parameter shall conform to the DA field specified in 3.2.4.1.

sourceAddress

The sourceAddress parameter is the individual address of the MAC that originated the frame. The structure and contents of this parameter shall conform to the SA field specified in 3.2.4.2.

routingInformation

The routingInformation parameter is optional and used only when the routing information indicator is set in the sourceAddress parameter. When used, the structure and contents of this parameter shall conform to the RI field specified in 3.2.5.

macInformation

The structure and contents of the macInformation parameter shall conform to the MAC frame information field format specified in 3.3.2, as modified by 10.3.

frameCheckSequence

The frameCheckSequence parameter specifies the FCS value of the received MAC frame. The structure and content of this parameter shall conform to the FCS field specified in 3.2.7.

11.3 Management information definitions

11.3.1 DTR MAC MIB definitions

Editor's note on special word usage in the MIB definitions:

The terms "shall", "mandatory," and "required" in the MIB definition are constrained within the definition of the MIB itself. Implementation of the MIB is optional by this standard.

```
DtrMacMIB DEFINITIONS ::= BEGIN

IMPORTS
      transmission
            FROM RFC1213-MIB
      MODULE-IDENTITY, OBJECT-TYPE, Counter32, NOTIFICATION-TYPE
            FROM SNMPv2-SMI
      InterfaceIndex
            FROM IF-MIB
      MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
            FROM SNMPv2-CONF
      TruthValue, DisplayString, MacAddress, TimeStamp
            FROM SNMPv2-TC;

dtrMacMIB MODULE-IDENTITY
      LAST-UPDATED "9826081035Z"
      ORGANIZATION "IEEE 802.5"
      CONTACT-INFO
                  "Katie D. Lee
                  IBM
                  CNMA/664
                  RTP, NC 27709
                  kdlee@vnet.ibm.com
                  (919) 254-7507

                  Neil Jarvis
                  Madge Networks Ltd.
                  2 Pioneer Park
                  Amy Johnson Way
                  York
                  YO30 4TN
                  United Kingdom
                  njarvis@madge.com
                  +44 1904 693409"
```



```
      DESCRIPTION
            "The MIB module for dedicated token ring MACs."
      ::= {transmission 86 }

dtrMacObjects     OBJECT IDENTIFIER ::= { dtrMacMIB 1 }
dtrMacTraps       OBJECT IDENTIFIER ::= { dtrMacMIB 2 }
dtrMacConformance OBJECT IDENTIFIER ::= { dtrMacMIB 3 }

--*******************************************************

-- This SNMP MIB module contains definitions for management
-- of both the DTR Station (SMAC) and the DTR C-Port (PMAC).
--
-- A DTR Station using TXI protocol has an entry in the
-- following tables:
--     txiProtocolTable
--     dtrStationTable
--
-- A DTR Station using TKP protocol shall implement RFC 1748
-- IEEE 802.5 token ring MIB, as well as the following table:
--     dtrStationTable
--
-- A C-Port in Port mode using TXI protocol has an entry in each of the
-- following tables:
--     txiProtocolTable
--     dtrCportTable
--
-- A C-Port in Port mode using TKP protocol shall implement RFC 1748 IEEE 802.5
-- token ring MIB, as well as the following table:
--     dtrCportTable
--
-- A C-Port in Station Emulation mode using TXI protocol has an
-- entry in each of the following tables:
--     txiProtocolTable
--     dtrStationTable
--     dtrCportTable
--
-- A C-Port in Station Emulation mode using TKP protocol shall implement
-- RFC 1748 IEEE 802.5 token ring MIB, as well as the following tables:
--     dtrCportTable
--     dtrStationTable
--
--*******************************************************

-- Relationship to RFC 1573

-- Layering model
--  For the typical usage of this IEEE 802.5 DTR MIB module, there will
--  be no sublayers "above" or "below" the 802.5 DTR interface. However,
--  this MIB module does not preclude such layering.

-- Virtual circuits
--  802.5 DTR does not support virtual circuits.

-- ifTestTable
--  This MIB module does not define tests.

-- ifRcvAddressTable
--  The ifRcvAddressTable is defined to contain all MAC addresses—
--  unicast, multicast (group), and broadcast—for which an interface
--  will receive packets. For 802.5 DTR interfaces, its use includes
--  functional addresses. The format of the address, contained in
--  ifRcvAddressAddress, is the same as for ifPhysAddress.
--  For functional addresses on a particular 802.5 DTR interface, only
```

```
--  one ifRcvAddressTable entry is required. That entry is the one for
--  the address that has the functional address bit ANDed with the bit
--  mask of all functional address for which the interface will accept
--  frames.

-- ifPhysAddress
--  For an 802.5 DTR interface, ifPhysAddress contains the interface's IEEE
--  MAC address, stored as an octet string of length 6, in IEEE 802.1
--  "canonical" order; i.e., the Group Bit is positioned as the low-order
--  bit (0x01) of the first octet.

-- ifType
--  The objects defined in this MIB module apply to each interface for which
--  the ifType has the value:
--    iso88025Dtr = 86

--*******************************************************
-- TXI Protocol
--  This table provides information about an 802.5 TXI MAC.
--  A managed system will have one entry in this table
--  for each of its TXI MAC interfaces. It is mandatory
--  that systems having TXI interfaces implement this
--  table in addition to the generic interfaces table and
--  its generic extensions, defined in RFC 1573.
-- *******************************************************
txiProtocolTable    OBJECT-TYPE
 SYNTAX        SEQUENCE OF TxiProtocolEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    "This table contains TXI interface characteristics.
    There is one entry for each TXI interface in the
    managed system."
::= { dtrMacObjects 1 }

txiProtocolEntry    OBJECT-TYPE
 SYNTAX        TxiProtocolEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    "A list of characteristics for an 802.5 TXI interface."
 INDEX
   { txiProtocolIfIndex }
::= { txiProtocolTable 1 }

TxiProtocolEntry ::= SEQUENCE {
  txiProtocolIfIndex                    InterfaceIndex,
  txiProtocolMacType                    INTEGER,
  txiProtocolFunctionalAddress          MacAddress,
  txiProtocolUpstreamNeighborAddress    MacAddress,
  txiProtocolMicrocodeLevel             OCTET STRING,
  txiProtocolProductInstanceId          OCTET STRING,
  txiProtocolAuthorizedFunctionClasses  OCTET STRING,
  txiProtocolErrorReportTimer           INTEGER,
  txiProtocolPhysicalDropNumber         OCTET STRING,
  txiProtocolRingNumber                 OCTET STRING,
  txiProtocolRingStatus                 INTEGER,
  txiProtocolJoinState                  INTEGER,
  txiProtocolMonitorState               INTEGER,
  txiProtocolBeaconSA                   MacAddress,
  txiProtocolBeaconType                 INTEGER,
  txiProtocolBeaconUNA                  MacAddress,
  txiProtocolBeaconPDN                  OCTET STRING,
  txiProtocolEventStatus                INTEGER }
```

```
txiProtocolIfIndex    OBJECT-TYPE
 SYNTAX        InterfaceIndex
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    “This object identifies the interface for which this entry contains
    management information. The value of this object for a particular
    interface has the same value as the ifIndex object, defined in
    RFC 1573, for the same interface.”
::= { txiProtocolEntry 1 }

txiProtocolMacType    OBJECT-TYPE
 SYNTAX          INTEGER{ Station(1), cPortPortMode(2), cPortStnEmula-
tion(3) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This objects indicates whether this MAC interface is a Station, a
    C-Port in Port mode, or a C-Port in Station Emulation mode.”
::= { txiProtocolEntry 2 }

txiProtocolFunctionalAddress    OBJECT-TYPE
 SYNTAX        MacAddress
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the Functional Addresses
    subvector X'2C' used in the Report Station Addresses and Report Station
    Attachments MAC frames. The value of this object can be set by
    management.”
::= { txiProtocolEntry 3 }

txiProtocolUpstreamNeighborAddress    OBJECT-TYPE
 SYNTAX        MacAddress
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the individual address of the nearest
    upstream neighbor. The value of this object is derived
    from the Heart Beat frame.”
::= { txiProtocolEntry 4 }

txiProtocolMicrocodeLevel    OBJECT-TYPE
 SYNTAX        OCTET STRING (SIZE(1..32))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the Ring Station Version
    Number subvector X'23' used in the Report Station State MAC frame.
    The value of this object cannot be set by management.”
::= { txiProtocolEntry 5 }

txiProtocolProductInstanceId    OBJECT-TYPE
 SYNTAX        OCTET STRING (SIZE(1..31))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the Product Instance ID subvector
    X'22' used in the Report Station Attachment and Report New Active
    Monitor MAC frames. The value of this object cannot be set by
    management.”
::= { txiProtocolEntry 6 }

txiProtocolAuthorizedFunctionClasses    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
```

```
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value set by the Authorized
    Function Classes subvector X'06' of the Change Parameters
    MAC frame.”
::= { txiProtocolEntry 7 }

txiProtocolErrorReportTimer    OBJECT-TYPE
 SYNTAX        INTEGER (0..65535)
 UNITS         “1/100 second”
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the timer TSER as set by
    the Error Timer Value subvector X'05' from the Change Parameters
    or the Initialize Station MAC frame. This object indicates the
    value in .01 s increments.”
::= { txiProtocolEntry 8 }

txiProtocolPhysicalDropNumber    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(4))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value set by the Assign Physical Drop
    Number subvector X'04' of the Change Parameters or the Initialize
    Station MAC frame.”
::= { txiProtocolEntry 9 }

txiProtocolRingNumber    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value set by the Local Ring Number
    subvector X'03' from the Change Parameters or Initialize Station
    MAC frame.”
::= { txiProtocolEntry 10 }

txiProtocolRingStatus    OBJECT-TYPE
 SYNTAX        INTEGER (0..262143)
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “The current interface status that can be used to diagnose
    fluctuating problems that can occur on token rings, after
    a Station has successfully been added to the ring.

    Before an open is completed, this object has the value for
    the ‘no status’ condition. The txiProtocolRingStatus objects
    provide for debugging problems when the Station cannot even
    enter the ring.

    The object’s value is a sum of values, one for each currently
    applicable condition. The following values are defined for
    various conditions:
             0 = No problems detected
             1 = Link_status deasserted
             2 = Remove Alert received
            32 = Ring Recovery
           256 = Remove Received
           512 = reserved
          1024 = Auto-Removal Error
          2048 = Lobe Wire Fault
```



```
          4096 = Transmit Beacon
          8192 = Soft Error
         16384 = Hard Error
         32768 = Signal Loss
        131072 = no status, open not completed.”
::= { txiProtocolEntry 11 }

txiProtocolJoinState    OBJECT-TYPE
 SYNTAX        INTEGER{
                  notSpecified(1),
                  bypass(2),
                  registration(3),
                  lobeTest(4),
                  duplicateAddrCheck(5),
                  duplicateAddrDetected(6),
                  joinCompleteTXI(7),
                  awaitNotification(8),
                  removeAlertWait(9),
                  highMediaRateTradeUp(10) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the present state of the Join FSM. The value will
    be one of the following:
            (1) notSpecified,
            (2) bypass (JS=BP),
            (3) registration (JS=PREG or JS=SREG),
            (4) lobeTest (JS=PLT or JS=SLT),
            (5) duplicateAddrCheck (JS=PDAC or JS=SDAC),
            (6) duplicateAddrDetected (JS=PDAD),
            (7) joinComplete TXI (JS=PJCI or JS=SJC),
            (8) awaitNotification (JS=PANNC),
            (9) removeAlertWait (JS=PRAW or JS=SRAW),
            (10) highMediaRateTradeUp (JS=PHMRTU or JS=SHMRTU)”
::= { txiProtocolEntry 12 }

txiProtocolMonitorState    OBJECT-TYPE
 SYNTAX        INTEGER{
                  notSpecified(1),
                  operational(2),
                  beaconTransmit(3),
                  wireFaultDelay(4),
                  internalTest(5) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the present state of the Monitor FSM.
    The value will be one of the following:
      (1) notSpecified,
      (2) Operational (MS=POPT or MS=SOPT),
      (3) TransmitBeacon (MS=PTBN or MS=STBN),
      (4) wireFaultDelay (MS=PITW or MS=SITW)
      (5) Internal Test Wait (MS=PIT or MS=SIT).”
::= { txiProtocolEntry 13 }

txiProtocolBeaconSA    OBJECT-TYPE
 SYNTAX        MacAddress
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the source address used in the last Beacon MAC
    frame transmitted or received.”
::= { txiProtocolEntry 14 }

txiProtocolBeaconType    OBJECT-TYPE
```

```
 SYNTAX        INTEGER{
                  type1(1),
                  type2(2),
                  type3(3),
                  type4(4),
                  type5(5) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the Beacon Type subvector X'01'
    used in the last Beacon MAC frame transmitted or received as follows:
      (1) notSpecified
      (2) signalLoss
      (3) notUsed
      (4) notUsed
      (5) heartBeatFailure”
::= { txiProtocolEntry 15 }

txiProtocolBeaconUNA    OBJECT-TYPE
 SYNTAX        MacAddress
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the UNA subvector X'02' used in
    the last Beacon MAC frame transmitted or received.”
::= { txiProtocolEntry 16 }

txiProtocolBeaconPDN    OBJECT-TYPE
 SYNTAX        OCTET STRING (SIZE(4))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the Physical Drop Number subvector
    X'0B' used in the last Beacon MAC frame transmitted or received.”
::= { txiProtocolEntry 17 }

txiProtocolEventStatus    OBJECT-TYPE
 SYNTAX        INTEGER {
                  macInsertREQReceived(1),
                  macInsertRSPReceived(2),
                  reportError(3),
                  heartBeatLost(4),
                  signalLoss(5),
                  beaconReceived(6),
                  remove(7),
                  internalError(8),
                  StationOrCPortError(9),
                  wireFault(10),
                  claimReceived(11),
                  purgeReceived(12),
                  standbyReceived(13),
                  invalidSourceAddress(14),
                  activeMonitorReceived(15),
                  phantomLoss(16),
                  duplicateAddressDetected(17),
                  removeAlertReceived(18),
                  link_statusDeasserted(19) }
 MAX-ACCESS    accessible-for-notify
 STATUS        current
 DESCRIPTION
    “This object specifies the latest event status of the TXI interface.”
::= { txiProtocolEntry 18 }
```

```
-- ********************************************************
-- Station Protocol Characteristics Table
--  This table contains protocol information for DTR Stations
--  and C-Ports in Station Emulation mode (both TKP and TXI).
--  There is an entry in this table for each Station
--  in a managed system.
-- ********************************************************

dtrStationTable    OBJECT-TYPE
 SYNTAX        SEQUENCE OF DtrStationEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    "This table contains characteristics for each DTR Station.
    There is one entry for each interface in the managed system."
::= { dtrMacObjects 2 }

dtrStationEntry    OBJECT-TYPE
 SYNTAX        DtrStationEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    "A list of Station characteristics."
 INDEX
    { dtrStationIfIndex }
::= { dtrStationTable 1 }

DtrStationEntry ::= SEQUENCE {
  dtrStationIfIndex                     InterfaceIndex,
  dtrStationStationType                 INTEGER,
  dtrStationCurrentAccessProtocol       INTEGER,
  dtrStationRequestedAccessProtocol     OCTET STRING,
  dtrStationAccessProtocolResponse      OCTET STRING,
  -- policy variables
  dtrStationAccessProtocolMask          OCTET STRING,
  dtrStationIndividualAddressCount      OCTET STRING,
  dtrStationMaxFrameSize                INTEGER,
  dtrStationPhantomDriveSupport         OCTET STRING,
  -- policy flags
  dtrStationAdminErrorCountingOption    INTEGER,
  dtrStationAdminOpenOption             INTEGER,
  dtrStationAdminRegistrationOption     INTEGER,
  dtrStationAdminRejectRemoveOption     INTEGER,
  dtrStationAdminMediumRateOption       INTEGER,
  dtrStationAdminRegistrationQueryOption  INTEGER,
  dtrStationAdminRegistrationDeniedOption INTEGER,

  dtrStationOperErrorCountingOption     INTEGER,
  dtrStationOperOpenOption              INTEGER,
  dtrStationOperRegistrationOption      INTEGER,
  dtrStationOperRejectRemoveOption      INTEGER,
  dtrStationOperMediumRateOption        INTEGER,
  dtrStationOperRegistrationQueryOption INTEGER,
  dtrStationOperRegistrationDeniedOption  INTEGER,  -- HMR policy flags
  dtrStationAdminAutoNegotiationOption  INTEGER,
  dtrStationAdminAbortSequenceOption    INTEGER,
  dtrStationAdminHMRTradeUpOption       INTEGER,
  dtrStationAdminLobeMediaTestOption    INTEGER,

  dtrStationOperAutoNegotiationOption   INTEGER,
  dtrStationOperAbortSequenceOption     INTEGER,
  dtrStationOperHMRTradeUpOption        INTEGER,
  dtrStationOperLobeMediaTestOption     INTEGER
   }
```

```
dtrStationIfIndex    OBJECT-TYPE
 SYNTAX        InterfaceIndex
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    “This object identifies the interface for which this entry contains
    management information. The value of this object for a particular
    interface has the same value as the ifIndex object, defined in RFC 1573,
    for the same interface.”
::= { dtrStationEntry 1 }

dtrStationStationType    OBJECT-TYPE
 SYNTAX        INTEGER { dtrStation(1), cPortInStnEmulation(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies whether this entry is a DTR Station or a C-Port
    in Station Emulation mode.”
::= { dtrStationEntry 2 }

dtrStationCurrentAccessProtocol    OBJECT-TYPE
 SYNTAX        INTEGER { tKP(1), tXI(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies which access protocol is currently in use by the
    MAC. The value of this object is either (1) TKP or (2) TXI.
    This object cannot be set by management.”
::= { dtrStationEntry 3 }

dtrStationRequestedAccessProtocol    OBJECT-TYPE
 SYNTAX        OCTET STRING (SIZE(2))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the access protocol Request subvec-
tor
    X'0E' transmitted in the Registration Request MAC frame. The value
    X'0002' indicates TXI access protocol. The value X'0006' indicates TXI
    access protocol and the Station is capable of operating at 100 Mbit/s.
    If the Station is running TKP protocol, the value is X'FFFF'. All
    other values are reserved for future standardization.”
::= { dtrStationEntry 4 }

dtrStationAccessProtocolResponse    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the value of the access protocol Response subvector
    X'0F' received from the Registration Response MAC frame. The value
    X'0000' means access denied and the value X'0002' indicates TXI and
    phantom and wire fault support method accepted.  The value X'0004'
    indicates that the C-Port will support the Station’s 100 Mbit/s capabil-
ity.”
::= { dtrStationEntry 5 }

dtrStationAccessProtocolMask    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies which access protocols can be supported by the
    Station. This object indicates the value of the SPV(AP_MASK)
    variable. The value of this object is either: X'0001' (TKP),
```



```
    X'0002'(TXI), or X'0003' (TKPAndTXI).”
::= { dtrStationEntry 6 }

dtrStationIndividualAddressCount    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies the number of individual addresses supported
    by the MAC. This object is used to set the value of the Individual
    Address Count subvector X'21'. A value of X'0000' means
    that more than one individual address is not supported. A non-zero value
    specifies the number of individual address in use by this MAC.”
::= { dtrStationEntry 7 }

dtrStationMaxFrameSize    OBJECT-TYPE
 SYNTAX        INTEGER(133..18207)
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies the maximum frame size that a MAC
    will transmit and indicates the value of the SPV(MAX_TX) variable.
    At 4 Mbit/s, the maximum permitted value is 4550. At 16 Mbit/s, the
    maximum permitted value is 18200. At 100 Mbit/s the maximum permitted
    value is 18207.”
::= { dtrStationEntry 8 }

dtrStationPhantomDriveSupport    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies the MAC’s support of Phantom Drive
    and Wire Fault detection. This object indicates the value of the
    SPV(PD) variable and the value of the Phantom subvector
    X'0C' used in the Registration Request MAC frame.  The value X'0001'
    indicates that the Station supports phantom signaling and wire fault
    detection as described in ANSI/IEEE Std 802.5, 1998 Edition.  The
    value X'0002' indictates that the Station does not support phantom
    signaling.”
::= { dtrStationEntry 9 }

dtrStationAdminErrorCountingOption    OBJECT-TYPE
 SYNTAX        INTEGER {triggered(1), freeRunning(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies how the MAC manages the error report timer.
    If set to triggered(1), the MAC resets TSER when the first error is
    received and, when TSER expires, sends an error report MAC frame.
    If set to freeRunning(2), each time TSER expires the MAC resets TSER
    and, if any of the error counters are not zero, sends the error
    report MAC frame. This object is used to set the value of the
    FSECO flag to be used at the next Connect.SMAC event. A write
    operation to this object will not change the operational value
    reflected in dtrStationOperErrorCountingOption until the next
    Connect.SMAC event.”
::= { dtrStationEntry 10 }

dtrStationAdminOpenOption    OBJECT-TYPE
 SYNTAX        INTEGER{ exitToClause4(1), enterBypass(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies the action of the Station when a response is
```

```
    not received during the registration process.  If set to
    exitToClause4(1), then SMAC attempts to use the TKP access protocol by
    exits to Clause 4. If set to enterBypass(2), then SMAC enters Bypass.
    This object indicates the value of the FSEPO flag to be used at the next
    Connect.SMAC event. A write operation to this object will not change the
    operational value reflected in dtrStationOperOpenOption until the next
    Connect.SMAC event."
::= { dtrStationEntry 11 }

dtrStationAdminRegistrationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ noRegistration (1), dtrRegistration(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "This object specifies if the Station or C-Port in Station Emulation
    mode registers with the C-Port to request the use of an access protocol
    and a method of phantom drive and wire fault detection. If the value is
    noRegistration(1), then the Station does not register and uses the Join
    FSM defined in Clause 4. If the value is dtrRegistration(2), then the
    Station uses the registration process by using the Join FSM defined in
    9.2. This object indicates the value of the FSREGO flag to be
    used at the next Connect.SMAC event. A write
    operation to this object will not change the operational value
    reflected in dtrStationOperRegistrationOption until the next
    Connect.SMAC event."
::= { dtrStationEntry 12 }

dtrStationAdminRejectRemoveOption    OBJECT-TYPE
 SYNTAX        INTEGER{ removes(1), rejects(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "This object specifies how the Station responds to a REMOVE
    MAC frame. If set to removes(1), then the SMAC deinserts upon
    receiving a REMOVE MAC frame. If set to rejects(2), then the
    SMAC rejects the REMOVE MAC frame and transmits a Response
    MAC frame indicating function disabled. This object indicates
    the value of the FSRRO flag to be used at the next Connect.SMAC
    event. A write operation to this object will not change the
    operational value reflected in dtrStationOperRejectRemoveOption
    until the next Connect.SMAC event."
::= { dtrStationEntry 13 }

dtrStationAdminMediumRateOption    OBJECT-TYPE
 SYNTAX        INTEGER{ rate4Mbps(1), rate16Mbps(2), rate100Mbps(3),
                        rate1000Mbps(4) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "The value of this object specifies the medium rate as either 4 Mbit/s,
    16 Mbit/s, 100 Mbit/s or 1000 Mbit/s. If set to rate4Mbps(1), then
    SMAC operates the medium at 4 Mbit/s. If set to rate16Mbps(2), then
    SMAC operates the medium at 16 Mbit/s. If set to rate100Mbps(3), then
    SMAC operates the medium at 100 Mbit/s. If set to rate1000Mbps(4), then
    SMAC operates the medium at 1000 Mbit/s. This object indicates the value
    of the FSMRO flag to be used at the next Connect.SMAC event. A write
    operation to this object will not change the operational value
    reflected in dtrStationOperMediumRateOption until the next
    Connect.SMAC event."
::= { dtrStationEntry 14 }

dtrStationAdminRegistrationQueryOption    OBJECT-TYPE
 SYNTAX        INTEGER{ support(1), ignore(2) }
 MAX-ACCESS    read-write
 STATUS        current
```



```
 DESCRIPTION
    "The value of this object indicates if the registration query protocol
    is supported by MAC when using the TKP access protocol. If set to
    support(1), then MAC recognizes the Registration Query MAC frame.
    If set to ignore(2), then MAC ignores the Registration Query MAC frame.
    This object indicates the value of FSRQO flag to be used at the next
    Connect.SMAC event. A write operation to this object will not change
    the operational value reflected in dtrStationOperRegistrationQueryOption
    until the next Connect.SMAC event."
::= { dtrStationEntry 15 }

dtrStationAdminRegistrationDeniedOption    OBJECT-TYPE
 SYNTAX        INTEGER{ tkpJoin(1), close(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "The value of this object specifies how the Station acts upon receiving
    a denied registration request. If set to tkpJoin(1), then SMAC attempts
    to Join using the TKP access protocol. If set to close(2), then the SMAC
    closes. This object indicates the value of FSRDO flag to be used
    at the next Connect.SMAC event. A write operation to this object
    will not change the operational value reflected in
    dtrStationOperRegistrationDeniedOption until the next
    Connect.SMAC event."
::= { dtrStationEntry 16 }

dtrStationOperErrorCountingOption    OBJECT-TYPE
 SYNTAX        INTEGER { triggered(1), freeRunning(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies how the MAC manages the error
    report timer.  If set to triggered(1), the MAC resets TSER
    when the first error is received and, when TSER expires,
    transmits a Report Error MAC frame. If set to freeRunning(2),
    each time TSER expires the MAC resets TSER and, if any of the
    error counters are not zero, transmits the Report Error MAC
    frame. This object is used to set the value of the FSECO
    flag at which the Station is currently operating."
::= { dtrStationEntry 17 }

dtrStationOperOpenOption    OBJECT-TYPE
 SYNTAX        INTEGER{ exitToClause4(1), enterBypass(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies the action of the Station when a response is
    not received during the registration process.  If set to exitToClause4(1),
    then SMAC attempts to use the TKP access protocol and exits to Clause 4.
    If set to enterBypass(2), then SMAC enters Bypass. This object indicates
    the value of the FSOPO flag at which the Station is currently
    operating."
::= { dtrStationEntry 18 }

dtrStationOperRegistrationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ noRegistration (1), dtrRegistration(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies if the Station or C-Port in Station Emulation
    mode registers with the C-Port to request the use of an access protocol
    and a method of phantom drive and wire fault detection. If the
    value is noRegistration(1), then the Station does not register and
    uses the Join FSM defined in Clause 4. If the value is
    dtrRegistration(2), then the Station uses the registration process by
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    using the Join FSM defined in 9.2. This object indicates the value of
    the FSOPO flag at which the Station is currently operating."
::= { dtrStationEntry 19 }

dtrStationOperRejectRemoveOption    OBJECT-TYPE
 SYNTAX        INTEGER{ removes(1), rejects(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies how the Station responds to a REMOVE
    frame. If set to removes(1), then the SMAC deinserts upon
    receiving a REMOVE MAC frame. If set to rejects(2), then the
    SMAC rejects the REMOVE MAC frame and transmits a Response
    MAC frame indicating function disabled. This object indicates
    the value of the FSRRO flag at which the Station is currently
    operating."
::= { dtrStationEntry 20 }

dtrStationOperMediumRateOption    OBJECT-TYPE
 SYNTAX        INTEGER{ rate4Mbps(1), rate16Mbps(2), rate100Mbps(3),
                        rate1000Mbps(4) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "The value of this object specifies the medium rate as either 4 Mbit/s,
    16 Mbit/s, 100 Mbit/s or 1000 Mbit/s. If set to rate4Mbps(1), then
    SMAC operates the medium at 4 Mbit/s. If set to rate16Mbps(2), then SMAC
    operates the medium at 16 Mbit/s. If set to rate100Mbps(3), then SMAC
    operates the medium at 100 Mbit/s. If set to rate1000Mbps(4), then SMAC
    operates the medium at 1000 Mbit/s. This object indicates the media
    rate at which the Station is currently operating."
::= { dtrStationEntry 21 }

dtrStationOperRegistrationQueryOption    OBJECT-TYPE
 SYNTAX        INTEGER{ support(1), ignore(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "The value of this object indicates if the registration query protocol
    is supported by MAC when using the TKP access protocol. If set to
    support(1), then MAC recognizes the Registration Query MAC frame.
    If set to ignore(2), then MAC ignores the Registration Query MAC frame.
    This object indicates the value of FSRQO flag at which the
    Station is currently operating."
::= { dtrStationEntry 22 }

dtrStationOperRegistrationDeniedOption    OBJECT-TYPE
 SYNTAX        INTEGER{ tkpJoin(1), close(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "The value of this object specifies how the Station acts upon receiving
    a denied registration request. If set to tkpJoin(1), then SMAC attempts
    to Join using the TKP access protocol. If set to close(2), then the
    SMAC closes. This object indicates the value of FSRDO at which the
    Station is currently operating."
::= { dtrStationEntry 23 }

dtrStationAdminAutoNegotiationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ notSupported(1) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "The value of this object specifies what auto negotiation support a
    Station has. When set to notSupported(1), the Station does not support
```



```
    auto negotiation. This object indicates the value of FSANO flag to be
    used at the next Connect.SMAC event. A write operation to this object
    will not change the operational value reflected in
    dtrStationOperAutoNegotiationOption until the next Connect.SMAC event."
::= { dtrStationEntry 24 }

dtrStationAdminAbortSequenceOption    OBJECT-TYPE
 SYNTAX        INTEGER{ abortSequence(1), invalidFCS(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "This object specifies the method used by the SMAC to control the ending
    sequence for aborted frames when operating at the high media rate.
    When set to abortSequence(1), a frame is ended with an abort sequence.
    When set to invalidFCS(2), a frame is ended with an invalid FCS and by
    setting the E bit to 1 in the Ending Delimiter field. This object
    indicates the value of the FSASO flag to be used at the next
    Connect.SMAC event. A write operation to this object will not change the
    operational value reflected in dtrStationOperAbortSequenceOption until
    the next Connect.SMAC event."
::= { dtrStationEntry 25 }

dtrStationAdminHMRTradeUpOption    OBJECT-TYPE
 SYNTAX        INTEGER{ notHMRCapable(1), HMRCapable(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "This object specifies if the Station is capable of operating at the
    high media rate. When set to notHMRCapable(1), the Station will not
    attempt to register high media rate capability when registering at 4 or
    16 Mbit/s. When set to HMRCapable(2), the Station will register its high
    media rate capability during registration at 4 or 16 Mbit.s. This object
    indicates the value of the FSHMRTUO flag to be used at the next
    Connect.SMAC event. A write operation to this object will not change the
    operational value reflected in dtrStationOperHMRTradeUpOption until the
    next Connect.SMAC event."
::= { dtrStationEntry 26 }

dtrStationAdminLobeMediaTestOption    OBJECT-TYPE
 SYNTAX        INTEGER{ classicLMT(1), hmrLMT(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
   "This object specifies the lobe media test method employed by the
    Station. When set to classicLMT(1), the Station will employ the lobe
    media test as specified in ANSI/IEEE Std 802.5, 1998 Edition. When
    set to hmrLMT(2), the Station will employ the two phase lobe media
    test as defined in 9.1.6.2.1. This object indicates the value of the
    FSLMTO flag to be used at the next Connect.SMAC event. A write
    operation to this object will not change the operational value
    reflected in dtrStationOperLobeMediaTestOption until the next
    Connect.SMAC event."
::= { dtrStationEntry 27 }

dtrStationOperAutoNegotiationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ notSupported(1) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "The value of this object specifies what auto negotiation support a
    Station has. If set to notSupported(1), the Station does not support
    auto negotiation. This object indicates the value of FSANO at which the
    Station is currently operating."
::= { dtrStationEntry 28 }
```

```
dtrStationOperAbortSequenceOption    OBJECT-TYPE
 SYNTAX        INTEGER{ abortSequence(1), invalidFCS(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies the method used by the SMAC to control the ending
    sequence for aborted frames when operating at the high media rate.
    If set to abortSequence(1), a frame is ended with an abort sequence. If
    set to invalidFCS(2), a frame is ended with an invalid FCS and by
    setting the E bit to 1 in the Ending Delimiter field. This object
    indicates the value of FSASO at which the Station is currently
    operating."
::= { dtrStationEntry 29 }

dtrStationOperHMRTradeUpOption    OBJECT-TYPE
 SYNTAX        INTEGER{ notHMRCapable(1), HMRCapable(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies if the Station is capable of operating at the
    high media rate. If set to notHMRCapable(1), the Station will not
    attempt to register high media rate capability when registering at 4 or
    16 Mbit/s. If set to HMRCapable(2), the Station will register its high
    media rate capability during registration at 4 or 16 Mbit/s. This object
    indicates the value of FSHMRTUO at which the Station is currently
    operating."
::= { dtrStationEntry 30 }

dtrStationOperLobeMediaTestOption    OBJECT-TYPE
 SYNTAX        INTEGER{ classicLMT(1), hmrLMT(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies the lobe media test method employed by the
    Station. If set to classicLMT(1), the Station will employ the lobe media
    test as specified in ANSI/IEEE Std 802.5, 1998 Edition. If set to
    hmrLMT(2), the Station will employ the two phase lobe media test as
    defined in 9.1.6.2.1. This object indicates the value of FSLMTO at
    which the Station is currently operating."
::= { dtrStationEntry 31 }

-- ******************************************************
-- C-Port Protocol Characteristics Table
--  This table contains Protocol information for C-Ports (both TKP and TXI).
--  There is an entry in this table for each C-Port in this managed
--  system.
-- ******************************************************

dtrCportTable    OBJECT-TYPE
 SYNTAX        SEQUENCE OF DtrCportEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    "This table contains information for C-Port interfaces. There is
    one entry in this table for each C-Port interface in a managed
    system."
::= { dtrMacObjects 3 }

dtrCportEntry    OBJECT-TYPE
 SYNTAX        DtrCportEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    "A list of characteristics of a C-Port."
```



```
 INDEX
    { dtrCportIfIndex }
::= { dtrCportTable 1 }

DtrCportEntry ::= SEQUENCE {
  dtrCportIfIndex                    InterfaceIndex,
  dtrCportCurrentAccessProtocol      INTEGER,
  -- policy variables
  dtrCportAccessProtocolMask         OCTET STRING,
  dtrCportMaxFrameSize               INTEGER,
  dtrCportPhantomDriveMask           OCTET STRING,
  -- policy flags
  dtrCportAdminErrorCountingOption   INTEGER,
  dtrCportAdminMediumRateOption      INTEGER,
  dtrCportAdminOperationOption       INTEGER,
  dtrCportAdminRepeatPathOption      INTEGER,
  dtrCportAdminAbortSequenceOption   INTEGER,
  dtrCportAdminBeaconHandlingOption  INTEGER,
  dtrCportAdminFrameControlOption    INTEGER,

  dtrCportOperErrorCountingOption    INTEGER,
  dtrCportOperMediumRateOption       INTEGER,
  dtrCportOperOperationOption        INTEGER,
  dtrCportOperRepeatPathOption       INTEGER,
  dtrCportOperAbortSequenceOption    INTEGER,
  dtrCportOperBeaconHandlingOption   INTEGER,
  dtrCportOperFrameControlOption     INTEGER,
  -- HMR policy flags
  dtrCportAdminAutoNegotiationOption INTEGER,
  dtrCportAdminHMRTradeUpOption      INTEGER,

  dtrCportOperAutoNegotiationOption  INTEGER,
  dtrCportOperHMRTradeUpOption       INTEGER
   }

dtrCportIfIndex    OBJECT-TYPE
 SYNTAX        InterfaceIndex
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    “This object identifies the interface for which this entry contains
    management information. The value of this object for a particular
    interface has the same value as the ifIndex object, defined in RFC 1573,
    for the same interface.”
::= { dtrCportEntry 1 }

dtrCportCurrentAccessProtocol    OBJECT-TYPE
 SYNTAX        INTEGER { tKP(1), tXI(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies which access protocol is currently in use by
    the MAC. The value of this object is either (1) TKP or (2) TXI.
    This object cannot be set by management.”
::= { dtrCportEntry 2 }

dtrCportAccessProtocolMask    OBJECT-TYPE
 SYNTAX        OCTET STRING(SIZE(2))
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies which access protocols can be supported by the
    PMAC. This object indicates the value of the PPV(AP_MASK)
    The value of this object is either: X'0001' (TKP), X'0002'(TXI),
    or X'0003' (TKPAndTXI).”
```

```
::= { dtrCportEntry 3 }

dtrCportMaxFrameSize    OBJECT-TYPE
 SYNTAX        INTEGER(133..18207)
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies the maximum frame size that a PMAC
    will transmit and indicates the value of the PPV(MAX_TX) variable.
    At 4 Mbit/s, the maximum permitted value is 4550. At 16 Mbit/s, the
    maximum permitted value is 18200. At 100 Mbit/s, the maximum permitted
    value is 18207.”
::= { dtrCportEntry 4 }

dtrCportPhantomDriveMask    OBJECT-TYPE
 SYNTAX        OCTET STRING (SIZE(2))
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “The object indicates the value of the C-Port policy variable
    PPV(PD_MASK). It represents a bit mask of phantom drive and wire fault
    detection methods supported by the C-Port.”
::= { dtrCportEntry 5 }

dtrCportAdminErrorCountingOption    OBJECT-TYPE
 SYNTAX        INTEGER { triggered(1), freeRunning(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies how the MAC manages the error report timer.
    If set to triggered(1), the MAC resets TPER when the first error is
    received and, when TPER expires, transmits the Report Error PMAC frame.
    If set to  freeRunning(2), each time TPER expires the PMAC resets TPER
    and, if any of the error counters are not zero, transmits the Report
    Error MAC frame. This object indicates the value of the FPECO flag.
    A write operation to this object will not change the operational
    value reflected in dtrCportOperErrorCountingOption until the
    next Connect.PMAC event.”
::= { dtrCportEntry 6 }

dtrCportAdminMediumRateOption    OBJECT-TYPE
 SYNTAX        INTEGER{ rate4Mbps(1), rate16Mbps(2), rate100Mbps(3),
                        rate1000Mbps(4) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “The value of this object specifies the medium rate as either 4 Mbit/s,
    16 Mbit/s, 100 Mbit/s or 1000 Mbit/s. If set to rate4Mbps(1), then
    PMAC operates the medium at 4 Mbit/s. If set to rate16Mbps(2), then PMAC
    operates the medium at 16 Mbit/s. If set to rate100Mbps(3), then PMAC
    operates the medium at 100 Mbit/s. If set to rate1000Mbps(4), then PMAC
    operates the medium at 1000 Mbit/s. The PMAC uses this object to set the
    value of the FPMRO flag to be used at the next Connect.PMAC event. A
    write operation to this object will not change the operational value
    reflected in dtrCportOperMediumRateOption until the next Connect.PMAC
    event.”
::= { dtrCportEntry 7 }

dtrCportAdminOperationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ portMode(1), StationEmulationMode(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies whether the C-Port is in Port mode or Station
    Emulation mode. If set to portMode(1), then PMAC is operating in the
```



```
    Port mode. If set to StationEmulationMode(2), then PMAC is operating
    in the Station Emulation mode. This object indicates the value of the
    FPOTO flag to be used at the next Connect.PMAC event. A write
    operation to this object will not change the operational
    value reflected in dtrCportOperOperationOption until the next
    Connect.PMAC event."
::= { dtrCportEntry 8 }

dtrCportAdminRepeatPathOption    OBJECT-TYPE
 SYNTAX        INTEGER{ repeatsACBits (1), setsACBits(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "When this object is set to repeatsACBits(1), the C-Port repeat path
    will not set the A and C bits to 1, when an address is
    recognized by the C-Port. When set to setsACBits(2), the C-Port repeat
    path will set the A bit to 1 when a destination address is recognized
    by the C-Port and the C bit to 1 if the frame is copied. This object
    indicates the value of the FPACO flag to be used at the next
    Connect.PMAC event. A write operation to this object will not change the
    Operational value reflected in dtrCportOperRepeatPathOption until the
    next Connect.PMAC event."
::= { dtrCportEntry 9 }

dtrCportAdminAbortSequenceOption    OBJECT-TYPE
 SYNTAX        INTEGER{ abortSequence (1), invalidFCS(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "At 4 and 16 Mbit/s, this object specifies the method used by the PMAC
    to control the ending sequence for over-length frames when a cut-through
    design is supported. When set to abortSequence(1), an over-length frame
    is ended with an abort sequence. When set to invalidFCS(2), an over-
    length frame is ended with an invalid FCS and by setting the E bit to 1
    in the Ending Delimiter field. At high media rate, this object specifies
    the method used by the PMAC to control the ending sequence for aborted
    frames. When set to abortSequence(1), a frame is ended with an abort
    sequence. When set to invalidFCS(2), a frame is ended with an invalid
    FCS and by setting the E bit to 1 in the Ending Delimiter field. This
    object indicates the value of the FPASO flag to be used at the next
    Connect.PMAC event. A write operation to
    this object will not change the operational value reflected in
    dtrCportOperAbortSequenceOption until the next Connect.PMAC event."
::= { dtrCportEntry 10 }

dtrCportAdminBeaconHandlingOption    OBJECT-TYPE
 SYNTAX        INTEGER{
                  afterNeighborNotification(1),
                  atJoinCompleteStateEntry(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "This object indicates how a PMAC participates in the beaconing process
    prior to the C-Port completing the joining process while operating in
    the TKP access protocol.  If set to afterNeighborNotification(1), then
    beacon process operates when Neighbor Notification completes. If set
    to atJoinCompleteStateEntry(2), then the beacon process operates when
    PMAC has completed Join. This object indicates the value of the FPBHO
    flag to be used at the next Connect.PMAC event. A write operation to
    this  object will not change the operational value reflected in
    dtrCportOperBeaconHandlingOption until the next Connect.PMAC event."
::= { dtrCportEntry 11 }

dtrCportAdminFrameControlOption    OBJECT-TYPE
 SYNTAX        INTEGER{ fr_FC(1), fr(2) }
```

```
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "This object indicates the value of the FPFCO flag, which is used to
    control the forwarding of frames to the DTU interface. If set to
    fr_FC(1), then PMAC causes the received FR_FC event to be indicated to
    the DTU. If set to fr(2), then PMAC cause the received FR event to be
    indicated to the DTU. This object specifies the value of the FPFCO flag
    to be used at the next Connect.PMAC event. A write operation to this
    object will not change the operational value reflected in
    dtrCportOperFrameControlOption until the next Connect.PMAC event."
::= { dtrCportEntry 12 }

dtrCportOperErrorCountingOption    OBJECT-TYPE
 SYNTAX        INTEGER{ triggered(1), freeRunning(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies how the MAC manages the error report timer.
    This object indicates the value of the FPECO flag. If set to
    triggered(1), the MAC resets TPER when the first error is received and,
    when TPER expires, transmits a Report Error MAC frame. If set to
    freeRunning(2), each    time TPER expires the MAC resets TPER and, if
    any of the error counters are    not zero, transmits the Report Error
    MAC frame. This object indicates the    value of the FPECO flag at which
    the C-Port is currently operating."
::= { dtrCportEntry 13 }

dtrCportOperMediumRateOption    OBJECT-TYPE
 SYNTAX        INTEGER{ rate4Mbps(1), rate16Mbps(2), rate100Mbps(3),
                        rate1000Mbps(4) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "The value of this object specifies the medium rate as either 4 Mbit/s,
    16 Mbit/s, 100 Mbit/s or 1000 Mbit/s. If set to rate4Mbps(1), then
    PMAC operates the medium at 4 Mbit/s. If set to rate16Mbps(2), then PMAC
    operates the medium at 16 Mbit/s. If set to rate100Mbps(3), then PMAC
    operates the medium at 100 Mbit/s. If set to rate1000Mbps(4), then PMAC
    operates the medium at 1000 Mbit/s. The PMAC uses this object during a
    MGT_ACTION.request(OPEN). This object specifies the value at which the
    C-Port is currently operating."
::= { dtrCportEntry 14 }

dtrCportOperOperationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ portMode(1), StationEmulationMode(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object specifies whether the C-Port is in Port mode or Station
    Emulation mode. If set to portMode(1), then PMAC is operating in the
    Port mode. If set to StationEmulationMode(2), then PMAC is operating
    in the Station Emulation mode. This object indicates the value of the
    FPOTO flag at which the C-Port is currently operating."
::= { dtrCportEntry 15 }

dtrCportOperRepeatPathOption    OBJECT-TYPE
 SYNTAX        INTEGER{ repeatsACBits (1), setsACBits(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "When this object is set to repeatsACBits(1), the C-Port repeat path
    will not set the A and C bits to 1 when an address is recognized by
    by the C-Port. When set to setsACBits(2), the C-Port repeat
    path will set the A bit to 1 when a destination address is recognized
```



```
    by the C-Port and the C bit to 1 if the frame is copied. This object
    indicates the value of the FPACO flag at which the C-Port is
    currently operating."
::= { dtrCportEntry 16 }

dtrCportOperAbortSequenceOption    OBJECT-TYPE
 SYNTAX        INTEGER{ abortSequence(1), invalidFCS(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "At 4 and 16 Mbit/s, this object specifies the method used by the PMAC
    to control the ending sequence for over-length frames when a frame of
    unknown length is supported. When set to abortSequence(1), an over-
    length frame is ended with an abort sequence. When set to
    invalidFCS(2), an over-length frame is ended with an invalid FCS and by
    setting the Error Detected bit in the Ending Delimiter field. At high
    media rate, this object specifies the method used by the PMAC to control
    the ending sequence for aborted frames. If set to abortSequence(1), a
    frame is ended with an abort sequence. If set to invalidFCS(2), a frame
    is ended with an invalid FCS and by setting the E bit to 1 in the Ending
    Delimiter field. This object indicates the value of the FPASO flag at
    which the C-Port is currently operating."
::= { dtrCportEntry 17 }

dtrCportOperBeaconHandlingOption    OBJECT-TYPE
 SYNTAX        INTEGER{
                  afterNeighborNotification(1),
                  atJoinCompleteStateEntry(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object indicates how a PMAC participates in the beaconing process
    prior to the C-Port completing the joining process while operating in
the
    TKP access protocol.  If set to afterNeighborNotification(1), then
    beacon process operates when Neighbor Notification completes. If set
    to atJoinCompleteStateEntry(2), then the beacon process operates when
    PMAC has completed Join. This object indicates the value of the FPBHO
    flag at which the C-Port is currently operating."
::= { dtrCportEntry 18 }

dtrCportOperFrameControlOption    OBJECT-TYPE
 SYNTAX        INTEGER{ fr_FC(1), fr(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object indicates the value of the FPFCO flag that is used to
    control the forwarding of frames to the DTU interface. If set to fr_FC(1),
    then PMAC causes the received FR_FC event to be indicated to the DTU.
    If set to fr(2), then PMAC causes the received FR event to be indicated to
    the DTU. This object indicates the value of the FPFCO flag at which the
    C-Port is currently operating."
::= { dtrCportEntry 19 }

dtrCportAdminAutoNegotiationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ notSupported(1) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    "The value of this object specifies what auto negotiation support a C-Port
    has. When set to notSupported(1), the C-Port does not support auto
    negotiation. This object indicates the value of FPANO flag to be used at
    the next Connect.PMAC event. A write operation to this object will not
    change the operational value reflected in
    dtrCportOperAutoNegotiationOption until the next Connect.PMAC event."
```

```
::= { dtrCportEntry 20 }

dtrCportAdminHMRTradeUpOption    OBJECT-TYPE
 SYNTAX        INTEGER{ disableHMRTradeUp(1), enableHMRTradeUp(2) }
 MAX-ACCESS    read-write
 STATUS        current
 DESCRIPTION
    “This object specifies if the C-Port allows a Trade-up to the high media
    rate duiring registration. When set to disableHMRTradeUp(1), the C-Port
    will deny a Stations’s request to trade up. When set to
    enableHMRTradeUp(2), the C-Port will accept a Stations’s request to trade-
    up. This object indicates the value of the FPHMRTUO flag to be used at the
    next Connect.PMAC event. A write operation to this object will not change
    the operational value reflected in dtrCportOperHMRTradeUpOption until the
    next Connect.PMAC event.”
::= { dtrCportEntry 21 }

dtrCportOperAutoNegotiationOption    OBJECT-TYPE
 SYNTAX        INTEGER{ notSupported(1) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “The value of this object specifies what auto negotiation support a C-port
    has. If set to notSupported(1), the C-port does not support auto
    negotiation. This object indicates the value of FPANO at which the
    C-Port is currently operating.”
::= { dtrCportEntry 22 }

dtrCportOperHMRTradeUpOption    OBJECT-TYPE
 SYNTAX        INTEGER{ disableHMRTradeUp(1), enableHMRTradeUp(2) }
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This object specifies if the C-Port allows a Trade-up to the high media
    rate duiring registration. If set to disableHMRTradeUp(1), the C-Port will
    deny a Stations’s request to trade up. If set to enableHMRTradeUp(2),
the
    C-Port will accept a Stations’s request to trade up. This object indicates
    the value of FPHMRTUO at which the C-Port is currently operating.”
::= { dtrCportEntry 23 }

-- ******************************************************
-- TXI Statistics
--  This table contains statistics for TXI MACs. There
--  is one entry in this table for each TXI MAC in
--  a managed system.
-- ******************************************************

txiStatisticsTable    OBJECT-TYPE
 SYNTAX        SEQUENCE OF TxiStatisticsEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
  “This table contains statistics for each TXI MAC in a managed system.”
::= { dtrMacObjects 4 }

txiStatisticsEntry    OBJECT-TYPE
 SYNTAX        TxiStatisticsEntry
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
  “A list of statistics”
 INDEX
    { txiStatsIfIndex }
::= { txiStatisticsTable 1 }
```



```
TxiStatisticsEntry ::= SEQUENCE {
  txiStatsIfIndex                    InterfaceIndex,
  txiStatsAbortErrorCounter          Counter32,
  txiStatsBurstErrorCounter          Counter32,
  txiStatsInternalErrorCounter       Counter32,
  txiStatsLineErrorCounter           Counter32,
  txiStatsFrequencyErrorCounter      Counter32,
  txiStatsRcvCongestionErrorCounter  Counter32,
  txiStatsOverlengthFrameCounter     Counter32
  txiStatsTimeStamp                  TimeStamp }

txiStatsIfIndex    OBJECT-TYPE
 SYNTAX        InterfaceIndex
 MAX-ACCESS    not-accessible
 STATUS        current
 DESCRIPTION
    “This object identifies the interface for which this entry contains
    management information. The value of this object for a particular
    interface has the same value as the ifIndex object, defined in RFC 1573,
    for the same interface.”
::= { txiStatisticsEntry 1 }

txiStatsAbortErrorCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This counter is incremented when the PMAC or SMAC prematurely ends
    a transmission by transmitting an abort sequence. A Network Management
    Station can detect discontinuities in this counter by monitoring the
    txiStatsTimeStamp object.”
::= { txiStatisticsEntry 2 }

txiStatsBurstErrorCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This counter is incremented when a PMAC or SMAC detects the absence
    of transitions at the receiver input. The counter is only required to be
    incremented once during each interval of signal disruption. The counter
    may be inhibited after a burst5_error has been indicated until an event
    occurs that indicates the MAC is receiving a valid signal. A MAC may
    count every burst5_error. A Network Management Station can detect
    discontinuities in this counter by monitoring the txiStatsTimeStamp ob-
ject.”
 REFERENCE “Subclause 5.4.2 in ANSI/IEEE Std 802.5, 1998 Edition”
::= { txiStatisticsEntry 3 }

txiStatsInternalErrorCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    “This counter is incremented when the MAC recognizes a recoverable
    internal error. A Network Management Station can detect discontinuities in
    this counter by monitoring the txiStatsTimeStamp object.”
::= { txiStatisticsEntry 4 }

txiStatsLineErrorCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
```

```
 DESCRIPTION
    "This counter is incremented when a frame with error
    (FR_WITH_ERR) is received by the Station or C-Port.
    A Network Management Station can detect discontinuities
    in this counter by monitoring the txiStatsTimeStamp object."
 REFERENCE "Subclause 4.3.2 in ANSI/IEEE Std 802.5, 1998 Edition"
::= { txiStatisticsEntry 5 }

txiStatsFrequencyErrorCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This counter is incremented when a frequency error is indicated
    by the Station or C-Port PHY. A Network Management
    Station can detect discontinuities in this counter by monitoring the
    txiStatsTimeStamp object."
 REFERENCE "Subclause 5.7.2 in ANSI/IEEE Std 802.5, 1998 Edition"
::= { txiStatisticsEntry 6 }

txiStatsRcvCongestionErrorCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This counter is incremented when a frame addressed to the MAC is
    not copied. A Network Management Station can detect discontinuities
    in this counter by monitoring the txiStatsTimeStamp object."
::= { txiStatisticsEntry 7 }

txiStatsOverlengthFrameCounter    OBJECT-TYPE
 SYNTAX        Counter32
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This counter is incremented when the PMAC prematurely
    ends a transmission due to an over-length frame. The
    value of this counter is 0 for SMACs. A Network Management
    Station can detect discontinuities in this counter by monitoring the
    txiStatsTimeStamp object."
::= { txiStatisticsEntry 8 }

txiStatsTimeStamp    OBJECT-TYPE
 SYNTAX        TimeStamp
 MAX-ACCESS    read-only
 STATUS        current
 DESCRIPTION
    "This object indicates the time of the last discontinuity. Counters
    have defined initial value, and thus, a single value of a counter has
    no information content. Discontinuities on the monotonically increasing
    value can occur at reinitialization and possibly at other times. This
    time-stamp indicates to a management Station that some discontinuity
    in counting has occurred."
::= (txiStatisticsEntry 9}

-- Traps

dtrMacNonOperational    NOTIFICATION-TYPE
 OBJECTS{
                 txiProtocolEventStatus,
                 txiProtocolBeaconSA,
                 txiProtocolBeaconType,
                 txiProtocolBeaconUNA,
                 txiProtocolBeaconPDN }
 STATUS       current
```

```
 DESCRIPTION
    "This notification indicates the Station or C-Port is in
    a non operational state. If the eventStatus is
    heartBeatLost or signalLoss, the value in the beacon
    objects represent those of the last transmitted Beacon
    MAC frame. If the eventStatus is beaconReceived, the
    values in the beacon objects represent those contained
    in the last received Beacon MAC frame."
::= { dtrMacTraps 1}

dtrMacFailure    NOTIFICATION-TYPE
 OBJECTS{ txiProtocolEventStatus }
 STATUS       current
 DESCRIPTION
    "This notification indicates that a fault has occurred,
    causing the Station to return to the Bypass state. This trap is
    sent if eventStatus is remove, internalError, StationorCPortError,
    or wireFault."
::= { dtrMacTraps 2}

dtrMacProtocolFailure    NOTIFICATION-TYPE
 OBJECTS{ txiProtocolEventStatus }
 STATUS        current
 DESCRIPTION
    "This notification indicates the PMAC or SMAC using the
    TXI access protocol detected a MAC frame that is only used by the
    TKP access protocol."
::= { dtrMacTraps 3}

-- Conformance Statement
--
**************************************************************************
-- Conformance information
--
**************************************************************************

dtrMacCompliances  OBJECT IDENTIFIER ::= { dtrMacConformance 1 }
dtrMacGroups       OBJECT IDENTIFIER ::= { dtrMacConformance 2 }

-- Compliance statements
dtrMacCompliance    MODULE-COMPLIANCE
 STATUS       current
 DESCRIPTION
    "The compliance statement for the SNMPv2 entities that implement
    the dtrMacMIB."
 MODULE  -- this module

  GROUP       txiProtocolGroup
  DESCRIPTION
    "The txiProtocolGroup is mandatory for those DTR MAC entities that
    implement the TXI protocol."

  GROUP        dtrStationGroup
  DESCRIPTION
    "The dtrStationGroup is optional."

  GROUP        dtrCportGroup
  DESCRIPTION
    "The dtrCportGroup is optional."

  GROUP        dtrMacNotificationsGroup
  DESCRIPTION
    "The dtrMacNotificationGroup is optional."
```

```
  OBJECT       txiProtocolFunctionalAddress
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAccessProtocolMask
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationIndividualAddressCount
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationMaxFrameSize
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminErrorCountingOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminOpenOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminRegistrationOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminRejectRemoveOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminMediumRateOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminRegistrationQueryOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminRegistrationDeniedOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminAutoNegiotiationOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”

  OBJECT       dtrStationAdminAbortSequenceOption
  MIN-ACCESS   read-only
  DESCRIPTION
    “Write access is not required.”
```



```
  OBJECT       dtrStationAdminHMRTradeUpOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrStationAdminLobeMediaTestOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAccessProtocolMask
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportMaxFrameSize
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminErrorCountingOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminOperationOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminRepeatPathOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminAbortSequenceOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminBeaconHandlingOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminFrameControlOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminAutoNegotiationOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

  OBJECT       dtrCportAdminHMRTradeUpOption
  MIN-ACCESS   read-only
  DESCRIPTION
    "Write access is not required."

::= {dtrMacCompliances 1}

-- Group definitions
txiProtocolGroup    OBJECT-GROUP
```

```
 OBJECTS{
                  txiProtocolMacType,
                  txiProtocolFunctionalAddress,
                  txiProtocolUpstreamNeighborAddress,
                  txiProtocolMicrocodeLevel,
                  txiProtocolProductInstanceId,
                  txiProtocolAuthorizedFunctionClasses,
                  txiProtocolErrorReportTimer,
                  txiProtocolPhysicalDropNumber,
                  txiProtocolRingNumber,
                  txiProtocolRingStatus,
                  txiProtocolJoinState,
                  txiProtocolMonitorState,
                  txiProtocolBeaconSA,
                  txiProtocolBeaconType,
                  txiProtocolBeaconPDN,
                  txiProtocolBeaconUNA,
                  txiProtocolEventStatus }
 STATUS        current
 DESCRIPTION
    “A collection of objects providing information for IEEE 802.5 TXI
    interface.”
::= { dtrMacGroups 1}

dtrCportGroup    OBJECT-GROUP
 OBJECTS{
                  dtrCportCurrentAccessProtocol,
                  dtrCportAccessProtocolMask,
                  dtrCportMaxFrameSize,
                  dtrCportPhantomDriveMask,
                  dtrCportAdminErrorCountingOption,
                  dtrCportAdminMediumRateOption,
                  dtrCportAdminOperationOption,
                  dtrCportAdminRepeatPathOption,
                  dtrCportAdminAbortSequenceOption,
                  dtrCportAdminBeaconHandlingOption,
                  dtrCportAdminFrameControlOption,
                  dtrCportOperErrorCountingOption,
                  dtrCportOperMediumRateOption,
                  dtrCportOperOperationOption,
                  dtrCportOperRepeatPathOption,
                  dtrCportOperAbortSequenceOption,
                  dtrCportOperBeaconHandlingOption,
                  dtrCportOperFrameControlOption,
                  dtrCportAdminAutoNegotiationOption,
                  dtrCportAdminHMRTradeUpOption,
                  dtrCportOperAutoNegotiationOption,
                  dtrCportOperHMRTradeUpOption }
 STATUS        current
 DESCRIPTION
    “A collection of objects providing protocol characteristics of
    for a DTR C-Port.”
::= { dtrMacGroups 2 }

dtrStationGroup    OBJECT-GROUP
 OBJECTS{
                  dtrStationStationType,
                  dtrStationCurrentAccessProtocol,
                  dtrStationRequestedAccessProtocol,
                  dtrStationAccessProtocolResponse,
                  dtrStationAccessProtocolMask,
                  dtrStationIndividualAddressCount,
                  dtrStationMaxFrameSize,
                  dtrStationPhantomDriveSupport,
                  dtrStationAdminErrorCountingOption,
```



```
                    dtrStationAdminOpenOption,
                    dtrStationAdminRegistrationOption,
                    dtrStationAdminRejectRemoveOption,
                    dtrStationAdminMediumRateOption,
                    dtrStationAdminRegistrationQueryOption,
                    dtrStationAdminRegistrationDeniedOption,
                    dtrStationOperErrorCountingOption,
                    dtrStationOperOpenOption,
                    dtrStationOperRegistrationOption,
                    dtrStationOperRejectRemoveOption,
                    dtrStationOperMediumRateOption,
                    dtrStationOperRegistrationQueryOption,
                    dtrStationOperRegistrationDeniedOption,
                    dtrStationAdminAutoNegotiationOption,
                    dtrStationAdminAbortSequenceOption,
                    dtrStationAdminHMRTradeUpOption,
                    dtrStationAdminLobeMediaTestOption,
                    dtrStationOperAutoNegotiationOption,
                    dtrStationOperAbortSequenceOption,
                    dtrStationOperHMRTradeUpOption,
                    dtrStationOperLobeMediaTestOption }
 STATUS        current
 DESCRIPTION
    “A collection of objects providing protocol characteristics of
    a DTR Station.”
::= { dtrMacGroups 3 }

txiStatisticsGroup    OBJECT-GROUP
 OBJECTS{
                    txiStatsAbortErrorCounter,
                    txiStatsBurstErrorCounter,
                    txiStatsInternalErrorCounter,
                    txiStatsLineErrorCounter,
                    txiStatsFrequencyErrorCounter,
                    txiStatsRcvCongestionErrorCounter,
                    txiStatsOverlengthFrameCounter,
                    txiStatsTimeStamp }
 STATUS        current
 DESCRIPTION
    “A collection of objects providing statistics for 802.5 TXI
    interfaces.”
::= { dtrMacGroups 4 }

dtrMacNotificationGroup    NOTIFICATION-GROUP
 NOTIFICATIONS{
                    dtrMacNonOperational,
                    dtrMacFailure,
                    dtrMacProtocolFailure }
 STATUS        current
 DESCRIPTION
    “DTR MAC notifications.”
::= {dtrMacGroups 5 }
```

Add to Clause 13:

13.9 100 Mbit/s PMCs

This subclause defines the PMCs of the fibre optic Station and C-Port attachment PHY layer to be used for 100 Mbit/s transmission.

13.9.1 FO-PMC

The FO-PMC shall meet all specifications of the [FO-PMD] 8, 9, and 10, with the exceptions listed below. In [FO-PMD], Annexes A through G provide additional information useful to PMC sublayer implementers. Where there is conflict between specifications in [FO-PMD] and those in this standard, those of this standard shall prevail.

13.9.1.1 MAC issues

The scope and general description discussed in [FO-PMD] 1 and 5 relate to the use of those standards with an FDDI PHY and MAC. These sections are not relevant to the use of the PMC with 100 Mbit/s Token Ring.

13.9.1.2 References

For the purposes of this standard, the normative references, definitions, and conventions contained in [FO-PMD] 2, 3, and 4 have relevance only as informative material, which may be necessary to interpret the applicable sections referenced in this clause.

13.9.1.3 Service specifications

The PMD service specifications of [FO-PMD] 6 are replaced by those specified in 9.8.1.1.5 and 9.8.1.1.6, which are a proper subset of the PMD service specifications in [FO-PMD].

13.9.1.4 Terminology

There are minor terminology differences between this standard and [FO-PMD] that do not cause ambiguity. The terminology used in this standard was chosen to be consistent with other IEEE 802 standards, rather than with FDDI. Terminology is both defined and consistent within each standard. Special note should be made of the interpretations shown in Table 13.9-1.

Table 13.9-1—Interpretation of general FDDI terms and concepts

FDDI term or concept	Interpretation for 100 Mbit/s Token Ring
Bypass	<Unused>
Connection Management (CMT)	<No comparable entity>
Frame	Frame
Halt Line State (HLS)	<Unused>
Hybrid mode	<No comparable entity>
MAC (or MAC-2)	MAC
Master Line State (MLS)	<Unused>
Maximum frame size = 9000 symbols[a]	Maximum frame size = 18207 octets[a]
PHY (or PHY-2)	PSC
PHY Service Data Unit (SDU)	Stream
PM_SIGNAL.indication (Signal_Detect)	<Unused>
PM_UNITDATA.indication(PM_Indication)	PM_UNITDATA.indication [Rcv_NRZI_bit]
PM_UNITDATA.request(PM_Request)	PM_UNITDATA.request [Tx_ NRZI_bit]
Preamble	Interframe gap (IFG)
Quiet Line State (QLS)	<Unused>
SM_PM_BYPASS.request(Control_Action)	Assume: SM_PM_BYPASS.request(Control_Action=Insert)

Table 13.9-1—Interpretation of general FDDI terms and concepts

FDDI term or concept	Interpretation for 100 Mbit/s Token Ring
SM_PM_CONTROL.request(Control_Action)	Assume: SM_PM_CONTROL.request(Control_Action=Transmit_Enable)
SM_PM_SIGNAL.indication(Signal_Detect)	<Unused>
Station Management (SMT)	<No comparable entity>
Symbol	5-bit code-group (see [802.3])

[a]Note that the definition of frame size for [FO-PMD] is different from that in this standard. These are not equivalent terms.

13.9.1.5 Medium dependent interface (MDI)

The FO-PMC MDI may conform to one of the following connectors:

a) Low-cost fibre optical interface connector (commonly called the duplex SC connector), as specified in ANSI X3.237-1995, 7.1.1 through 7.3.1, inclusive.
b) Media Interface Connector (MIC), as specified in [FO-PMD] 7 and Annex F. When the MIC is used, the receptacle shall be keyed as "M."
c) Optical medium connector plug and socket (commonly called the ST connector), as specified in [802.3] 15.3.2.

The implementor may also use any other suitable connector style not listed here.

13.9.1.6 Crossover function

A crossover function shall be implemented in every fibre optic cable-pair link. The crossover function connects the transmitter of one PHY to the receiver of the PHY at the other end of the cable-pair link. For 100 Mbit/s Token Ring, the crossover function for fibre attachment is realized in the cable plant.

Add Clause 14:

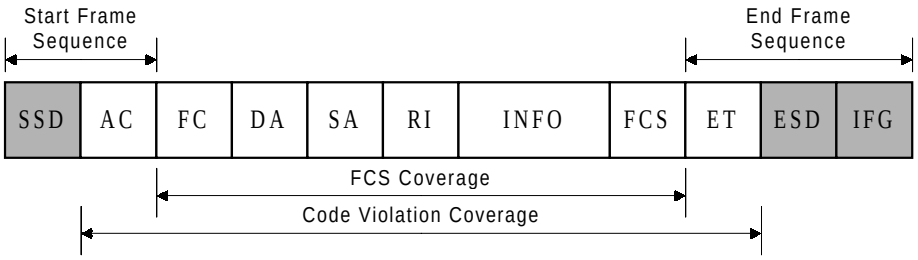
14. Formats and facilities for HMR

This clause defines the new sequence definitions (14.1) and field descriptions (14.2) used for HMR operation. The clause also notes the changes from Clause 3 (ANSI/IEEE Std 802.5, 1998 Edition) and Clause 10 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) to MAC frames (14.3), system timers (14.4), and policy flags and variables (14.5) when used for HMR operation.

14.1 Sequence definitions

This subclause defines the frame, abort, token, and fill sequences for HMR operation. The sequences are defined as a series of fields. There are two types of fields: media encoding dependent and media encoding independent. Media encoding dependent fields are shown with shading, and their precise length and definition are shown in 14.2.2. Media encoding independent fields are composed of octets, and are shown without shading and with octet counts.

14.1.1 Frame sequence



Field abbr.	Field name	Ref.	Field length (octets)
SSD	Start-of-sequence delimiter	14.2.2	Media dependent
AC	Access control	10.2.1	1
FC	Frame control	3.2.3	1
DA	Destination address	3.2.4.1	6
SA	Source address	3.2.4.2	6
RI	Routing information	3.2.5	0 to 30
INFO	Information	3.2.6	0 or more
FCS	Frame check sequence	3.2.7	4
ET	End transmit	14.2.1.1	1
ESD	End-of-sequence delimiter	14.2.2	Media dependent
IFG	Interframe gap	14.2.2	Media dependent

Figure 14-1—Frame sequence

The frame sequence shall be used for transmitting both MAC and LLC messages to the destination entities. It may or may not contain an information (INFO) field, and it may or may not contain a routing information (RI) field. The frame sequence may occur anywhere in the data stream. Receiving entities shall be able to detect a frame on any signal element boundary.

14.1.2 Abort sequence

Field abbr.	Field name	Ref.	Field length (octets)
AT	Abort transmit	14.2.2	Media dependent
ESD	End-of-sequence delimiter	14.2.2	Media dependent
IFG	Interframe gap	14.2.2	Media dependent

Figure 14-2 Abort sequence

The abort sequence is transmitted by an entity when it prematurely terminates a frame's transmission. An abort sequence shall be transmitted on an octet boundary, but may optionally be transmitted on any nibble boundary in the case of a STATION_ERR or a PORT_ERR.

An implementation shall be capable of receiving an abort sequence on any nibble boundary. An implementation may optionally count a frame received with an abort sequence on a non-octet boundary as a line error. The abort sequence causes the receiving entity to recognize that the frame being received is not a valid frame.

14.1.3 Fill sequence

Field abbr.	Field name	Ref.	Field length (octets)
FILL	Fill	14.2.2	Media dependent

Figure 14-3—Fill sequence

An entity shall transmit the fill sequence in accordance with the protocol described in Clause 9.

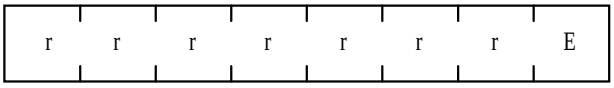
14.2 Field descriptions

14.2.1 Media encoding independent field descriptions

The following is a detailed description of the individual fields used in frame, token, abort, and fill sequences, where they differ from Classic Token Ring (as defined in ANSI/IEEE Std 802.5, 1998 Edition) and DTR (as defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition).

14.2.1.1 End transmit (ET)

14.2.1.1.1 ET for frame sequence using TXI Access Protocol



Field abbr.	Field name	Field length (bits)
E	Error	1
r	Reserved	1

Figure 14-4—ET field bits—TXI

14.2.1.1.1.1 Error (E) bit

The E bit shall be transmitted as 0 by the entity when it originates the frame sequence, except when the entity is aborting the transmission of the frame, and the abort option FxASO is set to 1; then the E bit shall be transmitted as 1. All entities check frame sequences for errors. When a frame with error is detected and the received E bit is equal to 0, the frame is counted as a line error.

14.2.1.1.1.2 Reserved (r) bits

The reserved bits are reserved for future standardization. They shall be transmitted as 0 and ignored on receipt.

14.2.2 Media encoding dependent field descriptions

The following is a detailed description of the media encoding dependent fields used in frame, token, abort, and fill sequences.

14.2.2.1 100 Mbit/s PSC operation

These are the field definitions for SSD, AT, ESD, IFG, and FILL used during 100 Mbit/s PSC operation.

14.2.2.1.1 Start-of-sequence delimiter (SSD)

The SSD is composed of the two code-groups, /J/K/.

14.2.2.1.2 Abort transmit (AT)

The AT is composed of the two code-groups, /H/H/.

14.2.2.1.3 End-of-sequence delimiter (ESD)

The ESD is composed of the two code-groups, /T/R/.

14.2.2.1.4 Interframe gap (IFG)

The IFG is composed of /I/ code-groups. For TXI Access Protocol operation, the IFG shall be transmitted on the wire as a minimum of 24 /I/ code-groups. Note that if an MII device is being employed, then a minimum of 26 code-groups are required at the MII interface to satisfy the IFG requirement, as the first two code-groups on the interface are converted into the ESD, /T/R/, by the MII device. Also note that FILL may follow the IFG.

14.2.2.1.5 Fill (FILL)

The FILL is composed of 0 or more /I/ code-groups.

14.3 MAC frames

This subclause defines the new and modified MAC frame vector and subvectors used at HMR operation, where they differ from Clause 3 (ANSI/IEEE Std 802.5, 1998 Edition) and Clause 10 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition).

14.3.1 Vector descriptions

14.3.1.1 X'08'–LMT (TEST)

The LMT MAC frame is used in the test to determine whether the lobe between the Station and the C-Port has an acceptable BER, as defined in Annex P. At HMR, the LMT is defined as consisting of 1120 TEST frames, each frame 112 octets long, including the FCS. The LMT MAC frame shall not contain a RI field. These requirements fix the length of the X'26' Wrap Data subvector to be 90 octets.

14.3.1.2 X'16'–LMT Notification (LMTN)

The LMT Notification MAC frame is used by Stations to indicate to C-Ports that they are ready to perform the LMT. Upon receipt of this frame, the C-Port prepares to repeat LMT (TEST) frames. When the C-Port is ready, it transmits a copy of the LMTN frame back to the Station. Upon receipt of this LMT notification frame, the Station commences the execution of the LMT, as defined in 9.1.6.

14.3.1.3 X'17'–Remove Alert (RMV_ALRT)

Both the Station and C-Port using the TXI Access Protocol and operating at the HMR use the Remove Alert MAC frame. The Remove Alert MAC frame indicates to the entity at the other end of the dedicated link that the sender is about to enter the Bypass state. The Remove Alert MAC frame is sent using an assured delivery mechanism in an attempt to ensure that the receiving entity receives this frame.

14.3.2 Subvector descriptions

14.3.2.1 X'0C'–Phantom (PD)

This subvector has a value field two octets long and indicates to the C-Port which phantom signaling and wire fault detection methods are being supported by the Station. The methods are defined in Table 14-1. All other values are reserved for future standardization.

Table 14-1—Phantom subvector definition

Value	Definition
X'0001'	The Station supports the Phantom signaling and wire fault detection method described in 7.2.1 in ANSI/IEEE Std 802.5, 1998 Edition.
X'0002'	The Station does not support Phantom signaling and, therefore, cannot support wire fault detection.

14.3.2.2 X'0E'–Access Protocol Request (AP_REQ)

This subvector has a value field two octets long and is used by the Station in the Registration Request MAC frame to indicate to the C-Port which Access Protocol is being requested and, optionally, a set of enhanced capabilities the Station possesses. The AP_REQ value is formed by a bit-wise ORing, together with one Access Protocol request type and zero or more capability values. All other values are reserved for future standardization. The C-Port can use its mask PPV(AP_MASK) to determine if the Station is requesting an acceptable Access Protocol. The C-Port performs this determination using both bit-wise operations and direct comparisons with known values.

Table 14-2—Access Protocol request subvector definition

Value	Definition
X'0002'	Transmit Immediate (TXI) Access Protocol requested.
X'0004'	Station is 100 Mbit/s capable.

14.3.2.3 X'0F'–Access Protocol Response (AP_RSP)

This subvector has a value field two octets long, and is used by the C-Port in Port Mode in the Registration Response MAC frame in response to the Registration Request MAC frame. This subvector's value indicates whether the requested Access Protocol, Phantom signaling, and wire fault support method have been accepted or denied, or if the C-Port wants to use one of the capabilities the Station indicated in its AP_REQ subvector. The values are defined in Table 14-3. All other values are reserved for future standardization.

Table 14-3—Access Protocol Response subvector definition

Value	Definition
X'0000'	Access denied. The Access Protocol or the Phantom signaling and wire fault support method are unsupported by the C-Port in Port Mode either by design or by management.
X'0002'	Transmit Immediate (TXI) Access Protocol and Phantom signaling and wire fault support method accepted.
X'0004'	The C-Port will support the Station's 100 Mbit/s capability.

14.3.2.4 X'26'–Wrap Data

For the LMT employed when FSLMTO=1, the length of the Wrap Data subvector shall be 90 octets, inclusive of the SVL and SVI fields. The contents of the SVV field are undefined.

14.3.2.5 X'2D'–Isolating error counts

This subvector has a value field six octets long, containing the error counters shown in Table 14-4 and defined in 10.6. The values of the error counters indicate the number of errors of each type detected since the Station or C-Port transmitted the last error report. If an error counter has not been incremented, is marked as not used, or is marked as reserved, then its value shall be reported as X'00'.

The second character of the counter's name specifies whether it is a C-Port (P) counter or a Station (S) counter.

Table 14-4—Isolating error counts definition

Access Protocol	Octet	Counter name	Station counter	C-Port counter
TKP	0	Line error	CSLE	CPLE
	1	Internal error	CSIE	CPIE
	2	Burst error	Not used	Not used
	3	AC error	CSACE	CPACE
	4	Abort sequence transmitted	CSABE	CPABE
	5	Reserved	Not used	Not used
TXI	0	Line error	CSLE	CPLE
	1	Internal error	CSIE	CPIE
	2	Burst error	Not used	Not used
	3	AC error	Not used	Not used
	4	Abort sequence transmitted	CSABE	CPABE
	5	Reserved	Not used	Not used

14.3.2.6 X'2E'–Non-isolating error counts

This subvector has a value field six octets long and contains the error counters shown in Table 14-5 and defined in 10.6. The values of the error counters indicate the number of errors of each type detected since the Station or C-Port transmitted the last error report. If an error counter has not been incremented, is marked as not used, or is marked as reserved, then its value shall be reported as X'00'.

The second character of the counter's name specifies whether it is a C-Port (P) counter or a Station (S) counter.

Table 14-5—Non-isolating error counts definition

Access Protocol	Octet	Counter name	Station counter	C-Port counter
TKP	0	Lost frame error	CSLFE	CPLFE
	1	Receive congestion error	CSRCE	CPRCE
	2	Frame copied error	CSFCE	CPFCE
	3	Frequency error	Not used	Not used
	4	Token error	CSTE	CPTE
	5	Reserved	Not used	Not used
TXI	0	Lost frame error	Not used	Not used
	1	Receive congestion error	CSRCE	CPRCE
	2	Frame copied error	Not used	Not used
	3	Frequency error	Not used	Not used
	4	Token error	Not used	Not used
	5	Reserved	Not used	Not used

14.3.3 MAC frames transmitted

The following subclauses specify the MAC frame transmit requirements for HMR operation. The transmission of MAC frames shall take priority over the transmission of LLC frames.

14.3.3.1 Station MAC frames transmitted

A Station shall support the transmission of the frames shown in Table 10-12 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) as required by the Station Operation Tables and, additionally, the frames shown in Table 14-6. The Station MAC may optionally transmit frames that are shown in these tables, but are not required by the Station Operation Tables.

The LMT and LMT Notification MAC frames shall be transmitted as shown. Other frames may be transmitted with additional subvectors.

Table 14-6—Station MAC frame transmit definitions

Vector (VI, Name)	FC	DA	VC	Designator**2	Subvectors (SVI, Name)
X'08' ****1** LMT	X'08'	FA(TEST)	X'00'		X'26' Wrap Data
X'16' ****1** LMT Notification	X'08'	Broadcast	X'00'		None
X'17' ****1** Remove Alert	X'07'	Broadcast	X'30'		None

Legend:
****1** Shall not be transmitted with an RI field.
****2** Subvectors with no preceding designator shall be transmitted.

14.3.3.2 C-Port MAC frames transmitted

A C-Port shall support the transmission of the frames shown in Table 10-13 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) as required by the C-Port Operation Tables and,

additionally, the frames shown in Table 14-7. The C-Port MAC may optionally transmit frames that are shown in these tables, but are not required by the C-Port Operation Tables.

The LMT and LMT Notification MAC frames shall be transmitted as shown. Other frames may be transmitted with additional subvectors.

Table 14-7—C-Port MAC frame transmit definitions

Vector (VI, Name)	FC	DA	VC	Designator**2	Subvectors (SVI, Name)
X'08' ****1**3** LMT	X'08'	FA(TEST)	X'00'		X'26' Wrap Data
X'16' ****1** LMT Notification	X'08'	Broadcast	X'00'		None
X'17' ****1** Remove Alert	X'07'	Broadcast	X'03'		None

Legend:
****1** Shall not be transmitted with an RI field.
****2** Subvectors with no preceding designator shall be transmitted.
****3** The LMT MAC frame is only transmitted by a C-Port with FPRPTO set to 0.

14.3.4 MAC frames received

This subclause defines the MAC frame reception requirements of the Station and C-Port, and the receive MAC frame processing used by the Station and C-Port.

14.3.4.1 Station MAC frame reception

A DTR station or a C-Port in Station Emulation Mode shall support the reception of the frames defined in Table 10-14 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) as required by the Station Operation Tables in 9.2.5 and, additionally, the frames defined in Table 14-8.

A Station may also optionally support the reception of frames not specified in these tables.

Table 14-8—Station MAC frame receive definitions

Vector (VI, Name)	FC	VC	Designator**1	Subvectors (SVI, name)
X'08' LMT	X'08'	X'00'	req	X'26' Wrap Data
X'16' LMT Notification	X'08'	X'00'		None
X'17' Remove Alert	X'07'	X'03'		None

Legend:
****1** Subvectors with no preceding designator may or may not be present within the received vector, and are not required for verification.

14.3.4.2 C-Port MAC frame reception

A C-Port in Port Mode shall support the reception of the frames defined in Table 10-15 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) as required by the Port Operation Tables in 9.3.4 and, additionally, the frames defined in Table 14-9.

A C-Port may also optionally support the reception of frames not specified in these tables.

Table 14-9—C-Port MAC frame receive definitions

Vector (VI, Name)	FC	VC	Designator**1	Subvectors (SVI, name)
X'08' LMT	X'08'	X'00'	req	X'26' Wrap Data
X'16' LMT Notification	X'08'	X'00'		None
X'17' Remove Alert	X'07'	X'30'		None

Legend:
****1** Subvectors with no preceding designator may or may not be present within the received vector, and are not required for verification.

14.4 System timers

In general, timers control the maximum period of time that a particular condition may exist. All timers are stopped when the Bypass state (JS=BP) of the Join state machine is entered, and they do not start until the first time they are reset.

14.4.1 Station timers

The following timers (14.4.1.1 through 14.4.1.5) are used by DTR Stations and C-Ports in Station Emulation mode operating at the HMR, in addition to the timers defined in 10.4.1 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition).

14.4.1.1 Timer, Station HMR wait (TSHMRW)

Each Station shall have a timer TSHMRW. The timer is used to time-out waiting for LINK_STATUS to be asserted during HMR Trade-up. The value of TSHMRW shall be between 8.5 s and 10 s.

14.4.1.2 Timer, Station LMT Notification Pace (TSLMTNP)

Each Station shall have a timer TSLMTNP. The timer is used to pace the transmission of LMTN MAC frames during the notification phase of LMT. The value of TSLMTNP shall be between 10 ms and 30 ms.

14.4.1.3 Timer, Station LMT Pace (TSLMTP)

Each Station shall have a timer TSLMTP. The timer is used to time-out waiting for a TEST MAC frame to be repeated during the testing phase of LMT. The value of TSLMTP shall be between 10 ms and 30 ms.

14.4.1.4 Timer, Station LMT Response (TSLMTR)

Each Station shall have a timer TSLMTR. This timer is used to bound the time allowed for a C-Port to enable its frame repeat path. The value of TSLMTR shall be between 200 ms and 250 ms.

14.4.1.5 Timer, Station Remove Alert Pace (TSRAP)

Each Station shall have a timer TSRAP. This timer is used to pace the transmission of the RMV_ALRT MAC frames during the removal process. The value of TSRAP shall be between 10 ms and 30 ms.

14.4.2 C-Port timers

The following timers (14.4.2.1 through 14.4.2.5) are used by DTR C-Ports in Port mode operating at the HMR, in addition to the timers defined in 10.4.1 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition).

14.4.2.1 Timer, C-Port HMR Wait (TPHMRW)

Each C-Port shall have a timer TPHMRW. The timer is used to time-out waiting for LINK_STATUS to be asserted during HMR Trade-up. The value of TPHMRW shall be between 8.5 s and 10 s.

14.4.2.2 Timer, C-Port Phantom Detect (TPPD)

Each C-Port shall have a timer TPPD. This timer is used to ascertain if a C-Port fails to detect Phantom being raised by the Station after the two entities have entered their Join complete states. The value of TPPD shall be between 1.8 s and 2.2 s. A value of 2 s is recommended. This timer is used only when Phantom detection is supported by the C-Port.

14.4.2.3 Timer, C-Port Protocol Loss Detect (TPPLD)

Each C-Port shall have a timer TPPLD. This timer is used during error recovery to ensure that the protocol is operating correctly. The timer expiring indicates that the protocol is not operating correctly, and the C-Port should return to Bypass. The error conditions this timer catches are Phantom (if supported), not being deasserted, or the start of LMT not being detected. The value of TPPLD shall be between 15.8 s and 18.2 s. A value of 16 s is recommended.

14.4.2.4 Timer, C-Port Remove Alert Pace (TPRAP)

Each C-Port shall have a timer TPRAP. This timer is used to pace the transmission of the RMV_ALRT MAC frames during the removal process. The value of TPRAP shall be between 10 ms and 30 ms.

14.4.2.5 Timer, C-Port Trade-up Assured Delivery (TPTUAD)

Each C-Port supporting HMR Trade-up shall have a timer TPTUAD. The period before this timer expires allows the C-Port to handle any further Registration Request frames from the Station at the current media rate, providing an assured delivery process for HMR Trade-up. When the timer expires, the C-Port changes media rate and waits until it sees link status from the Station. The value of TPTUAD shall be between 240 ms and 300 ms.

14.5 Policy flags and variables

14.5.1 Station policy flags and variables

The Station policy flags and variables defined in this subclause are used in addition to those defined in 10.5 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) by both a DTR Station and a C-Port in Station Emulation Mode using the TXI Access Protocol at the HMR.

14.5.1.1 Station policy flag definitions

The station policy flags (“O”–suffix acronym) are set externally to the SMAC (see Clause 11 of ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) and are not changed by the SMAC FSMs.

14.5.1.1.1 Flag, Station Auto Negotiation Option (FSANO)

The flag FSANO is used to determine whether a Station has auto negotiation support. If FSANO is set to 0, the Station does not support auto negotiation. FSANO set to values other than 0 is reserved for future standardization.

14.5.1.1.2 Flag, Station Abort Sequence Option (FSASO)

This flag is used to control the ending sequence for aborted frames when the Station is operating at the HMR. When FSASO is set to 0, an aborted frame is ended with an abort sequence. When FSASO is set to 1, an aborted frame is ended with an invalid FCS and by setting the Error Detected bit (E) in the Ending Delimiter field.

14.5.1.1.3 Flag, Station HMR Trade-up Option (FSHMRTUO)

When this flag is set to 1, the Station indicates to the C-port during registration that it is capable of HMR when connecting at 4 Mbit/s or 16 Mbit/s.

14.5.1.1.4 Flag, Station LMT Option (FSLMTO)

The flag FSLMTO is used to indicate the type of LMT being used by a Station. If FSLMTO is set to 0, the Station shall operate at 4 Mbit/s or 16 Mbit/s (FSMRO < 2) and shall implement the LMT as specified by ANSI/IEEE Std 802.5, 1998 Edition. For this type of LMT, the C-Port shall provide a repeat path as defined in 9.7.1. If FSLMTO is set to 1, the Station shall implement the two-phase LMT as defined in 9.1.6.2.1. For this type of LMT, the C-Port shall provide either a PHY or PMAC repeat path as defined in 9.7.1 or 9.7.2.

When the Station is operating at the HMR (FSMRO > 1), the Station shall be implemented with FSLMTO set to 1.

14.5.1.1.5 Flag, Station Medium Rate Option (FSMRO)

The flag FSMRO is used to indicate the operating speed of the Station, as shown in Table 14-10.

Table 14-10—FSMRO settings

FSMRO setting	Meaning
FSMRO = 0	Station shall operate at 4 Mbit/s.
FSMRO = 1	Station shall operate at 16 Mbit/s.
FSMRO = 2	Station shall operate at 100 Mbit/s.

14.5.1.2 Station policy variable definitions

Station policy variables are similar to policy flags. They are set by Management prior to Connect.SMAC and are not altered by the SMAC. Table 14-11 specifies modified Station policy variable definitions.

Table 14-11—Station policy variables

Variable	Permitted values	Description
SPV(AP_MASK)	• A bitmask value of X'0001' shall indicate the TKP Access Protocol is being supported. • A bitmask value of X'0002' shall indicate the TXI Access Protocol is being supported. • The Station shall not use any other value of SPV(AP_MASK).	SPV(AP_MASK) represents the mask used to indicate which Access Protocols are being supported.
SPV(MAX_TX)	• At 4 Mbit/s, the maximum permitted value is 4550. • At 16 Mbit/s, the maximum permitted value is 18200. • At 100 Mbit/s, the maximum permitted value is 18207.	SPV(MAX_TX) represents the maximum octet transmit count the Station can support per frame. The count covers the complete frame sequence, includ-ing SSD, ESD, and IFG, as defined in 14.1.1. A Station may support a value or a value range for this variable, provided these values do not exceed the maximum frame size permitted by the medium rate. When a Station is assigned a value range, a single point within the range is used during magnitude comparisons. An implementation is not required to use the same point for each comparison.
SPV(PD)	• The value X'0001' indicates that the Station supports Phantom signaling and wire fault detection, as de-scribed in ANSI/IEEE Std 802.5, 1998 Edition. • The value X'0002' indicates that the Station does not support Phantom signaling; therefore, wire fault detection cannot be supported. • All other values of SPV(PD) are reserved for future standardization.	SPV(PD) describes which method of Phantom signaling and wire fault detection is in use by the Station. The value is a bit mask, and only a single bit shall be set.

14.5.1.3 Allowable station policy flag and variable settings

The Station policy flags and variables defined in 14.5.1.1, 14.5.1.2, and Clause 10 have interdependencies that implementers should take into account. The following assertions shall be true in a Station implementation, in addition to the assertions in Clause 10:

- FSMRO=2 ⇒ AND(SPV(AP_MASK), X'0003')=X'0002' **and** FSOPO=1 **and** FSRDO=1
- FSLMTO=0 ⇒ FSMRO<2
- FSMRO>1 ⇒ FSLMTO=1
- FSMRO<2 ⇒ FSASO=0
- FSHSO=1 ⇒ AND(SPV(AP_MASK),X'0004')=X'0004' **or** AND(SPV(AP_MASK),X'0008')=X'0008'
- SPV(PD)=0002 ⇒ FSMRO>1
- FSMRO<2 ⇒ SPV(PD)=0001

14.5.2 C-Port policy flags and variables

The C-Port policy flags and variables defined in this subclause are used in addition to those defined in 10.5 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) by a C-Port at the HMR.

14.5.2.1 C-Port policy flag definitions

The C-Port policy flags ("O"–suffix acronym) are set externally to the PMAC (see Clause 11 in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) and are not changed by the PMAC FSMs.

14.5.2.1.1 Flag, C-Port Auto Negotiation Option (FPANO)

The flag FPANO is used to determine whether a C-Port has auto negotiation support. If FPANO is set to 0, the C-Port does not support auto negotiation. FPANO set to values other than 0 is reserved for future standardization.

14.5.2.1.2 Flag, C-Port Abort Sequence Option (FPASO)

When the C-Port is operating at 4 Mbit/s or 16 Mbit/s, this flag is used to control the ending sequence for over-length frames when cut-through operation is supported by the PMAC. When FPASO is set to 0, an over-length frame is ended with an abort sequence. When FPASO is set to 1, an over-length frame is ended with an invalid FCS and by setting the Error Detected bit (E) in the Ending Delimiter field.

When the C-Port is operating at the HMR, this flag is used to control the ending sequence for aborted frames. When FPASO is set to 0, an aborted frame is ended with an abort sequence. When FPASO is set to 1, an aborted frame is ended with an invalid FCS and by setting the Error Detected bit (E) in the Ending Delimiter field.

14.5.2.1.3 Flag, C-Port HMR Trade-up Option (FPHMRTUO)

When this flag is set to 1, the C-Port positively responds to the Station's request for a HMR Trade-up request (AP_RSP=0006). If this flag is set to 0, the C-Port responds to the Station that it must remain at its designated speed and Access Protocol (AP_RSP=0002).

14.5.2.1.4 Flag, C-Port Medium Rate Option (FPMRO)

The flag FPMRO is used to indicate the operating speed of the C-Port, as shown in Table 14-12.

Table 14-12—FPMRO Settings

FPMRO setting	Meaning
FPMRO = 0	C-Port shall operate at 4 Mbit/s.
FPMRO = 1	C-Port shall operate at 16 Mbit/s.
FPMRO = 2	C-Port shall operate at 100 Mbit/s.

14.5.2.1.5 Flag, C-Port Repeat Option (FPRPTO)

The flag FPRPTO is used to indicate whether a hardware frame repeat path is available in the C-Port. If FPRPTO is set to 1, the hardware repeat path is available. If the flag is set to 0, there is no hardware repeat path. At 4 Mbit/s or 16 Mbit/s, FPRPTO shall be set to 1 indicating that a hardware repeat path is available.

14.5.2.2 C-Port policy variable definitions

C-Port policy variables are similar to policy flags. They are set by Management prior to Connect.PMAC and are not altered by the PMAC. Table 14-13 specifies modified C-Port policy variable definitions.

Table 14-13—C-Port policy variables

Variable	Permitted Values	Description
PPV(AP_MASK)	• A bitmask value of X'0001' shall indicate the TKP Access Protocol is supported. • A bitmask value of X'0002' shall indicate the TXI Access Protocol is supported. • A bitmask value of X'0004' shall indicate the C-Port is 100 Mbit/s capable. • The C-Port shall not use any other value of PPV(AP_MASK).	The C-Port policy variable PPV(AP_MASK) represents the mask used to indicate which Access Protocols and additional capabilities are being supported. The C-Port uses the variable to determine whether it can support the Station's Access Protocol request. Details on how the C-Port determines if the AP request is acceptable are given in 9.1.4.2.
PPV(MAX_TX)	• At 4 Mbit/s, the maximum permitted value is 4550. • At 16 Mbit/s, the maximum permitted value is 18200. • At 100 Mbit/s, the maximum permitted value is 18207.	The C-Port policy variable PPV(MAX_TX) represents the maximum octet transmit count the C-Port can support per frame. The count covers the complete frame sequence, including the SSD, ESD, and IFG, as defined in 14.1.1. A C-Port may support a value or a value range for this variable, provided these values do not exceed the maximum frame size permitted by the medium rate. When a C-Port is assigned a value range, a single point within the range is used during magnitude comparisons. An implementation is not required to use the same point for each comparison.
PPV(PD_MASK)	• The value X'0001' indicates the C-Port supports Phantom signaling detection and wire fault load provision. • The value X'0002' indicates the C-Port supports neither Phantom signaling detection nor wire fault load provision. • The value X'0003' indicates the C-Port does not support Phantom signaling detection, but supports wire fault load provision. • All other bit positions are reserved for future standardization.	The C-Port policy variable PPV(PD_MASK) represents a bit mask of Phantom signaling and wire fault detection methods supported by the C-Port.

14.5.2.3 Allowable C-Port policy flag and variable settings

The C-Port policy flags and variables defined in 14.5.1, 14.5.2, and Clause 10 have interdependencies that implementers should take into account. The following assertions shall be true in a C-Port implementation, in addition to the assertions in Clause 10:

- FPMRO<2 ⇒ FPASO = 0
- FPMRO<2 ⇒ FPRPTO=1
- SPV(PD_MASK)=X'0002' ⇒ FPMRO>1
- SPV(PD_MASK)=X'0003' ⇒ FPMRO>1
- FPMRO>1 ⇒ AND(PPV(PD_MASK),X'0002')=X'0002'

Replace Annex A:

Annex A[1]

(normative)

Protocol Implementation Conformance Statement (PICS) proforma

A.1 Introduction

The supplier of a protocol implementation that is claimed to conform to this standard shall complete the following PICS proforma.

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. The PICS can have a number of uses, including use by the following:

a) The protocol implementor, as a checklist to reduce the risk of failure to conform to the standard through oversight;
b) The supplier and acquirer, or potential acquirer, of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard PICS proforma;
c) The user, or potential user, of the implementation, as a basis for initially checking the possibility of interworking with another implementation (note that while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible PICSs);
d) The protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Abbreviations and special symbols

A.2.1 Status symbols

The following symbols are used in the PICS proforma:

M	mandatory field/function
O	optional field/function
O.<n>	optional field/function indicating mutually exclusive or selectable options among a set
X	prohibited field/function
<pred>:	simple-predicate condition for an item, dependent on the support marked for <pred>
<pred>::	simple-predicate condition for a table, dependent on the support marked for <pred>

A.2.2 Abbreviations

N/A Not applicable

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[1] *Copyright release for PICS proforma:* Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose, and may further publish the completed PICS.

A.3 Instructions for completing the PICS proforma

A.3.1 General structure for the PICS proforma

The first part of the PICS proforma, implementation identification and protocol summary, is to be completed as indicated with the information necessary to identify fully both the supplier and the implementation.

The main part of the PICS proforma is a fixed-format questionnaire divided into subclauses, each containing a group of items. Answers to the questionnaire items are to be provided in the right-most column, either by simply marking an answer to indicate a restricted choice (usually Yes, No, or Not Applicable), or by entering a value, or a set or range of values. (Note that there are some items where two or more choices from a set of possible answers can apply; all relevant choices are to be marked.)

Each item is identified by an item reference in the first column; the second column contains the question to be answered; and the third column contains the reference or references to the material that specifies the item in the main body of the standard. The other columns record the status of the item—whether the support is mandatory, optional, or conditional—and provide spaces for the answers (see also A.3.4).

The supplier may also provide, or be required to provide, further information, categorized as either "additional information" or "exception information." When present, each type of further information is to be provided in a further subclause of items labeled A<i> or E<i>, respectively, for cross-referencing purposes, where <i> is the unambiguous identification for the item (e.g., simply a numerical). There are no other restrictions on its format or presentation.

A completed PICS proforma, including any additional information or exception information, is the PICS for the implementation in question.

NOTE—Where an implementation is capable of being configured in more than one way, according to the items listed in A.5, a single PICS may be able to describe all such configurations. However, the supplier has the choice of providing more than one PICS, each covering some subset of the implementation's configuration capabilities, if that would make presentation of information easier and cleaner.

A.3.2 Additional information

Items of additional information allow a supplier to provide further information intended to assist the interpretation of the PICS. It is not intended or expected that a large quantity will be supplied, and the PICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations; or a brief rationale, based perhaps upon specific application needs, for the exclusion of features which, although optional, are nonetheless commonly present in implementations of the Token Ring protocol.

References to items of additional information may be entered next to any answer in the questionnaire, and may be included in items of exception information.

A.3.3 Exception information

It may occasionally happen that a supplier will wish to answer an item with mandatory status or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No preprinted answer will be found in the Support column for this; instead, the supplier is required to write into the Support column an E<i> reference to an item of exception information, and to provide the appropriate rationale in the exception item itself.

An implementation for which an exception item is required in this way does not conform to this standard.

NOTE—A possible reason for the situation described above is that a defect in the standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

A.3.4 Conditional status

A.3.4.1 Conditional items

The PICS proforma contains a number of conditional items. These are items for which the status that applies—mandatory, optional, or prohibited—is dependent upon whether or not certain other items are supported, or upon the value supported for other items.

In many cases, whether or not the item applies at all is conditional in this way, as well as the status when the item does not apply.

A conditional symbol is of the form "<pred>:<s>"

where

<pred> is a predicate as described in A.3.4.2;
<s> is one of the status symbols M, O, O.<n>, or X.

A conditional symbol of the form "<pred>: :" may be indicated above a particular table. That table shall be completed if, and only if, the condition evaluates to true.

A.3.4.2 Predicates

A predicate is one of the following:

a) An item-reference for an item in the PICS proforma. The value of the predicate is true if the item is marked as supported, and is otherwise false.
b) A predicate-name for a predicate defined as a boolean expression, constructed by combining item-references using the boolean operators AND and OR. The value of the predicate is true if the boolean expression evaluates to true.
c) The logical negation symbol "¬" prefixed to an item-reference or predicate-name. The value of the predicate is true if the value of the predicate formed by omitting the "¬" symbol is false, and vice versa.

An asterisk in the Item column indicates each item-reference that is used in a predicate or predicate definition. If such an item reference is not supported (false), then the support of the item itself will be indicated as N/A (not applicable); otherwise, the support of the item will be indicated as YES.

A.4 Identification

A.4.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation name(s) and version(s)	
Other information necessary for full identification; e.g., name(s) and version(s) for machines and/or operating systems; system name(s)	

NOTES
1—Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirements for full identification.
2—The terms *name* and *version* should be interpreted appropriately to correspond with a supplier's terminology (e.g., type, series, model).

A.4.2 Protocol summary

Protocol version	
Amendments implemented	
Corrigenda implemented	
Have any exception items been required? No [] Yes [] (See A.3.3; the answer "Yes" means that the implementation does not conform to the standard.)	
Date of statement	

A.5 Major capabilities

Item	Feature	Reference	Status	Support
*DS	Data station	2.4	O.1	Yes [] No []
*DTRS	DTR Station	9.2	O.1	Yes [] No []
*DTRP	DTR C-Port	9.3	O.1	Yes [] No []
*ACON	Active retiming concentrator	8.5	O.1	Yes [] No []
*PCON	Passive concentrator	8.4	O.1	Yes [] No []
*DR4	4 Mbit/s data rate	5.3	O.3	Yes [] No []
*DR16	16 Mbit/s data rate	5.3	O.3	Yes [] No []
*DR100	100 Mbit/s data rate	9.8	O.3	Yes [] No []
*STP	Shielded Twisted Pair cable attachment	7.2	O.4	Yes [] No []
*UTP	Unshielded Twisted Pair cable attachment	7.2	O.4	Yes [] No []
*FIB	Fibre attachment	13.2	O.4	Yes [] No []

Item	Feature	Reference	Status	Support
*DTRSTXI	DTR Station using TXI Access Protocol	9.2	DTRS:M	N/A [] Yes []
*DTRSTKP	DTR Station using TKP Access Protocol	9.2, 9.6	PRED1:M PRED2:X	N/A [] Yes [] N/A [] Yes []
*DTRPPMTXI	DTR C-Port in port mode using TXI Access Protocol	9.3	DTRP:M	N/A [] Yes []
*DTRPPMTKP	DTR C-Port in port mode using TKP Access Protocol	9.3, 9.4	PRED3:M PRED4:X	N/A [] Yes [] N/A [] Yes []
*DTRPSETXI	DTR C-Port in Station emulation mode using TXI Access Protocol.	9.3, 9.2	DTRP:O	N/A [] Yes [] No []
*DTRPSETKP	DTR C-Port in Station emulation mode using TKP Access Protocol.	9.3, 9.5	PRED3:O PRED4:X	N/A [] Yes [] No [] N/A [] Yes []
*TKP	Station or C-Port using the TKP Access Protocol		PRED5:M	N/A [] Yes []
*TXI	Station or C-Port using the TXI Access Protocol		PRED6:M	N/A [] Yes []
*DTRPPM	C-Port in Port mode		PRED7:M	N/A [] Yes []
*DTRPSE	C-Port in Station emulation mode		PRED8:M	N/A [] Yes []
*LMR	Low Media Rate (4 Mbit/s or 16 Mbit/s)		PRED9:M	N/A [] Yes []
*HMR	High Media Rate (100 Mbit/s or greater)		PRED10: M	N/A [] Yes []
*COPPER	Copper attachment		PRED11: M	N/A [] Yes []
*FIBRE	Fibre attachment		PRED12: M	N/A [] Yes []

NOTES—
O.1: Support for one, and only one, of the options is required.

O.3, O.4: Support for at least one of the options is required.

PREDICATES—
PRED1 = DTRS **AND** (DR4 **OR** DR16)
PRED2 = DTRS **AND** DR100
PRED3 = DTRP **AND** (DR4 **OR** DR16)
PRED4 = DTRP **AND** DR100
PRED5 = DS **OR** DTRSTKP **OR** DTRPSETKP **OR** DTRPPMTKP
PRED6 = DTRSTXI **OR** DTRPSETXI **OR** DTRPPMTXI
PRED7 = DTRPPMTXI **OR** DTRPPMTKP
PRED8 = DTRPSETXI **OR** DTRPSETKP
PRED9 = DR4 **OR** DR16
PRED10 = DR100
PRED11= STP **OR** UTP
PRED12 = FIB

A.6 PICS proforma for the MAC

A.6.1 Transmission and receive frame formats

Item	Feature	Reference	Status	Support
FF1a	Token transmit	3.1.1	TKP:M	N/A [] Yes []
FF1b	Token receive	3.1.1	TKP:M	N/A [] Yes []
FF2a	MAC frame transmit	3.1.2	M	Yes []
FF2b	MAC frame receive	3.1.2	M	Yes []

Item	Feature	Reference	Status	Support
FF3a	LLC frame transmit	3.1.2	M	Yes []
FF3b	LLC frame receive	3.1.2	M	Yes []
*FF3c	LLC frame cut-through	12	DTRP:O	N/A [] Yes [] No []
FF4a	Abort sequence transmit	3.1.3	LMR:M	N/A [] Yes []
FF4b	Abort sequence receive	3.1.3	LMR:M	N/A [] Yes []
*FF4c	Abort sequence transmit	14.1.2	HMR:O	N/A [] Yes [] No []
FF4d	Abort sequence receive	14.1.2	HMR:M	N/A [] Yes []
FF4e	Generation of invalid FCS to abort transmit	10.1	PRED13:O	N/A [] Yes [] No []
FF4f	Generation of invalid FCS to abort transmit	14.1.2	PRED14:M	N/A [] Yes []
FF5a	Fill transmit	3.1.4	M	Yes []
FF5b	Fill receive	3.1.4	M	Yes []

PREDICATES—
PRED13 = LMR **AND FF3c**
PRED14 = HMR **AND** ¬FF4c

A.6.2 Frame transmit and receive parameters

Item	Feature	Reference	Status	Support
FP1a	Starting delimiter transmit	3.2.1	LMR:M	N/A [] Yes []
FP1b	Starting delimiter receive	3.2.1	LMR:M	N/A [] Yes []
FP1c	Starting delimiter transmit	14.2.2	HMR:M	N/A [] Yes []
FP1d	Starting delimiter receive	14.2.2	HMR:M	N/A [] Yes []
FP2a	Access control transmit	3.2.2	TKP:M	N/A [] Yes []
FP2b	Access control receive	3.2.2	TKP:M	N/A [] Yes []
FP2c	Access control transmit	10.2.1	TXI:M	N/A [] Yes []
FP2d	Access control receive	10.2.1	TXI:M	N/A [] Yes []
FP3a	Frame control transmit	3.2.3	M	Yes []
FP3b	Frame control receive	3.2.3	M	Yes []
FP4a	Destination address transmit	3.2.4.1	TKP:M	N/A [] Yes []
FP4b	Destination address receive	3.2.4.1	TKP:M	N/A [] Yes []
FP4c	Destination address transmit	10.2.2	TXI:M	N/A [] Yes []
FP4d	Destination address receive	10.2.2	TXI:M	N/A [] Yes []
FP5a	Source address transmit	3.2.4.2	TKP:M	N/A [] Yes []
FP5b	Source address receive	3.2.4.2	TKP:M	N/A [] Yes []
FP5c	Source address transmit	10.2.2	TXI:M	N/A [] Yes []
FP5d	Source address receive	10.2.2	TXI:M	N/A [] Yes []

Item	Feature	Reference	Status	Support
FP6a	Routing information indicator transmit	3.2.4.2	M	Yes []
FP6b	Routing information indicator receive	3.2.4.2	M	Yes []
*FP7a	Routing information field transmit	3.2.5	O	Yes [] No []
FP7b	Routing information field receive	3.2.5	M	Yes []
FP8a	RI field length bits transmit	3.2.5	FP7a:M	N/A [] Yes []
FP8b	RI field length bits receive	3.2.5	M	Yes []
FP9a	MAC frame, info field transmit	3.2.6.2	M	Yes []
FP9b	MAC frame, info field receive	3.2.6.2	M	Yes []
FP10a	LLC frame, info field transmit	3.2.6.3	M	Yes []
FP10b	LLC frame, info field receive	3.2.6.3	DR4:M	N/A [] Yes []
	Maximum LLC frame, info receive length (133 min)			_____ octets
FP10c	LLC frame, info field receive	3.2.6.3	DR16:M	N/A [] Yes []
	Maximum LLC frame, info receive length (133 min)			_____ octets
FP10d	LLC frame, info field receive	14.1.1	DR100:M	N/A [] Yes []
	Maximum LLC frame, info receive length (133 min)			_____ octets
FP11a	Frame check sequence transmit	3.2.7	M	Yes []
FP11b	Frame check sequence receive	3.2.7	M	Yes []
FP12a	Ending delimiter transmit	3.2.8	PRED15:M	N/A [] Yes []
FP12b	Ending delimiter receive	3.2.8	PRED15:M	N/A [] Yes []
FP12c	Ending delimiter transmit	10.2.3	PRED16:M	N/A [] Yes []
FP12d	Ending delimiter receive	10.2.3	PRED16:M	N/A [] Yes []
FP13a	Frame status transmit	3.2.9	PRED15:M	N/A [] Yes []
FP13b	Frame status receive	3.2.9	PRED15:M	N/A [] Yes []
FP13c	Frame status transmit	10.2.4	PRED16:M	N/A [] Yes []
FP13d	Frame status receive	10.2.4	PRED16:M	N/A [] Yes []
FP14a	End transmit transmit	14.2.1.1.2	PRED17:M	N/A [] Yes []
FP14b	End transmit receive	14.2.1.1.2	PRED17:M	N/A [] Yes []

PREDICATES—
PRED15 = LMR **AND** TKP
PRED16 = LMR **AND** TXI
PRED17 = HMR **AND** TXI

A.6.3 Transitions relating to MAC frame

Item	Feature	Reference	Status	Support
TRM	Transitions relating to MAC frames	4, 9.2, 9.3, 9.4, 9.5, 9.6	M	Yes []

A.6.4 MAC timers

A.6.4.1 Station or C-Port using TKP Access Protocol—TKP::

Item	Feature	Reference	Status	Support
TAM	Active monitor	3.4.2.1	M	Yes []
TBR	Beacon repeat	3.4.2.2	M	Yes []
TBT	Beacon transmit	3.4.2.3	M	Yes []
TCT	Claim token	3.4.2.4	M	Yes []
TER	Error report	3.4.2.5	M	Yes []
TID	Insert delay	3.4.2.6	M	Yes []
TJR	Join ring	3.4.2.7	M	Yes []
TNT	No token	3.4.2.8	M	Yes []
TQP	Queue PDU	3.4.2.9	M	Yes []
TRH	Remove hold	3.4.2.10	M	Yes []
TRI	Request initialization	3.4.2.12	M	Yes []
TRP	Ring purge	3.4.2.14	M	Yes []
TRR	Return to repeat	3.4.2.13	M	Yes []
TRW	Remove wait	3.4.2.11	M	Yes []
TSL	Signal loss	3.4.2.15	M	Yes []
TSM	Standby monitor	3.4.2.16	M	Yes []
TVX	Valid transmission	3.4.2.17	M	Yes []
TWF	Wire fault	3.4.2.19	M	Yes []
TWFD	Wire fault delay	3.4.2.18	M	Yes []
TSRW	Station registration wait	10.4.1.13	¬DS:M	N/A [] Yes []
TLMTR	Station LMT running	10.4.3.1	¬DS:O	N/A [] Yes [] No []

A.6.4.2 Station using TXI Access Protocol—(DTRS and TXI) or DTRPSETXI::

Item	Feature	Reference	Status	Support
TSER	Error report	10.4.1.1	M	Yes []
TSHMRW	HMR wait	14.4.1.1	HMR:M	N/A [] Yes []
TSIP	Insert process	10.4.1.2	M	Yes []
TSIS	Initial sequence	10.4.1.3	M	Yes []
TSIT	Internal test	10.4.1.4	M	Yes []
TSJC	Join complete	10.4.1.5	M	Yes []
TSLMT	LMT	10.4.1.6	M	Yes []
TSLMTC	LMT complete	10.4.1.7	M	Yes []

Item	Feature	Reference	Status	Support
TSLMTD	LMT delay	10.4.1.8	M	Yes []
TSLMTNP	LMT notification pace	14.4.1.2	FSLMTO_1:M	N/A [] Yes []
TSLMTP	LMT pace	14.4.1.3	FSLMTO_1:M	N/A [] Yes []
TSLMTR	LMT response	14.4.1.4	FSLMTO_1:M	N/A [] Yes []
TSQHB	Queue heart beat	10.4.1.9	M	Yes []
TSQP	Queue PDU	10.4.1.10	M	Yes []
TSRAP	Remove alert pace	14.4.1.5	HMR:M	N/A [] Yes []
TSREQ	Registration request	10.4.1.11	M	Yes []
TSRHB	Receive heart beat	10.4.1.12	M	Yes []
TSSL	Signal loss	10.4.1.13	M	Yes []
TSWF	Wire fault	10.4.1.14	SRA5:M	N/A [] Yes []
TSWFD	Wire fault delay	10.4.1.15	SRA5:M	N/A [] Yes []

A.6.4.3 C-Port in port mode using TXI Access Protocol—DTRPPMTXI::

Item	Feature	Reference	Status	Support
TPER	Error report	10.4.2.1	M	Yes []
TPHMRW	HMR wait	14.4.2.1	HMR:M	N/A [] Yes []
TPIRD	Insert request delay	10.4.2.2	M	Yes []
TPIT	Internal test	10.4.2.3	M	Yes []
TPLMTR	LMT running	10.4.2.5	M	Yes []
TPPD	Phantom detect	14.4.2.2	LMR:O PRED18:M	N/A [] Yes [] No [] N/A [] Yes []
TPPLD	Protocol loss detect	14.4.2.3	LMR:O PRED18:M	N/A [] Yes [] No [] N/A [] Yes []
TPQHB	Queue heart beat	10.4.2.6	M	Yes []
TPQP	Queue PDU	10.4.2.7	M	Yes []
TPRAP	Remove alert pace	14.4.2.4	HMR:M	N/A [] Yes []
TPRHB	Received heart beat	10.4.2.8	M	Yes []
TPRQD	Registration query delay	10.4.2.9	M	Yes []
TPSL	Signal loss	10.4.2.10	M	Yes []
TPTUAD	Trade-up assured delivery	10.4.2.5	PRED19:M	N/A [] Yes []

PREDICATES—
PRED18 = HMR **AND** PRA3
PRED19 = HMR **AND** FPHMRTUO_1

A.6.5 MAC policy flags and variables

A.6.5.1 Station or C-Port using TKP Access Protocol—TKP::

Item	Feature	Reference	Status	Support
FBHO_0	Beacon handling option—flag=0	3.5.1	O.5	Yes [] No []
FBHO_1	Beacon handling option—flag=1	3.5.1	O.5	Yes [] No []
FCCO_0	Claim contender option—flag=0	3.5.2	O.6	Yes [] No []
FCCO_1	Claim contender option—flag=1	3.5.2	O.6	Yes [] No []
FECO_0	Error counting option—flag=0	3.5.4	O.7	Yes [] No []
FECO_1	Error counting option—flag=1	3.5.4	O.7	Yes [] No []
FETO_0	Early token release option—flag=0	3.5.3	DR4: M DR16:O.8	N/A [] Yes [] N/A [] Yes [] No []
FETO_1	Early token release option—flag=1	3.5.3	DR16:O.8	N/A [] Yes [] No []
FGTO_0	Good token option—flag=0	3.5.10	O.9	Yes [] No []
FGTO_1	Good token option—flag=1	3.5.10	O.9	Yes [] No []
FMFTO_0	Multiple frame transmission—flag=0	3.5.6	O.10	Yes [] No []
FMFTO_1	Multiple frame transmission—flag=1	3.5.6	O.10	Yes [] No []
FMRO_0	Media rate—flag=0	3.5.5	DR4:M	N/A [] Yes []
FMRO_1	Media rate—flag=1	3.5.5	DR16:M	N/A [] Yes []
FRRO_0	Reject remove option—flag=0	3.5.7	O.11	Yes [] No []
FRRO_1	Reject remove option—flag=1	3.5.7	O.11	Yes [] No []
FTEO_0	Token error detect option—flag=0	3.5.8	O.12	Yes [] No []
FTEO_1	Token error detect option—flag=1	3.5.8	O.12	Yes [] No []
FTHO_0	Token handling option—flag=0	3.5.9	O.13	Yes [] No []
FTHO_1	Token handling option—flag=1	3.5.9	O.13	Yes [] No []
FTUBO_0	Transmit under-run behavior option—flag=0	3.5.9a	O.14	Yes [] No []
FTUBO_1	Transmit under-run behavior option—flag=1	3.5.9a	O.14	Yes [] No []
FWFDO_0	Wire fault detection option—flag=0	3.5.11	O.15	Yes [] No []
FWFDO_1	Wire fault detection option—flag=1	3.5.11	O.15	Yes [] No []
NOTE—O.5 to O.15: Support of at least one of the policy flag settings is required.				

A.6.5.2 Station using TXI Access Protocol—(DTRS and TXI) or DTRPSETXI::

Item	Feature	Reference	Status	Support
FSANO_0	Auto negotiation option—flag=0	14.5.1.1.1	HMR:M	N/A [] Yes []
FSANO_1	Auto negotiation option—flag=0	14.5.1.1.1	HMR:X	N/A [] Yes []
FSASO_0	Abort sequence option—flag=0	14.5.1.1.2	HMR:O.16	N/A [] Yes [] No []
*FSASO_1	Abort sequence option—flag=1	14.5.1.1.2	HMR:O.16	N/A [] Yes [] No []
FSASO_1_FCS	Invalid FCS generation method	14.5.1.1.2	FSASO_1:M	N/A [] Method___
FSECO_0	Error counting option—flag=0	10.5.1.1.1	O.17	Yes [] No []
FSECO_1	Error counting option—flag=1	10.5.1.1.1	O.17	Yes [] No []
FSHMRTUO_0	HMR Trade-up option—flag=0	14.5.1.1.3	O.18	Yes [] No []
FSHMRTUO_1	HMR Trade-up option—flag=1	14.5.1.1.3	O.18	Yes [] No []
FSLMTO_0	LMT option—flag=0	14.5.1.1.4	LMR:M HMR:X	N/A [] Yes [] N/A [] Yes []
*FSLMTO_1	LMT option—flag=1	14.5.1.1.4	LMR:O HMR:M	N/A [] Yes [] No [] N/A [] Yes []
FSMRO_0	Media rate option—flag=0	14.5.1.1.5	DR4:O.19	N/A [] Yes [] No []
FSMRO_1	Media rate option—flag=1	14.5.1.1.5	DR16:O.19	N/A [] Yes [] No []
FSMRO_2	Media rate option—flag=2	14.5.1.1.5	DR100:O.19	N/A [] Yes [] No []
*FSOPO_0	Open option—flag=0	10.5.1.1.3	O	Yes [] No []
FSOPO_1	Open option—flag=1	10.5.1.1.3	M	Yes []
FSRDO_0	Registration denied option—flag=0	10.5.1.1.4	O.20	Yes [] No []
FSRDO_1	Registration denied option—flag=1	10.5.1.1.4	O.20	Yes [] No []
FSREGO_0a	Registration option—flag=0	10.5.1.1.5	¬FSOPO_0: M	N/A [] Yes []
FSREGO_0b	Registration option—flag=0	10.5.1.1.5	FSOPO_0:O	N/A [] Yes [] No []
FSREGO_1	Registration option—flag=1	10.5.1.1.5	M	Yes []
FSRQO_0	Registration query option—flag=0	10.5.1.1.6	O.21	Yes [] No []
FSRQO_1	Registration query option—flag=1	10.5.1.1.6	O.21	Yes [] No []
FSRRO_0	Reject remove option—flag=0	10.5.1.1.7	O.22	Yes [] No []
FSRRO_1	Reject remove option—flag=1	10.5.1.1.7	O.22	Yes [] No []
NOTE—O.16 to O.22: Support of at least one of the options is required.				

A.6.5.3 C-Port in port mode using TXI Access Protocol—DTRPPMTXI::

Item	Feature	Reference	Status	Support
FPANO_0	Auto negotiation option—flag=0	14.5.2.1.1	HMR:M	N/A [] Yes []
FPANO_1	Auto negotiation option—flag=1	14.5.2.1.1	HMR:X	N/A [] Yes []
FPACO_0	AC repeat path option—flag=0	10.5.2.1.1	O.23	Yes [] No []
FPACO_1	AC repeat path option—flag=1	10.5.2.1.1	O.23	Yes [] No []
FPASO_0	Abort sequence option—flag=0	10.5.2.1.2, 14.5.2.1.2	O.24	Yes [] No []
*FPASO_1	Abort sequence option—flag=1	10.5.2.1.2, 14.5.2.1.2	O.24	Yes [] No []
FPASO_1_FCS	Invalid FCS generation method	10.5.2.1.2, 14.5.2.1.2	FPASO_1:M	N/A [] Method___
FPBHO_0	Beacon handling option—flag=0	10.5.2.1.3	O.25	Yes [] No []
FPBHO_1	Beacon handling option—flag=1	10.5.2.1.3	O.25	Yes [] No []
FPECO_0	Error counting option—flag=0	10.5.2.1.4	O.26	Yes [] No []
FPECO_1	Error counting option—flag=1	10.5.2.1.4	O.26	Yes [] No []
FPFCO_0	Frame control option—flag=0	10.5.2.1.5	O.27	Yes [] No []
FPFCO_1	Frame control option—flag=1	10.5.2.1.5	O.27	Yes [] No []
FPHMRTUO_0	HMR Trade-up option—flag=0	14.5.2.1.3	O.28	Yes [] No []
*FPHMRTUO_1	HMR Trade-up option—flag=1	14.5.2.1.3	O.28	Yes [] No []
FPMRO_0	Media rate option—flag=0	10.5.2.1.6	DR4:O.29	N/A [] Yes [] No []
FPMRO_1	Media rate option—flag=1	10.5.2.1.6	DR16:O.29	N/A [] Yes [] No []
FPMRO_2	Media rate option—flag=2	10.5.2.1.6	DR100:O.29	N/A [] Yes [] No []
FPOTO_0	Operation table option—flag=0	10.5.3.3	M	Yes []
FPOTO_1	Operation table option—flag=1	10.5.3.3	O	Yes [] No []
FPRPTO_0	Repeat option—flag=0	14.5.2.1.5	HMR:O.30	N/A [] Yes [] No []
FPRPTO_1	Repeat option—flag=1	14.5.2.1.5	HMR:O.30	N/A [] Yes [] No []
NOTE—O.23 to O.30: Support of at least one of the options is required.				

A.6.6 MAC counters

A.6.6.1 Station or C-Port using TKP Access Protocol—TKP::

Item	Feature	Reference	Status	Support
CABE	Abort error	3.6.1	M	Yes []
CACE	AC error	3.6.2	M	Yes []
CBE	Burst error	3.6.3	M	Yes []
CFCE	Frame-copied error	3.6.4	M	Yes []

Item	Feature	Reference	Status	Support
CFE	Frequency error	3.6.5	M.31	Yes []
CIE	Internal error	3.6.6	M.31	Yes []
CLE	Line error	3.6.7	M	Yes []
CLFE	Lost frame error	3.6.8	M	Yes []
CRCE	Receive congestion error	3.6.9	M	Yes []
CTE	Token error	3.6.10	M	Yes []
NOTE—M.31: These counters are mandatory, but the indications that cause CFE and CIE to be incremented are optional.				

A.6.6.2 Station using TXI Access Protocol—(DTRS and TXI) or DTRPSETXI::

Item	Feature	Reference	Status	Support
CSABE	Abort error	10.6.1.1	M	Yes []
CSBE	Burst error	10.6.1.2, 14.3.2.5, 14.3.2.6	LMR:M HMR:X	N/A [] Yes [] N/A [] Yes []
CSFE	Frequency error	10.6.1.3, 14.3.2.5, 14.3.2.6	LMR:M.32 HMR:X	N/A [] Yes [] N/A [] Yes []
CSIE	Internal error	10.6.1.4	M.32	Yes []
CSLE	Line error	10.6.1.5	M	Yes []
CSRCE	Receive congestion error	10.6.1.6	M	Yes []
NOTE—M.32: These counters are mandatory, but the indications that cause CSFE and CSIE to be incremented are optional.				

A.6.6.3 C-Port in port mode using TXI Access Protocol—DTRPPMTXI::

Item	Feature	Reference	Status	Support
CPABE	Abort error	10.6.2.1	M	Yes []
CPBE	Burst error	10.6.2.2, 14.3.2.5, 14.3.2.6	LMR:M HMR:X	N/A [] Yes [] N/A [] Yes []
CPFE	Frequency error	10.6.2.3, 14.3.2.5, 14.3.2.6	LMR:M.33 HMR:X	N/A [] Yes [] N/A [] Yes []
CPIE	Internal error	10.6.2.4	M.33	Yes []
CPLE	Line error	10.6.2.5	M	Yes []
CPRCE	Receive congestion error	10.6.2.6	M	Yes []
NOTE—M.33: These counters are mandatory, but the indications that cause CPFE and CPIE to be incremented are optional.				

A.7 PICS proforma for the PHY

A.7.1 PHY Characteristics at 4 Mbit/s and 16 Mbit/s

A.7.1.1 Symbol timing—(DS or DTRS or DTRP or ACON) and LMR::

Item	Feature	Reference	Status	Support
ST1	4 Mbit/s data signaling rate	5.2	DR4:M	N/A [] Yes []
ST2	16 Mbit/s data signaling rate	5.2	DR16:M	N/A [] Yes []
ST3	Acquire phase lock within 1.5 ms	5.7.1	M	Yes []
ST4	Frequency error	5.7.2	O	Yes [] No []
ST5	Signal loss indication	5.7.1	O	Yes [] No []

A.7.1.2 Symbol encoding and decoding—(DS or DTRS or DTRP or ACON) and LMR::

Item	Feature	Reference	Status	Support
SY1	Symbol encoding	5.3	M	Yes []
SY2	Symbol decoding	5.6	M	Yes []
SY3	Burst error/idles transmit	5.4.2	M	Yes []

A.7.1.3 Station latency—(DS or DTRS or DTRP) and LMR and TKP::

Item	Feature	Reference	Status	Support
LB1	A fixed latency buffer of 24 symbols	5.8.2	M	Yes []
LB2	4 Mbit/s latency variation	5.8.3	DR4:M	N/A [] Yes []
LB3	16 Mbit/s latency variation	5.8.3	DR16:M	N/A [] Yes []

A.7.1.4 Accumulated correlated jitter—(DS or DTRS or DTRP or ACON) and LMR::

Item	Feature	Reference	Status	Support
AJ1a	Filtered accumulated phase jitter	7.1.1	DR4:M	N/A [] Yes []
AJ1b	Filtered accumulated phase jitter	7.1.1	DR16:M	N/A [] Yes []
AJ2a	Delta phase accumulated phase jitter	7.1.1	DR4:M	N/A [] Yes []
AJ2b	Delta phase accumulated phase jitter	7.1.1	DR16:M	N/A [] Yes []
AJ3a	Accumulated uncorrelated jitter	7.1.2	DR4:M	N/A [] Yes []
AJ3b	Accumulated uncorrelated jitter	7.1.2	DR16:M	N/A [] Yes []
AJ4	PHY net delay	7.1.3	M	Yes []

A.7.1.5 Transmitter specification

A.7.1.5.1 Transmitter specification—(DS or DTRS or DTRP or ACON) and LMR and COPPER::

Item	Feature	Reference	Status	Support
TR1a	Transmit duty cycle distortion	7.2.2.1	DR4:M	N/A [] Yes []
TR1b	Transmit duty cycle distortion	7.2.2.1	DR16:M	N/A [] Yes []
TR2a	Transmit Tdiff01	7.2.2.2.1	DR4:M	N/A [] Yes []
TR2b	Transmit Tdiff01	7.2.2.2.1	DR16:M	N/A [] Yes []
TR3	Transmit Tdiffmax	7.2.2.2.1	M	Yes []
TR4a	Transmit waveform(zero/one/SDEL)	7.2.2.2.2	DR4:M	N/A [] Yes []
TR4b	Transmit waveform(zero/one/SDEL)	7.2.2.2.2	DR16:M	N/A [] Yes []
TR5a	Transmit output voltage	7.2.2.3	STP:M	N/A [] Yes []
TR5b	Transmit output voltage	7.2.2.3	UTP:M	N/A [] Yes []
TR6a	Transmit return loss	7.2.2.4	STP:M	N/A [] Yes []
TR6b	Transmit return loss	7.2.2.4	UTP:M	N/A [] Yes []

A.7.1.5.2 Transmitter specification—(DS or DTRS or DTRP or ACON) and LMR and FIBRE::

Item	Feature	Reference	Status	Support
FIBTR1a	Optical transmit asymmetry	13.7.2.3.1	DR4:M	N/A [] Yes []
FIBTR1b	Optical transmit asymmetry	13.7.2.3.1	DR16:M	N/A [] Yes []
FIBTR2a	Average optical power	13.7.2.3	DR4:M	N/A [] Yes []
FIBTR2b	Average optical power	13.7.2.3	DR16:M	N/A [] Yes []
FIBTR3	Average optical power off	13.7.2.3	M	Yes []
FIBTR4a	Rise/fall time	13.7.2.3	DR4:M	N/A [] Yes []
FIBTR4b	Rise/fall time	13.7.2.3	DR16:M	N/A [] Yes []
FIBTR5	Overshoot	13.7.2.3	M	Yes []

A.7.1.6 Receiver specification

A.7.1.6.1 Receiver specification—(DS or DTRS or DTRP or ACON) and LMR and COPPER::

Item	Feature	Reference	Status	Support
RC1a	Receiver jitter tolerance (no noise)	7.2.3.1	DR4:M	N/A [] Yes []
RC1b	Receiver jitter tolerance (no noise)	7.2.3.1	DR16:M	N/A [] Yes []
RC2a	Receiver jitter tolerance (with noise)	7.2.3.1	DR4:M	N/A [] Yes []
RC2b	Receiver jitter tolerance (with noise)	7.2.3.1	DR16:M	N/A [] Yes []
RC3a	Receiver return loss	7.2.3.2	DR4:M	N/A [] Yes []
RC3b	Receiver return loss	7.2.3.2	DR16:M	N/A [] Yes []

A.7.1.6.2 Receiver specification—(DS or DTRS or DTRP or ACON) and LMR and FIBRE::

Item	Feature	Reference	Status	Support
FIBRC1	Average received power, Pr, operating	13.7.2.4	M	Yes []
FIBRC2	Signal detect threshold	13.7.2.4	M	Yes []
FIBRC3a	Input rise/fall time	13.7.2.4	DR4:M	N/A [] Yes []
FIBRC3b	Input rise/fall time	13.7.2.4	DR4:M	N/A [] Yes []
FIBRC4a	Receiver jitter tolerance (no noise)	7.2.3.1	DR4:M	N/A [] Yes []
FIBRC4b	Receiver jitter tolerance (no noise)	7.2.3.1	DR16:M	N/A [] Yes []

A.7.2 PHY characteristics at HMR

A.7.2.1 100BASE-X—(DS or DTRS or DTRP) and HMR::

Item	Feature	Reference	Status	Support
100BASE-X	Completed PICS proforma for 100BASE-X PCS and PMA sublayers	802.3u, subclause 24.8	M	Yes []

A.7.2.2 100BASE-TX—(DS or DTRS or DTRP) and HMR and COPPER::

Item	Feature	Reference	Status	Support
PD1	Integrates 100BASE-X PMA and PCS	802.3u, subclause 25.1	M	Yes []
PD2	Compliance with service primitives	9.8.1.1 9.7.2.2	M	Yes []
PD3	Compliance with ANSI X3.263-1995 [TP-PMD], 7, 8, 9, 10, 11 and Annex A (normative), with listed exceptions.	9.8.1.3	M	Yes[]
PD4	Compliance with crossover function	9.8.1.3.12	M	Yes []
PD5	Minimum jitter test pattern length of 4500 octets	9.8.1.14	M	Yes []

A.7.2.3 100BASE-FX—(DS or DTRS or DTRP) and HMR and FIBRE::

Item	Feature	Reference	Status	Support
PD6	Integrates 100BASE-X PMA and PCS	802.3u, subclause 26.1	M	Yes []
PD7	Compliance with service primitives	9.8.1.1 9.7.2.2	M	Yes []
PD8	Compliance with ISO 9314-3: 1990, 8, 9, and 10, with listed exceptions.	9.8.1.4	M	Yes[]
PD9	Compliance with crossover function in cable	13.9.8.1.5.5	M	Yes []

A.7.3 Access control

A.7.3.1 Station access control—(DS or DTRS or DTRPSE)::

Item	Feature	Reference	Status	Support
SRA1	Perform station ring access control	5.9	M	Yes []

A.7.3.2 Station access control—(DS or DTRS or DTRPSE) and COPPER::

Item	Feature	Reference	Status	Support
*SRA2	Phantom circuit source/return	7.2.1.1	LMR:M HMR:O	N/A [] Yes [] N/A [] Yes [] No []
SRA3	Ring insertion current/voltage	7.2.1.1	LMR:M PRED20:O	N/A [] Yes [] N/A [] Yes [] No []
SRA4	Ring bypass current/voltage	7.2.1.1	LMR:M PRED20:O	N/A [] Yes [] N/A [] Yes [] No []
*SRA5	Lobe fault indication	7.2.1.2	LMR:M PRED20:O	N/A [] Yes [] N/A [] Yes [] No []
PREDICATE—PRED20 = HMR **AND** SRA2				

A.7.3.3 Station access control—(DS or DTRS or DTRPSE) and FIBRE::

Item	Feature	Reference	Status	Support
SRA6	Ring insertion	13.7.2.2	LMR:M HMR:X.34	N/A [] Yes [] N/A [] Yes []
SRA7	Ring bypass	13.7.2.2	LMR:M HMR:X.34	N/A [] Yes [] N/A [] Yes []
NOTE—X.34: This style of insertion/bypass is not used at the HMR. Fibre insertion/bypass requirements at the HMR are dealt with by the 100BASE-X PICS item.				

A.7.3.4 C-Port in port mode access control—DTRPPM::

Item	Feature	Reference	Status	Support
PRA1	Perform port mode ring access control	8.3	M	Yes []

A.7.3.5 C-Port in port mode access control—DTRPPM and COPPER::

Item	Feature	Reference	Status	Support
PRA2	Phantom dc load	8.3.3	LMR:M HMR:O	N/A [] Yes [] N/A [] Yes [] No []
*PRA3	Phantom circuit insert detection	8.3.1	LMR:M HMR:O	N/A [] Yes [] N/A [] Yes [] No []

A.7.3.6 C-Port in port mode access control—DTRPPM and FIBRE::

Item	Feature	Reference	Status	Support
PRA4	Insertion/bypass detection	13.7.2.2	LMR:M HMR:X.35	N/A [] Yes [] N/A [] Yes []
NOTE—X.35: This style of insertion/bypass is not used at the HMR. Fibre insertion/bypass requirements at the HMR are dealt with by the 100BASE-X PICS item.				

A.7.3.7 Concentrator access control—(ACON or PCON) and COPPER::

Item	Feature	Reference	Status	Support
CRA1	Ring insertion max time	8.3.2	M	Yes []
CRA2	Ring bypass max time	8.3.2	M	Yes []
CRA3	Phantom dc load	8.3.3	M	Yes []
CRA4	Max ring open time	8.3.2	M	Yes []
CRA5	Phantom path leakage resistance	8.3	M	Yes []
CRA6	Ring access control insert & bypass	8.3.1	M	Yes []

A.7.3.8 Concentrator access control—(ACON or PCON) and FIBRE::

Item	Feature	Reference	Status	Support
CRA7	Ring insertion	13.7.2.2	M	Yes []
CRA8	Ring bypass	13.7.2.2	M	Yes []

A.7.4 Connector specification

A.7.4.1 Connector specification—DS or DTRS or DTRP::

Item	Feature	Reference	Status	Support
MI1a	STP media interface station connector	7.2.5.1	PRED21:M	N/A [] Yes []
MI1b	STP media interface station contact mapping	7.2	PRED21:M	N/A [] Yes []
MI1c	STP media interface concentrator connector	8.1.1	PRED22:M	N/A [] Yes []
MI1d	STP media interface concentrator contact mapping	8.1.1	PRED22:M	N/A [] Yes []
MI2a	UTP media interface station connector	7.2.5.2	PRED23:M	N/A [] Yes []
MI2b	UTP media interface station contact mapping	7.2	PRED23:M	N/A [] Yes []
MI2c	UTP media interface concentrator connector	8.1.1	PRED24:M	N/A [] Yes []
MI2d	UTP media interface concentrator contact mapping	8.1.1	PRED24:M	N/A [] Yes []
MI3a	Fibre media interface connector: duplex SC	13.7.2	PRED25:O.36	N/A [] Yes [] No []
MI3b	Fibre media interface connector: BFOC/2,5	13.7.2	PRED25:O.36	N/A [] Yes [] No []
MI3c	Fibre media interface connector: other	13.7.2	PRED25:O.36	N/A [] Yes [] No []
MI3d	Fibre media interface connector: duplex SC	13.9.8.1.5.5	PRED26:O.37	N/A [] Yes [] No []

Item	Feature	Reference	Status	Support
MI3e	Fibre media interface connector: FO-PMD MIC	13.9.8.1.5.5	PRED26:O.37	N/A [] Yes [] No []
MI3f	Fibre media interface connector: ST connector	13.9.8.1.5.5	PRED26:O.37	N/A [] Yes [] No []
MI3g	Fibre media interface connector: other	13.9.8.1.5.5	PRED26:O.37	N/A [] Yes [] No []

NOTE—O.36 and O.37: Support for at least one of the options is required.

PREDICATES—
PRED21 = STP **AND** (DS **OR** DTRS **OR** DTRPSE)
PRED22 = STP **AND** DTRPPM
PRED23 = UTP **AND** (DS **OR** DTRS **OR** DTRPSE)
PRED24 = UTP **AND** DTRPPM
PRED25 = FIB **AND** LMR
PRED26 = FIB **AND** HMR

A.7.4.2 Connector specification—(ACON or PCON) and LMR::

Item	Feature	Reference	Status	Support
CC1a	STP media lobe connector	8.1.1	STP:M	N/A [] Yes []
CC1b	UTP media lobe connector	8.1.1	UTP:M	N/A [] Yes []
CC1c	Fibre media interface connector: duplex SC	13.7.2	FIB:O.38	N/A [] Yes [] No []
CC1d	Fibre media interface connector: BFOC/2,5	13.7.2	FIB:O.38	N/A [] Yes [] No []
CC1e	Fibre media interface connector: other	13.7.2	FIB:O.38	N/A [] Yes [] No []
CC2a	Trunk connected STP MIC	8.2.1	O.39	Yes [] No []
CC2b	Trunk connected UTP MIC	8.2.1	O.39	Yes [] No []
CC2c	Trunk connected fibre	13.7.2	O.39	Yes [] No []
CC2d	No trunk connection	8.2.1	O.39	Yes [] No []
CC3	Main ring signal path	8.2.1	M	Yes []
CC4a	Trunk connected backup signal path	8.2.1	O.40	Yes [] No []
CC4b	No trunk connection	8.2.1	O.40	Yes [] No []
CC5	Lobe port indicators	8.2.1	O	Yes [] No []

NOTE—O.38 to O.40: Support of at least one of each option shown above is required.

A.7.5 Concentrator specific requirements

A.7.5.1 Concentrator specific requirements—ACON and LMR::

Item	Feature	Reference	Status	Support
AC1	Burst error correction	8.5.2	O	Yes [] No []
AC2	Deleting interframe bits	8.5.2	O	Yes [] No []
AC3a	Ring segment trunk port	8.2	O.41	Yes [] No []
AC3b	No trunk port	8.2	O.41	Yes [] No []

NOTE—O.41: Support of at least one of each option shown above is required.

A.7.5.2 Concentrator specific requirements—PCON and LMR::

Item	Feature	Reference	Status	Support
CPA1	Lobe return loss	8.4.1.1	M	Yes []
CPA2a	Trunk reflection coefficient	8.4.1.2	O.42	Yes [] No []
CPA2b	Ring segment boundary return loss	8.4.1.3	O.42	Yes [] No []
CPA2c	No passive trunk	8.4.1	O.42	Yes [] No []
CPA3	Maximum flat loss	8.4.2	M	Yes []
CPA4	Published lobe attenuation values	8.4.2	M	Yes []
CPA5	Crosstalk loss	8.4.4	M	Yes []
CPA6	Lobe low-frequency response	8.4.3	M	Yes []
CPA7a	Passive trunk low-frequency response	8.4.3	O.43	Yes [] No []
CPA7b	No passive trunk	8.4.3	O.43	Yes [] No []
CPA8a	Published passive trunk port	8.4	O.44	Yes [] No []
CPA8b	Published ring segment boundary trunk port	8.4	O.44	Yes [] No []
CPA8c	No trunk port	8.4	O.44	Yes [] No []
CPA9a	Published passive trunk attenuation values	8.4.2	O.45	Yes [] No []
CPA9b	No passive trunk	8.4.2	O.45	Yes [] No []
NOTE—O.42 to O.45: Support of at least one option shown above is required.				

Update Annex K:

Annex K

(informative)

DTR Concentrator Functional Description

Replace K.4.1.3 with the following text:

K.4.1.3 Reserved addresses

Frames containing any of the group addresses specified in Table K.7 in their destination field shall not be relayed by the CRF. They shall be configured in the filtering database as static entries, and management shall not provide the capability to remove these addresses from the filtering database. These group addresses are listed in ISO/IEC 10038:1998, 7.12.4, and are duplicated here using the format for hexadecimal values defined in Clause 3.

Table K.7—Reserved addresses

Assignment	Value
Bridge group address	80 01 43 00 00 00
IEEE Std 802.3x full duplex PAUSE operation	80 01 43 00 00 10
Reserved for future standardization	80 01 43 00 00 20
Reserved for future standardization	80 01 43 00 00 30
Reserved for future standardization	80 01 43 00 00 40
Reserved for future standardization	80 01 43 00 00 50
Reserved for future standardization	80 01 43 00 00 60
Reserved for future standardization	80 01 43 00 00 70
Reserved for future standardization	80 01 43 00 00 80
Reserved for future standardization	80 01 43 00 00 90
Reserved for future standardization	80 01 43 00 00 A0
Reserved for future standardization	80 01 43 00 00 B0
Reserved for future standardization	80 01 43 00 00 C0
Reserved for future standardization	80 01 43 00 00 D0
Reserved for future standardization	80 01 43 00 00 E0
Reserved for future standardization	80 01 43 00 00 F0

Update two MIB items in K.6.1 with the following text:

```
dtrConcMIB   MODULE-IDENTITY
      LAST-UPDATED “  9830071270Z “
      ORGANIZATION “ IEEE 802.5 “
      CONTACT-INFO
                  “
                  Stephen A. Owen
                  IBM
                  E95A/664
                  RTP, NC 27709
```

```
                  USA
                  saowen@us.ibm.com
                  (919) 254-4413
                  ”
      DESCRIPTION
            “ The MIB Module for DTR Concentrators. “
::= { ieee8025dtr 2 }

dtrCRFMaxInfo   OBJECT-TYPE
      SYNTAX            INTEGER(516..18207)
      MAX-ACCESS  read-only
      STATUS            current
      DESCRIPTION
            “ The maximum size of the INFO field the CRF can trans-
            mit/receive. “
::= { dtrCRFEntry 5  }
```

Replace Annex L with the following:

Annex L

(Informative)

DTR Station and C-Port in Station Emulation Mode using the TXI Access Protocol—Join, Transmit, and Monitor low-level FSMs—4 Mbit/s, 16 Mbit/s, and the HMR

This annex contains the 9.2 FSMs illustrated by Figures 9.2-2 through 9.2-4, but with the level of detail found in the 9.2 Station Operation Tables.

— Figure L-1 contains the Join FSM with the state transition detail of 9.2, Table 9.2-1.
— Figure L-2 contains the Transmit FSM with the state transition detail of 9.2, Table 9.2-2.
— Figure L-3 contains the Monitor FSM with the state transition detail of 9.2, Table 9.2-3.

The rules for these FSMs are identified in 9.1.1.9.

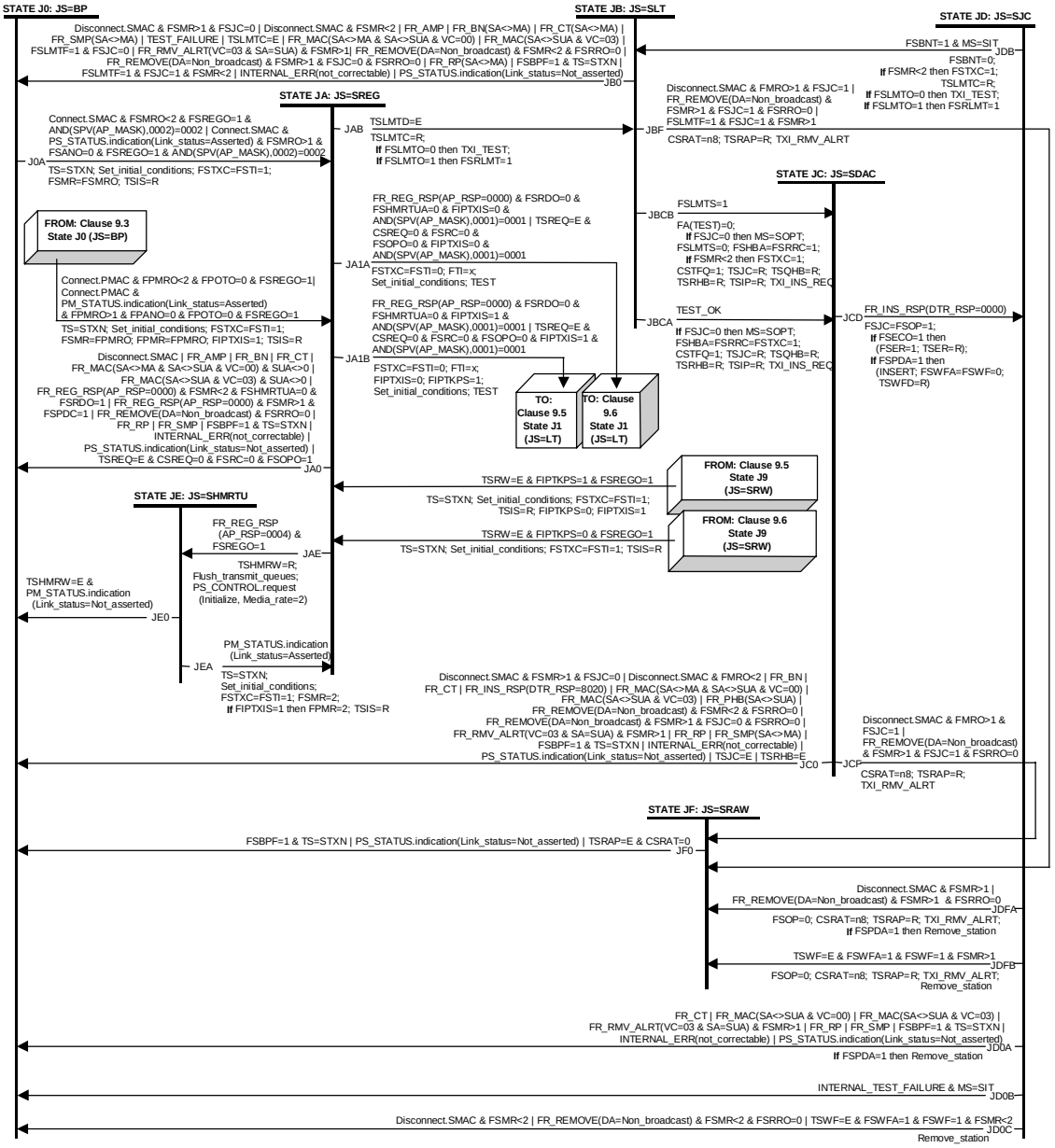

Figure L.1—Join FSM

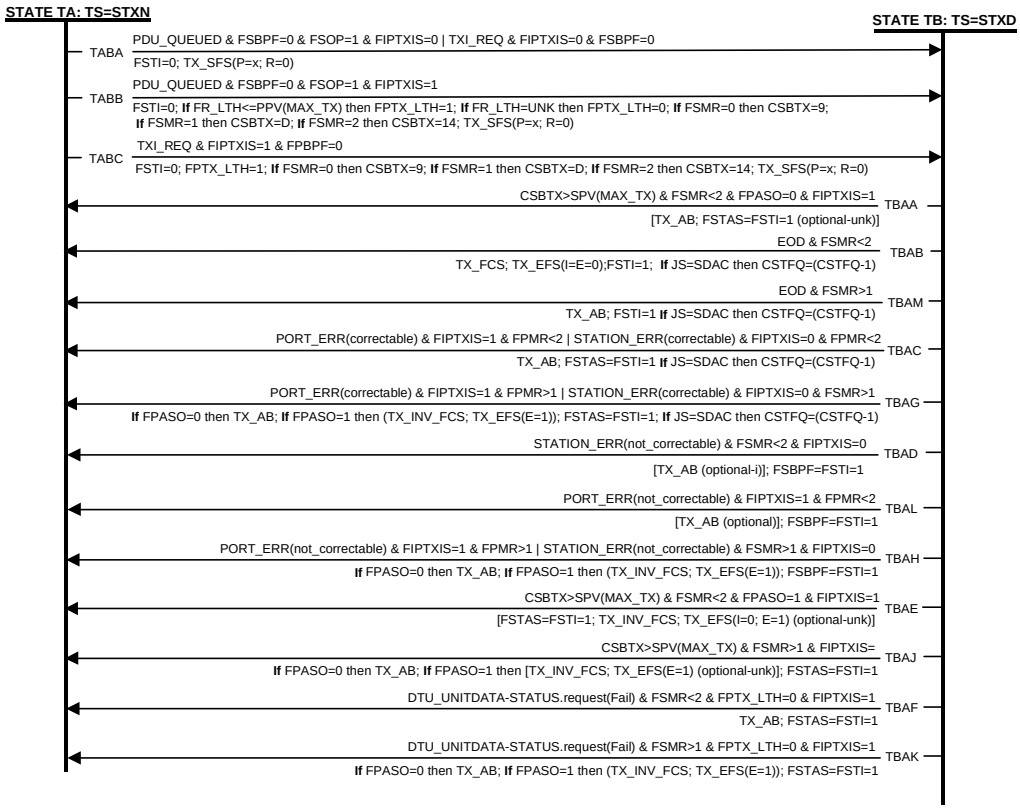

Figure L.2—Transmit FSM

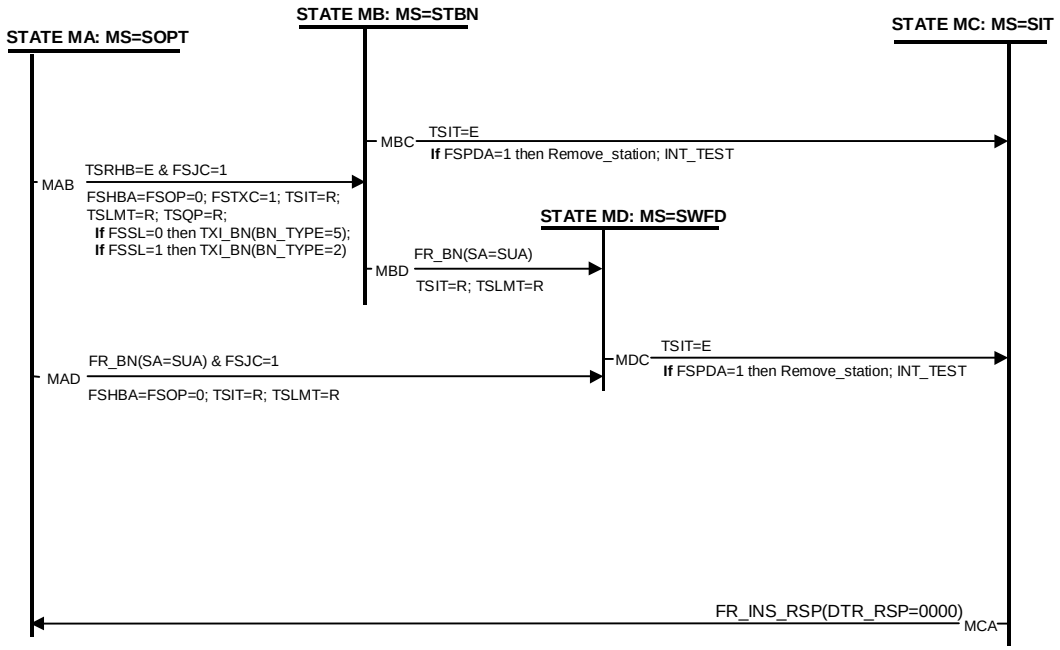

Figure L.3—Monitor FSM

Replace Annex M with the following:

Annex M

(informative)

C-Port in Port Mode using the TXI and TKP Access Protocols—Join, Transmit, and Monitor low-level FSMs—4 Mbit/s, 16 Mbit/s, and the HMR

This annex presents the 9.3 FSMs contained in Figures 9.3-1 through 9.3-3, with the same level of detail that can be found for state transitions in the C-Port Port Operation Tables (Tables 9.3-1 through 9.3-3).

— Figure M-1 contains the C-Port Join FSM for TXI support with the state transition detail of 9.3, Table 9.3-1.
— Figure M-2 contains the C-Port Join FSM for TKP support with the state transition detail of 9.3, Table 9.3-1.
— Figure M-3 contains the C-Port Transmit FSM with the state transition detail of 9.3, Table 9.3-2.
— Figure M-4 contains the C-Port Monitor FSM with the state transition detail of 9.3, Table 9.3-3.

The rules for these FSMs are identified in 9.1.1.9.

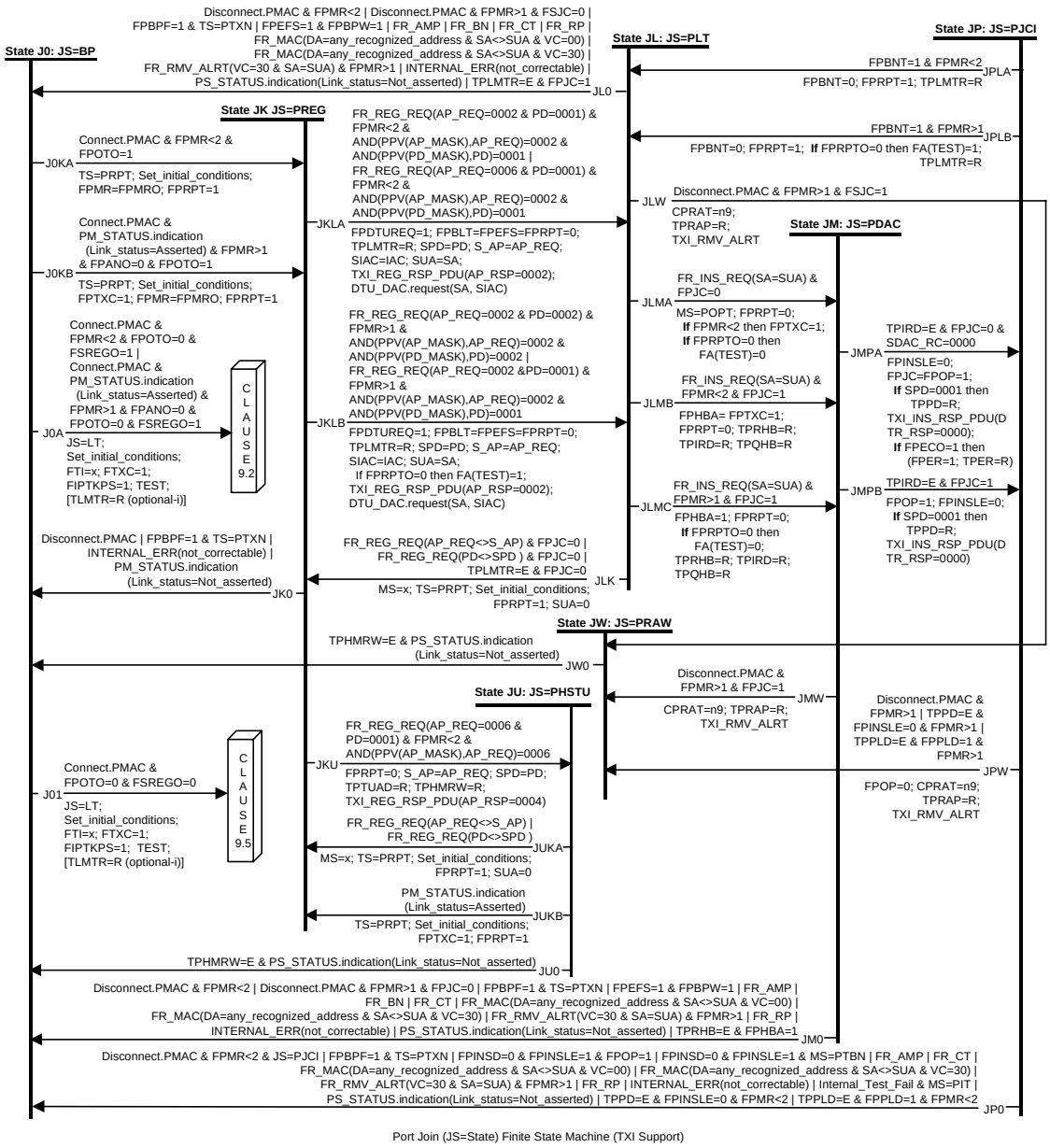

Figure M.1—C-Port Join (JS=State) FSM (TXI Access Protocol support)

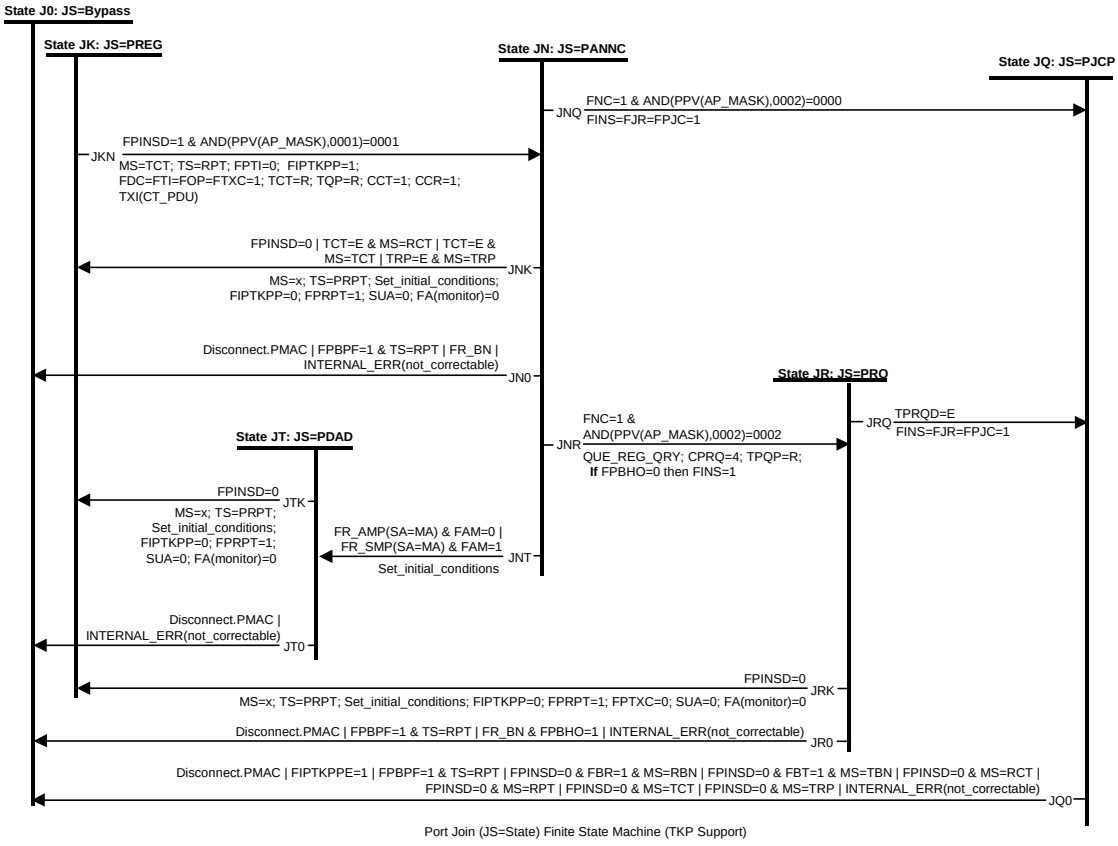

Figure M.2—C-Port Join (JS=State) FSM (TKP Access Protocol support)

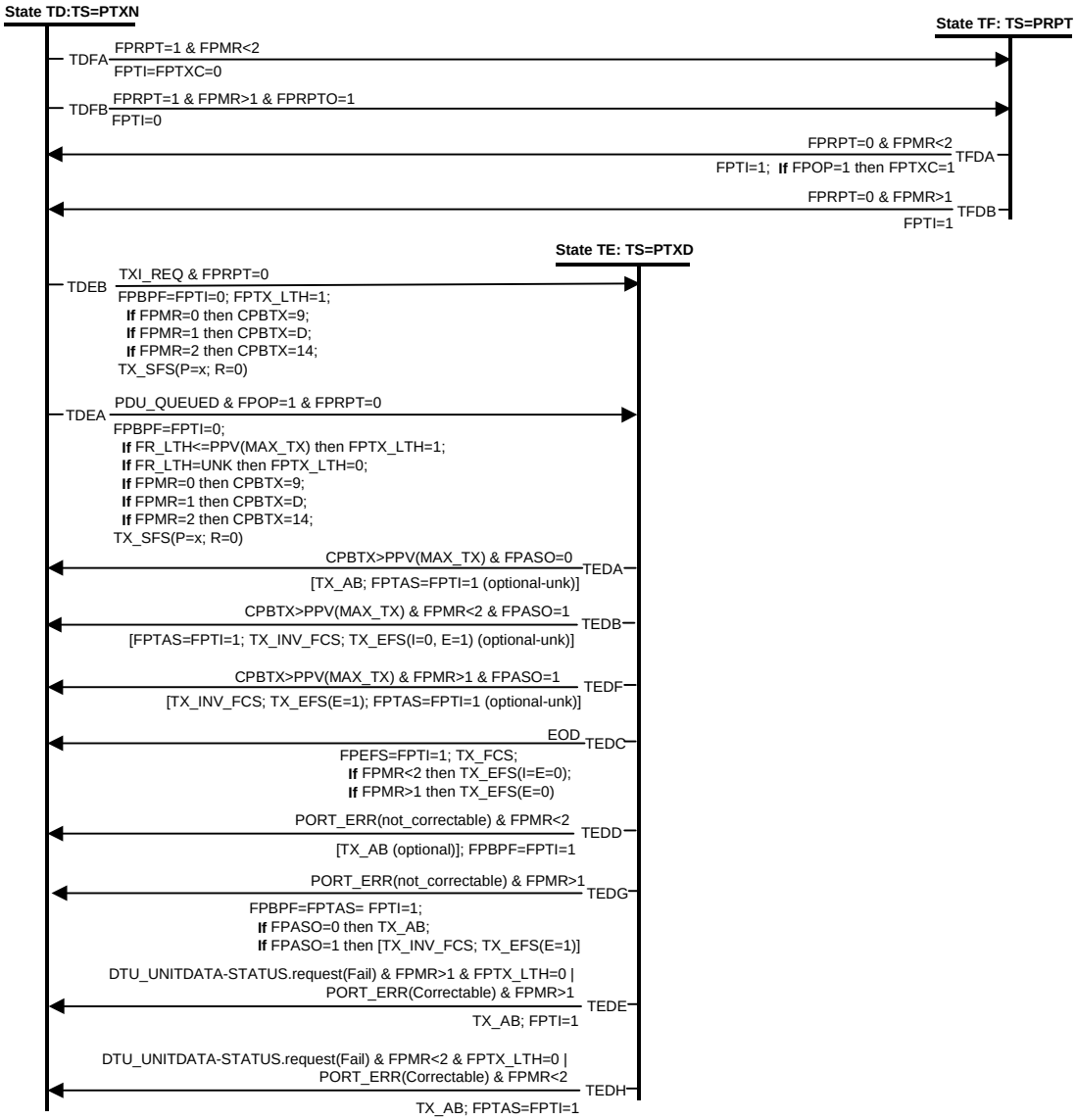

Figure M.3—C-Port Transmit (TS=State) FSM (TXI Access Protocol support)

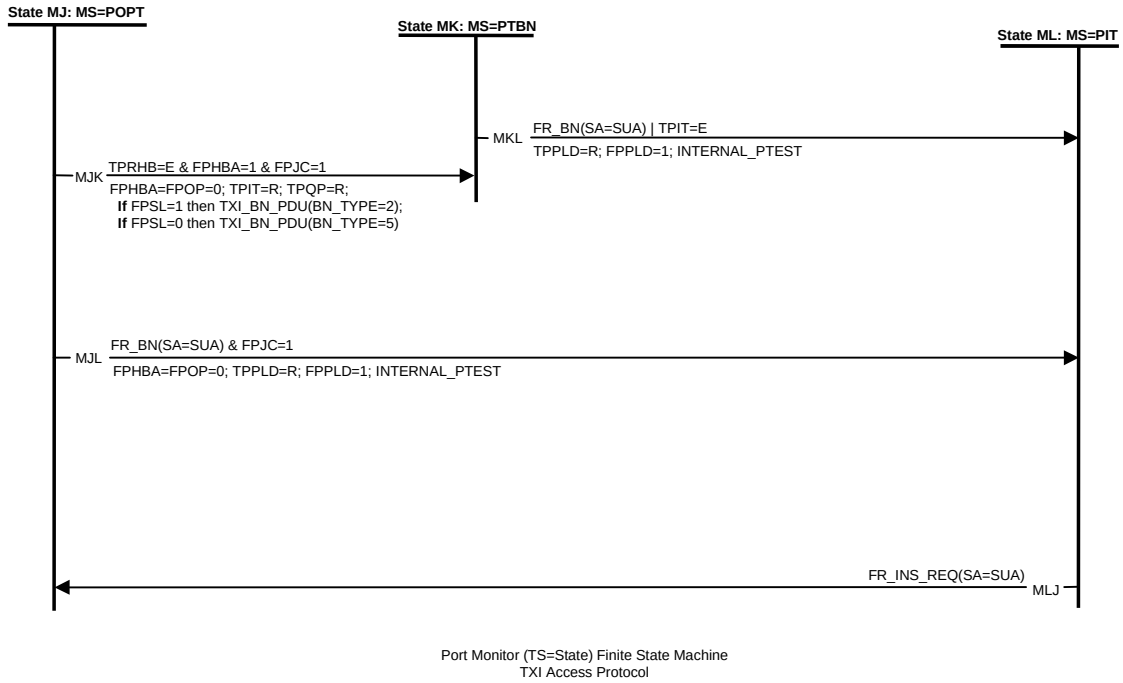

Figure M.4—C-Port Monitor (MS=state) FSM (TXI Access Protocol support)

Change the title of Annex N to the following:

Annex N

(informative)

C-Port in Port Mode using the TKP Access Protocol—Transmit and Monitor low-level FSMs—4 Mbit/s and 16 Mbit/s

Change the title of Annex O to the following:

Annex O

(informative)

Channel considerations for 16 Mbit/s Token Ring

Replace Annex P with the following:

Annex P

(normative)

Bit error rate (BER) criteria for lobe media testing

This annex presents analysis that can be used when designing lobe media testing for the Token Passing Access Protocol (TKP) or Transmit Immediate Access Protocol (TXI) operations. It is based on the assumption that frame error rate affects Token Ring operation as if the BERs were an independent random variable, with probabilities in the range of the calculations. Although line noise will often produce a burst error rather than a single error, each burst generally corrupts only a single frame. Therefore, the noise-induced frame error rate will be approximately the same as the frame error rate would be if each error-producing noise event produces only a single bit error. The analysis below derives the error rate based on this single bit error per event assumption, and can be applied to noise-induced errors observed in Token Ring networks.

The BER requirement for a Station operating on a conformant link and attached to a conformant concentrator is specified in Clause 7, and is not specifically validated by the Lobe Media Test (LMT). The purpose of the LMT is twofold.

a) The LMT must prevent the network attachment of stations whose BER would adversely affect the network performance.
b) The LMT must prevent rejection of a station that would meet the BER criteria if attached.

A further requirement for the LMT is that it must not unduly delay attachment of the station to the network.

These criteria are met by choosing an LMT pass/fail criteria of BER = 10^{-6}, where links with a BER of 10^{-7} or better would have a ≥99% chance of passing the test, and links with a BER of 10^{-5} or worse would have a ≥99% chance of failing the test. During the LMT, the station shall pass, with a probability of >99%, a lobe that has a sustained bit error rate of 10^{-7} or better, and shall fail, with a probability of >99%, a lobe that has a sustained bit error rate of 10^{-5} or worse. The following analysis provides the mathematical basis for designing an appropriate LMT.

Note that BER, expressed quantitatively for Token Ring network links, is a construct used to provide an estimator of the number of transmitted frames that are expected to be received in error because of noise. For complex coding, the term provides only an approximation of the actual error rate. However, since we are looking to distinguish among BERs that differ by an order of magnitude or more from each other, this approximation is adequate. The analysis below, based on this construct, provides a useful estimator for the frame error rate, even though noise errors may not produce single bit errors. Therefore, for Token Ring networks, BER testing, as described in this annex, will provide a valuable measurement as to the usability of a link between a station and its attaching port at all data rates to which it is applied. The way BER is used in the analysis below, one can expect a frame error rate due to noise to be approximately equal to the computed or measured BER times the number of information bits in a frame (including header and footer bits). This assumption is even true for 4B/5B line coding, where the bits being referred to are the bits as seen above the signaling level and, therefore, would be equal to 80% of the bit count measured on the transmission line.

P.1 BER Testing: Analysis

Given an LMT that employs "**m**" frames, each with an equal length of "**n**" bits, and each with a criteria that the test passes if no more than a single frame contains errors, what is the probability of the LMT failing that test given

— All bit errors are independent events; and
— The probability of a single bit error is **q?**

Analysis

The probability of completing the test without detecting any bit errors = $\mathbf{(1-q)^{nm}}$.

The probability of a ***single*** frame being in error = **1– (probability that it arrives without error):**

Probability_of_error = $\mathbf{1-(1-q)^{n}}$; i.e. the first frame has an error.

The probability that the rest of the frames are error free is the probability that there are no errors in the next **n(m–1)** bits:

The probability of having **m–1** frames without error = $\mathbf{(1-q)^{n(m-1)}}$.

Therefore, the probability that the first frame has at least one error and the rest of the frames are error free is

$$\mathbf{(1-(1-q)^{n})(1-q)^{n(m-1)}}$$

This expression is also equal to the probability that all frames but the second are error free, which equals the probability that all frames but the third are error free.

Therefore, the probability that exactly one frame has errors is the sum of these **m** terms, **1** (one) for each frame, and we get the probability that successfully completing the test with a single frame having an error is equal to

$$\mathbf{m(1-(1-q)^{n})(1-q)^{n(m-1)}}$$

Therefore, the total probability of completing the tests successfully is

$$\mathbf{(1-q)^{nm}+m(1-(1-q)^{n})(1-q)^{n(m-1)}}$$

Let $\mathbf{p = 1-q}$ and we get

$$\mathbf{p^{nm}+m(1-p^{n})p^{n(m-1)}} = \mathbf{p^{n(m-1)}(p^{n}+m(1-p^{n}))}$$

$$= \mathbf{p^{n(m-1)}(m-(m-1)p^{n})}$$

This equation can be plugged into a spreadsheet for various values of **n, m**, and **p** to show what is needed to have the probability of passing the test of ≥99% if BER is ≤ $\mathbf{10^{-7}}$, and the probability of failing the test of ≥ 99% if BER ≥ $\mathbf{10^{-5}}$.

There is a broad range of solutions that satisfies these criteria. This range includes LMTs with one million bits, in 256 bit to 1024 bit equal length frames, and a pass/fail criteria as follows:

— The LMT passes if there are 0 or 1 frames with error(s);
— The LMT fails if there are 2 or more frames with error(s).

NOTE—For this analysis, a frame is not considered to be with error if the error is due to a Token with error. This condition is required to satisfy the initial assumption that each frame has an equal and known length. Circulating tokens would contribute an unknown number of bits to each frame transmitted, and might cause LMT to fail a good lobe.

Change the title of Annex Q to the following:

Annex Q

(informative)

DTR Station using the TKP Access Protocol—Join, Transmit, and Monitor low-level FSMs—4 Mbit/s and 16 Mbit/s

Change the title of Annex R to the following:

Annex R

(informative)

C-Port in Station Emulation Mode using the TKP Access Protocol—Join, Transmit, and Monitor low-level FSMs—4 Mbit/s and 16 Mbit/s

Replace Annex T with the following:

Annex T

(informative)

Auto-detection protocol

4 Mbit/s and 16 Mbit/s using the TXI and TKP Access Protocols

This annex provides an optional method for DTR Concentrators to dynamically determine the operational mode (Port Mode or Station Emulation Mode) of each of its C-Ports. Using this method, manufacturers can develop products that are interoperable with

— Any 802.5-compliant products that have this capability and adhere to these recommendations;
— Classic Token Ring Stations[2];
— DTR Stations supporting the 4 Mbit/s and 16 Mbit/s media rates;
— Classic concentrators.

T.1 C-Port Auto-detection FSM overview

The Auto-detection FSM, shown in Figure T-1, is started when the 9.3 C-Port Join Port Operation Table is active and in its Bypass state (JS=BP). All other 9.3 C-Port Port Operation Tables are inactive.

The Auto-detection FSM is a “supervisory” FSM that modifies the C-Port Policy flag FPOTO to allow Port Management to issue a Connect.PMAC command to the 9.3 C-Port Join Port Operation Table once the Auto-detection protocol has determined the type of C-Port link connection to be made. In order to accomplish this, the Auto-detection FSM makes use of state machine elements and FSMs that are defined in Clause 4 and Clause 9. The Auto-detection FSM manipulates the Interface flags FIPTXIS and FIPTKPS, activates and deactivates the Wire Fault process, and activates and deactivates the TXI Transmit FSM defined in 9.3 and the TKP Transmit FSM defined in 9.5.

The following is true when the Auto-detection Port Operation Table T-2 defined in this annex is active:

— All Clause 9 Port Operation Tables are inactive, except the 9.3 and 9.5 Transmit Port Operation Tables, which are controlled by the Auto-detection Port Operation Table T-2.
— The Auto-detection Interface Signals Port Operation Table T-3 (defined in this annex) is active.
— Any frames recognized by the Auto-detection Port Operation Table T-2 must be as specified in Clause 3 and Clause 10.

The end result of the Auto-detection process is to allow Port management to start the 9.3 C-Port Join Port Operation Table with a Connect.PMAC command, with an option flag FPOTO value that directs the C-Port to start its operation in Port Mode (FPOTO=1) or Station Emulation Mode (FPOTO=0). The 9.3 C-Port Join Port Operation Table determines the Access Protocol to be used by the C-Port (either the TKP or TXI Access Protocol) as the result of this Connect.PMAC command.

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[2] During Active Detection state (AS=ADET, see T.1.3.3), there is a possibility that a directly attached station, attempting to join at that time, may fail its LMT.

Abbreviations and acronyms

AMAC = Auto-detection MAC protocol entity

Assumptions and requirements

This Auto-detection FSM shown in Figure T.8 assumes that the C-Port is enabled to run the TKP and TXI Access Protocols in both Station Emulation mode and Port Mode. In addition, this method requires a repeat path to be available from any attached C-Port.

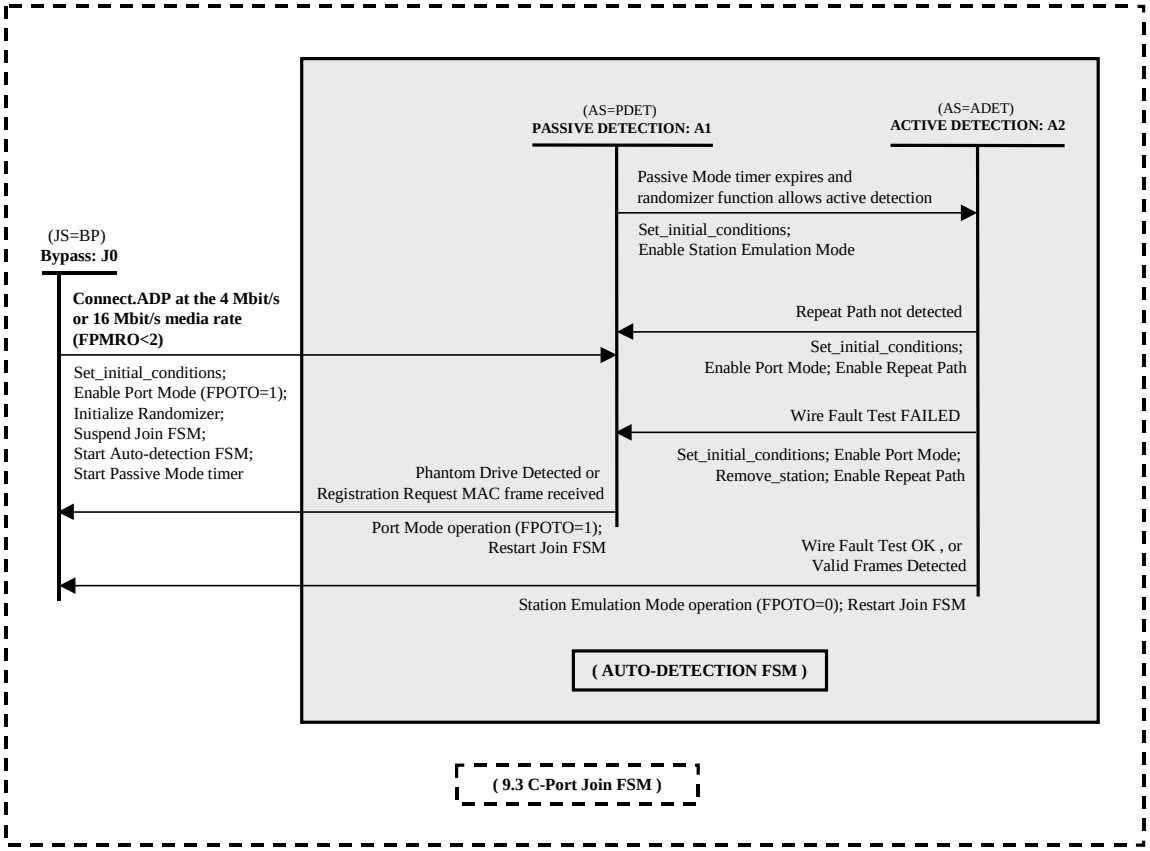

Figure T.1—Overview Auto-detection FSM (shaded)

T.1.1 Finite state notation

In addition to the rules outlined in 4.2.1 and 9.1.1.1, the following additional rules are used when evaluating the FSMs in this annex:

a) Actions are considered to occur simultaneously, except for changes to the PMC_Mode (see T.2.1).

b) A delay must be introduced to permit the PMC to respond and the electronics to settle when the FPOTO=0 or FPOTO=1 condition causes a change to the PMC_Mode (see T.2.1). This delay will vary based on the particular implementation used by the manufacturer. The following order is maintained when an action requires a change in the PMC_Mode:

   1) PMC_Mode change.
   2) Delay to permit the PMC to respond and the electronics to settle.
   3) Perform all other actions.

c) The following Auto-detection Port Operation Table "S/T" notations are unique to this annex:

S/T term	Meaning of S/T term
J0(A1)	The 9.3 Join Bypass state (J0) enters the Auto-detection state Passive Detection state (A1).
A1(J0)	The Auto-detection Passive Detection state (A1) enters the 9.3 Join Bypass state (J0).
A2(J0)	The Auto-detection Active Detection state (A2) enters the 9.3 Join Bypass state (J0).

T.1.2 Abbreviations and notations

The following abbreviations and notations are used in the Auto-detection Operation Tables and State Machine descriptions:

Auto-detection C-Port Policy Flag Notations

FPOTO = Flag, C-Port Operation Table Option

PMAC Interface Flag Notations

FIPTKPS = Flag, Interface C-Port TKP Station Emulation

FIPTXIS = Flag, Interface C-Port TXI Station Emulation

AMAC Protocol Flag Notations

FAFTST = Flag, AMAC Frame Transmit Test

FARH = Flag, AMAC Remove Hold

FARS = Flag, AMAC Remove Station

FAWF = Flag, AMAC Wire Fault

FAWFA = Flag, AMAC Wire Fault Active

FAWTST = Flag, AMAC Wire Fault Test

PMAC Protocol Flag Notations

FPINSD = Flag, C-Port Insert Detected

FPRPT = Flag, C-Port Repeat Path Enabled

SMAC Protocol Flag Notations

FSTI = Flag, Station Transmit Idles

FSTXC = Flag, Station Transmit from Crystal

MAC Protocol Flag Notations

FTI = Flag, Transmit Idles

FTXC = Flag, Transmit from Crystal

AMAC Timer Notations

TAACT = Timer, AMAC Active Detection

TAPAS = Timer, AMAC Passive Detection

TARH = Timer, AMAC Remove Hold

TARW = Timer, AMAC Remove Wait

TAWF = Timer, AMAC Wire Fault

TAWFD = Timer, AMAC Wire Fault Delay

TAWTST = Timer, AMAC Wire Fault Test

AMAC Auto-detection State Notations (AS=)

ADET = Active Detection

PDET = Passive Detection

PMAC Join State Notations (JS=)

BP = Bypass

MAC Transmit State Notations (TS=

DATA = Transmit frame data

FILL = Transmit fill and release token

RPT = Repeat

STRIP = Strip transmitted frames and transmit fill

SMAC Transmit State Notations (TS=

STXD = Station transmit frame data

STXN = Station transmit normal

PMAC Transmit State Notations (TS=)

PRPT = C-Port Repeat

PTXD = C-Port Transmit Frame Data

PTXN = C-Port Transmit Normal

T.1.3 State machine elements

SMAC, PMAC, and MAC machine elements defined in previous clauses are not repeated in this annex. New state machine elements, unique to the AMAC, are defined in this section. Timers, while normally defined in Clause 3 and Clause 10, are defined for the AMAC in this annex.

T.1.3.1 AMAC timers

Timer, AMAC Active Detection (TAACT). This timer controls the amount of time spent during the frame transmit test in the Active Detection state (AS=ADET). The value of the timer is in the range of 20 ms to 40 ms.

Timer, AMAC Passive Detection (TAPAS). This timer controls the amount of time spent in the Passive Detection state (AS=PDET). The value of the timer is in the range of 2.8 s to 3.2 s.

Timer, AMAC Remove Hold (TARH). The AMAC FSM uses this timer to delay the attempt to drop Phantom within 5 s of asserting Phantom. This allows compatibility with older concentrator implementations that require Phantom signaling for a minimum period to ensure successful deinsertion when Phantom is dropped. The value of TARH is in the range of 5 s to 7 s.

Timer, AMAC Remove Wait (TARW). The AMAC FSM uses this timer to ensure repeat path availability when dropping Phantom. This allows compatibility with concentrator implementations that exhibit a delay between the deinsert request and when the lobe is removed from the ring. The value of the timer is a minimum of 200 ms.

Timer, AMAC Wire Fault (TAWF). This timer provides a sampling time to filter the detection of wire fault. The value of the timer is in the range of 0 s to 10 s. A value of 5 s is recommended.

Timer, AMAC Wire Fault Delay (TAWFD). This timer delays the start of wire fault testing. It ensures that the asserted Phantom signal has had time to stabilize. The value of the timer is in the range of 5 s to 10 s. An additional requirement for the selection of this timer value for an implementation is that the sum of TAWFD + TAWF be a minimum of 7 s.

Timer, AMAC Wire Fault Test (TAWTST). This timer controls the time spent performing a wire fault test. The value of the timer is in the range of 7 s to 20 s. An additional requirement for the selection of this timer value for an implementation is that the value of TAWTST is greater than or equal to the sum of TAWFD + TAWF.

T.1.3.2 AMAC protocol flags

Flag, AMAC Frame Transmit Test (FAFTST). This flag is used during the Active Detection state (AS=ADET) and indicates that a frame transmit test is in progress.

Flag, AMAC Remove Hold (FARH). This flag indicates that a minimum waiting time has elapsed before a Remove_station action is allowed to occur. This flag is set to 0 when an INSERT action is required as part of the wire fault test. This flag is set to 1 when a minimum waiting time has elapsed (TARH=E).

Flag, AMAC Remove Station (FARS). This flag indicates that a Remove_station action is being requested. This flag is used with FARH to determine if a Remove_station action may occur. This flag is set to 1 when a frame is received (FR) while performing the wire fault test in the Active Detection state (AS=ADET).

Flag, AMAC Wire Fault (FAWF). This flag indicates that an unfiltered wire fault detection event has occurred. This flag is set to 1 when the PMC detects a wire fault. This flag is set to 0 when the PMC detects that the wire fault condition no longer exists.

Flag, AMAC Wire Fault Active (FAWFA). This flag indicates whether wire fault checking is operational. This flag is set to 1 when the timer TAWFA expires, indicating that the Phantom signal has stabilized and wire fault checking is operational. It is set to zero to disable wire fault checking.

Flag, AMAC Wire Fault Test (FAWTST). This flag, used during the Active Detection state (AS=ADET), indicates whether a wire fault test is in progress.

T.1.3.3 AMAC states

Active Detection (ADET). In this state, the Auto-detection FSM performs up to two active tests to determine if the C-Port is connected to a concentrator. The Auto-detection FSM sets the C-Port Policy flag FPOTO to 0, which causes the PMC to configure to Station Emulation mode. In this state, the Auto-detection FSM activates the Station TXI Transmit (9.3) and the Station TKP Transmit FSM (9.5). Only one transmit FSM is active at a time.

The first test performed is a frame transmit test. A Duplicate Address Test (DAT) frame is transmitted using the Station TXI Transmit FSM. A timer, TAACT, is used to control the duration of this test. If the timer TAACT expires before the frame is received, then the Auto-detection FSM transitions to the Passive Detection state (AS=PDET). If the DAT frame is received by the C-Port before the timer expires, then the second test, wire fault, is started.

The wire fault test is used by the Auto-detection FSM to determine if a wire fault can be detected. The Auto-detection FSM starts the Station TKP Transmit FSM and asserts the Phantom signal to start this test. The timer TAWTST controls the duration of this test. If a wire fault is detected before TAWTST expires, then the Auto-detection FSM transitions to the Passive Detection state (AS=PDET).

If a frame is received (FR) before TAWTST expires, or if TAWTST expires without a wire fault being detected, then the Auto-detection FSM directs Port Management to issue a Connect.PMAC with FPOTO=0 (C-Port operates in Station Emulation Mode) to the Join FSM and shuts down the Auto-detection FSM.

Passive Detection (PDET). In the Passive Detection state (AS=PDET), the Auto-detection FSM is waiting for a station or a C-Port in Station Emulation Mode to either send a Registration Request MAC frame or to raise the Phantom signal. The Auto-detection FSM sets the C-Port Policy flag FPOTO to 1, which causes the PMC to configure the C-Port in Port mode. In this state, the Auto-detection FSM supplies a repeat path, uses recovered clock (FPTXC=0), and activates the C-Port TXI Transmit FSM defined in 9.3.

If a Registration Request MAC frame is received, or if the Phantom signal is detected, then the Auto-detection FSM directs Port Management to issue a Connect.PMAC with FPOTO=1 (C-Port operates in Port mode) to the Join FSM and shuts down the Auto-detection FSM.

The duration of the Passive Detection state is controlled by the timer TAPAS. When this timer expires, the FSM transitions to the Active Detection state (AS=ADET). TAPAS is restarted during the Passive Detection state when a frame is received (FR) or when TAPAS expires and the randomizer function, PRND() (see T.1.4.5), returns with a 0 value.

T.1.4 Auto-detection operation tables

T.1.4.1 C-Port Join Port Operation Table additions

The following is an addition to the 9.3 C-Port Join Port Operation Table that allows Management to start the Auto-detection protocol for the 4 Mbit/s and 16 Mbit/s media rates.

Table T.1—C-Port Join Port Operation Table additions

S/T	REF	Event /Event and conditions	Actions/Outputs
J0(A1)	1199	**Connect.ADP** & FPMRO<2 & JS=BP << The 9.3 Join FSM recognizes a Connect requesting the Auto-detection Protocol for the 4 Mbit/s and 16 Mbit/s media rates. >>	JS=x; AS=PDET; Set_initial_conditions; FPOTO=1; TS=PRPT; FPRPT=1; TAPAS=R << Start in Port mode and enable the C-Port's repeat path. The 9.3 TXI C-Port Transmit FSM is operational, but all other 9.3 FSMs are inactive. >> << The Auto-detection Port Operation Table T-2 determines the operational mode in which the C-Port is to operate [Port mode (FPOTO=1) or Station Emulation mode (FPOTO=0)]. >>

T.1.4.2 Auto-detection Port Operation Table

The following is the Auto-detection protocol C-Port Port Operation Table used to select the mode in which the C-Port is to operate.

Table T.2—Auto-detection Port Operation Table

S/T	REF	Event /Event and conditions	Actions/Outputs
	2201	**FARS=1 & FARH=1** & AS=ADET	FARS=0; TARW=R; Remove_station << Remove station and then hold repeat path until the TCU is able to respond to the deinsert request. >>
A1(J0)	2202	**FPINSD=1** & AS=PDET << Classic Station detected. >>	JS=BP; AS=x; Connect.PMAC << Shut-down the Auto-detection FSM and restart the 9.3 Join FSM. >> << Port mode (FPOTO=1). >>
	2203	**FR** & AS=PDET	TAPAS=R << The receipt of a frame, even if not DA=any_recognized_address, causes an extension of the Passive Detection state. >>
	2204	**FR** & FAWTST=1 & AS=ADET << Frame received during the wire fault test. >>	FAWFA=0; FARS=1
	2205	**FR_DAT(SA=MA)** & FAFTST=1 & AS=ADET	TS=RPT; FIPTXIS=0; FIPTKPS=1; FAFTST=0; FAWTST=1; FARH=FAWFA=FAWF=FTI=FTXC=0; TARH=R; TAWFD=R; TAWTST=R; INSERT << Start the TKP Station Emulation Transmit FSM. >> << Repeat path detected; start-up the wire fault test to determine if connection to a valid port or a short). >>

Table T.2—Auto-detection Port Operation Table

S/T	REF	Event /Event and conditions	Actions/Outputs
A1(J0)	2206	**FR_REG_REQ** & AS=PDET	JS=BP; AS=x; Connect.PMAC << Shut down the Auto-detection FSM and restart the 9.3 Join FSM. >> << Port Mode (FPOTO=1). >>
A21A	2207	**TAACT=E** & FAFTST=1 & AS=ADET << Repeat path not detected. >>	AS=PDET; Set_initial_conditions; FPOTO=1; TS=PRPT; FPRPT=1; TAPAS=R << Start in Port mode and enable the C-Port repeat path. Start the 9.3 TXI C-Port Transmit FSM. All other 9.3 FSMs are inactive. >>
	2208	**TAPAS=E** & PRND()=0 & AS=PDET << Passive detection time out. >>	TAPAS=R << Continue Passive Detection state due to randomizer. >>
A12	2209	**TAPAS=E** & PRND()=1 & AS=PDET << Passive detection time out. >>	AS=ADET; Set_initial_conditions FIPTXIS=1; FPOTO=0; TS=STXN; FSTI=FSTXC=1; FAFTST=1; TAACT=R; TXI_DAT_PDU << Change to Station Emulation mode. Start the 9.2 TXI Station Transmit FSM. All other 9.2 FSMs are inactive. Start Active Detection timer. Transmit a DAT PDU. >>
	2210	**TARH=E** & AS=ADET	FARH=1 << The Remove Hold period over. >>
A2(J0)	2211	**TARW=E** & AS=ADET	JS=BP; AS=x; FIPTKPS=0; Connect.PMAC << Shut down the Auto-detection FSM and restart the 9.3 Join FSM. >> << Station Emulation mode (FPOTO=0). >>
A21B	2212	**TAWF=E** & FAWFA=1 & FAWF=1 & AS=ADET << Wire fault *is* detected. >>	AS=PDET; Remove_station; Set_initial_conditions; FPOTO=1; TS=PRPT; FPRPT=1; TAPAS=R << Start in Port mode and enable the C-Port repeat path. Start the 9.3 TXI C-Port Transmit FSM. All other 9.3 FSMs are inactive. >>
	2213	**TAWFD=E** & FARS=0 & AS=ADET	FAWFA=1 << Phantom has stabilized and the hardware is ready for wire fault detection. >>
A2(J0)	2214	**TAWTST=E** & AS=ADET << Wire Fault *is not* detected. >>	JS=BP; AS=x; FIPTKPS=0; Remove_station; Connect.PMAC << Shut down the Auto-detection FSM and restart the 9.3 Join FSM. >> << Station Emulation mode (FPOTO=0). >>

T.1.4.3 Auto-detection Interface Signals Port Operation Table

Table T.3—Auto-detection Interface Signals Port Operation Table

S/T	REF	Event /Event and conditions	Actions/Outputs
	2401	**FPOTO=0**	PM_CONTROL.request (PMC_Mode=Station_emulation_mode)
	2402	**FPOTO=1**	PM_CONTROL.request (PMC_Mode=Port_mode)
	2403	**PM_STATUS.indication (Wire_fault=Not_detected)** & FAWF=1 << Wire fault is no longer indicated. >>	FAWF=0
	2405	**PM_STATUS.indication(Insert=Detected)**	FPINSD=1
	2406	**PM_STATUS.indication(Insert=Not_detected)**	FPINSD=0
	2404	**PM_STATUS.indication(Wire_fault=Detected)** & FAWFA=1 & FAWF=0 << Wire fault is indicated; start Wire Fault sample period. >>	FAWF=1; TAWF=R

T.1.4.4 Precise specification of terms

This section provides a precise specification of terms used by the Auto-detection Operation Tables. These specifications are for the “Event/Event and conditions” and “Actions/Outputs” columns.

T.1.4.5 Precise specification of “Event/Event and conditions”

The following definitions are applied to the terms used for events in the FSMs and Auto-detection Operation Tables.

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
{term1} = {term2}.	Term 1 is equal to term 2.
{term1} < {term2}	Term 1 is less than term 2.
{flag}=0	The specified flag is set to zero (false).
{flag}=1	The specified flag is set to one (true).
{timer}=E	The specified timer has expired.

The following additional items of relevance are used in the tables:

— **&** means “and.”
— Values are in hexadecimal notation unless otherwise indicated.

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
AS=state	The Auto-detection is in the specified state
Connect.ADP	The C-Port receives this command from C-Port Management to start the Auto-detection FSM to determine the proper setting of FPOTO. The Auto-detection FSM acts as a C-Port Management proxy and, once it has determined the correct value of FPOTO, issues a Connect.PMAC command to C-Port Management. The C-Port Management response is to issue the appropriate Connect.PMAC to the 9.3 Join FSM with the value of FPOTO provided by the Auto-detection FSM.
FR	A frame has been received that meets the criteria specified in 4.3.2.
FR_DAT(criteria)	A verified DAT MAC frame with the specified criteria is received.
FR_REG_REQ	A verified Registration Request MAC frame is received.
PM_STATUS.indication (Wire_fault=Not_detected)	The PHY indicates no wiring fault (see T.2).
PM_STATUS.indication (Wire_fault=Detected)	The PHY indicates a wiring fault (see T.2).
PM_STATUS.indication (Insert=Detected)	The PHY indicates an insert request is received via the phantom signaling channel (see 9.7.1.2.1).
PM_STATUS.indication (Insert=Not_detected)	The PHY indicates the absence of an insert request on the phantom signaling channel (see 9.7.1.2.1).
PRND()=value	This is the randomizer function used to control when the Active Detection state (AS=ADET) is entered from the Passive Detection state (AS=PDET). Valid values are 0 and 1. Implementations of PRND() should ensure that the following conditions are met: — The function returns with a value of 1 at least 25% of the time. This is required to reduce the time it takes for the Auto-detection FSM to detect a connection to a concentrator. — Two C-Ports using the same randomizer functions do not remain synchronized for an extended period of time.

T.1.4.6 Precise specification of "Actions/Outputs"

The following definitions are applied to the terms used for actions and outputs in the FSMs and Auto-detection Operation Tables. Actions and outputs are separated by a semicolon (**;**).

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
variable = value	Set the variable to the specified value.
{flag}=0	Set the value of the specified flag to zero (false).
{flag}=1	Set the value of the specified flag to one (true).
{timer}=R	The specified timer is set to its initial value and started.

The following additional items of relevance are used in the tables:

— **;** means "and."
— Values are in hexadecimal notation unless otherwise indicated.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
AS=state	The Auto-detection FSM changes to the indicated state.
AS=x	The Auto-detection FSM changes to the unspecified state (not active).
Connect.PMAC	The C-Port receives this command from the Auto-detection FSM to start the process to join the network. The Auto-detection FSM is permitted to act as a management proxy to determine the value of FPOTO and direct Port Management to issue a Connect.PMAC command with this FPOTO value.
INSERT	Request the PHY to physically connect the Station to the network [5.1.4.2 PM_CONTROL.request(Insert_station)].
JS=x	The 9.3 Join FSM changes to the unspecified state (not active).
PM_CONTROL.request (PMC_Mode=Port_mode)	Request the PHY to change the PMC to support Port mode operation (see T.2.1).
PM_CONTROL.request (PMC_Mode=Station_emulation_mode)	Request the PHY to change the PMC to support Station Emulation mode (see T.2.1).
Remove_station	Request the PHY to physically disconnect the Station from the network [5.1.4.2 PM_CONTROL.request(Remove_station)].
Set_initial_conditions	The C-Port shall set all PMAC flags to zero, set all PMAC counters to zero, and stop all timers. The Monitor FSM and Transmit FSM are not specified. The PS_CONTROL.request(Medium_rate) and PM_CONTROL.request(Medium_rate) shall indicate to the PHY the value of FPMRO.
TXI_DAT_PDU	The C-Port shall transmit a DAT MAC frame. The frame shall contain all of the required subvectors. The transmission of the frame shall occur at the earliest opportunity. This action generates the TXI_REQ event.

T.2 MAC interface service specification

The following service primitives specify the required information that is passed between the AMAC and the PMC. This service specification is solely for the purpose of explaining Auto-detection Operation Table operation, and does not imply any particular implementation. This service specification is *in addition* to the PMAC service specification defined in 9.7.1.2.2.

PM_CONTROL.request

The following primitive is used by the AMAC to request certain actions of the PMC:

PM_CONTROL.request [PMC_Mode]

PMC_Mode is specified as one of the following.

Port_mode
Station_emulation_mode

When generated: The AMAC generates a PM_CONTROL.request for each PMC action request.

Effect of receipt: The PHY performs the appropriate action, as follows:

— When Port_mode is requested, the C-Port's PHY is connected to the media as a C-Port.
— When Station_emulation_mode is requested, the C-Port's PHY is connected to the media as a Station.

T.3 Recommendations for ring speed detection

In 5.2 of ANSI/IEEE Std 802.5, 1998 Edition, as part of the discussion on implementation of the Medium_rate_error function, the standard cautions that "certain ring conditions, such as circulating BURST4 data patterns, may create an incorrect frequency determination." Therefore, it is recommended that the mechanism used to determine ring speed be based on the reception of tokens or frames.

Add Annex U:

Annex U

(informative)

100 Mbit/s PHY design using 802.3 100BASE-X PHY implementations

This annex lists the minimal requirements on and specific functions not required from a 100BASE-X PHY implementation as it is used by a 100 Mbit/s Token Ring.

U.1 100BASE-X functions required by 100 Mbit/s Token Ring

a) MII Signals:
   1) TXD;
   2) TX_EN;
   3) TX_ER;
   4) TX_CLK;
   5) RXD;
   6) RX_ER;
   7) RX_CLK;
   8) RX_DV;
   9) MDC;
   10) MDIO.

b) Abilities:
   1) 100BASE-X full duplex;
   2) Support of 18207 octet frames.

U.2 100BASE-TX functions not currently used by 100 Mbit/s Token Ring

a) Abilities
   1) Auto-negotiation ability[3]

U.3 100BASE-X functions not used by 100 Mbit/s Token Ring

a) MII Signals:
   1) COL;
   2) CRS.

b) Abilities:
   1) 100BASE-X half duplex;
   2) Preamble suppression;
   3) Remote fault;
   4) Extended (register set) capabilities.

[3] For further information about Auto-negotiation for High-speed Token Ring, refer to Annex Z.

Add Annex V:

ANNEX V

(informative)

Group MAC address hashing

A method of filtering group addresses using a hash function is described in this annex. Organizations that assign group addresses may choose to allocate group addresses so that the hash function described here maps group addresses to distinct equivalence classes.

This section applies to frames addressed to nonfunctional group addresses.

A nonfunctional group addressed frame not recognized by the standard address recognition function is passed to the hash filter. This compares a hash function, described below, of the group address to the hash function of each wanted group address. The hash function splits the full range of possible group addresses into a smaller range of equivalence classes and copies frames belonging to a wanted equivalence class.

If there is a match, the frame is copied; but since an exact match has not been proven, the A and C bits should not be set. The frame must later be reexamined to discard any frame copied because its hash function equaled the hash function of a wanted address, even though it was not an exact match of a wanted address.

The hash function is the high order N bits of the remainder after division (modulo 2) of

> The product of X^{32} and the polynomial of degree 47, whose high order coefficient is the first received bit of the group address and whose low order coefficient is the last received bit of the group address

by

> The generator polynomial G(X) (see 3.2.7).

Any other hash function that splits group addresses into the same set of equivalence classes is considered equivalent to the one described.

Implementations may vary the number (N) of bits of the remainder examined. As a minimum, it is suggested that 6 bits (the coefficients of X^{31} to X^{26}) should be examined, splitting group addresses into 64 equivalence classes.

Add Annex W:

Annex W

(informative)

100 Mbit/s PHY designs using MII variants

This annex lists the functionality and interfaces required of a PHY device in order to be able to support 100 Mbit/s Token Ring in accordance with this supplement. Some such devices present an interface that is a variation of the media independent interface defined in [802.3u], and in such cases, some functionality required for token ring may not be present or may be modified. Some known variations are described in terms of their suitability for use with this supplement.

W.1 Signal level functions required by 100 Mbit/s Token Ring

W.1.1 100 Mbit/s Token Ring signals with common definitions

The following signals, or their equivalents, are likely to be present in a form that is unchanged or not significantly changed in all MII-variant PHY implementations, since they are required by 100BASE-X and 100 Mbit/s Token Ring in the same format:

— TXD (although a different bus width may be used);
— RXD (although a different bus width may be used);
— TX_EN;
— RX_ER;
— MDC;
— MDIO.

W.1.2 100 Mbit/s Token Ring signals with unique definitions

This section addresses MII signals that support 100 Mbit/s Token Ring functions that do not exist in all 100BASE-X implementations, or 100BASE-X functions that do not exist in the 100 Mbit/s Token Ring.

W.1.2.1 TX_ER

This signal is usually not used in 100BASE-X implementations and, therefore, may not be present on new PHY devices. To support 100 Mbit/s Token Ring, this signal, or a suitable substitute that will allow for real-time insertion of the /H/ code-group into the bit stream, must be implemented.

W.1.2.2 RX_DV

This signal may be combined with CRS in some PHY implementations. This is acceptable as long as the capability exists to turn off the combined function of the pin, resulting in a signal that is RX_DV only.

W.2 Operational functions required by 100 Mbit/s Token Ring

W.2.1 Flushing of the data stream after detection of a code violation

In [802.3u] implementations, any data received after detection by the PHY of a code violation is ignored. New PHY implementations may, therefore, choose to flush this data and not make it available to the MAC layer. In 100 Mbit/s Token Ring implementations, the MAC requires this data, which includes the ET and possibly other useful information. The PHY must not flush this information and must transfer all data to the MAC layer until the ESD is detected or a failure event has occurred on the link.

W.2.2 Programmable selector field

Currently, several PHY implementations claim that the auto-negotiation selector field, as defined by [802.3u], is programmable. In many implementations, the register itself may be reprogrammable by software; however, the PHY operation does not always change, because the selector value that is advertised during auto-negotiation may be hard coded to the value defined in [802.3u] for 100BASE-X operation.

Auto-negotiation is optional for the 100 Mbit/s Token Ring; but if it is used, then it must be possible to change the actual advertised selector value. This selector value is defined in Annex Z.

W.2.3 Device timers

Any PHY may contain one or more timers to monitor various link conditions. If they exist, the timers must allow proper operation of the link, with a maximum frame size of 18207 octets.

W.2.4 Elastic buffer when TX_CLK and RX_CLK are combined

In future PHY implementations, TX_CLK and RX_CLK may be combined. When this is done, an elastic buffer will be needed. Assuming that this elastic buffer is optimized for the maximum frame size and clock tolerance defined in [802.3u], it would be 18 bits in size.

Since the 100 Mbit/s Token Ring defines a larger maximum frame size and a tighter clock tolerance, this elastic buffer would have to be enlarged to 40 bits. This larger elastic buffer could degrade the performance of the PHY in 100BASE-X implementations, so the buffer size should be configurable.

Add Annex X:

Annex X

(informative)

LMT (FSLMTO=1) timing considerations

X.1 Timing diagram

Figure X-1 shows a worst-case LMT, as defined when FSLMTO=1, being performed by a Station. It includes the failure of a single TEST MAC frame, as allowed by the BER calculations shown in Annex P.

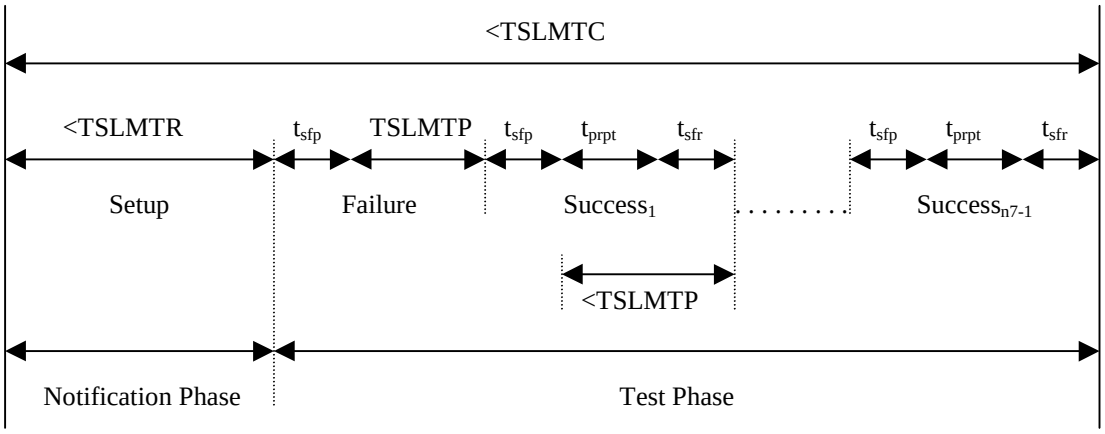

Figure X.1—LMT timing

The figure shows the relationship of various Station MAC timers and parameters. These are listed below, together with their allowable value ranges:

— TSLMTC (2.3–2.5 s).
The maximum amount of time allowed for the LMT to complete successfully.

— TSLMTP (10–30 ms).
The maximum amount of time allowed for a TEST MAC frame to be repeated by the C-Port and received by the Station.

— TSLMTR (200–250 ms).
The maximum amount of time allowed for the C-Port to detect the LMTN MAC frame and enable the repeat path to support the LMT.

— n7 (1117–1123).
The number of TEST MAC frames sent by the Station during the test phase.

Various timing measurements can be made from the diagram:

— t_{sfp} Station Frame Prepare/Transmit time
The average time it takes a Station to determine that it needs to send another TEST MAC frame, plus the time it takes to create a TEST MAC frame and to transmit it.

— t_{sfr} Station Frame Reception/Parsing time
The average time it takes a Station to receive a TEST MAC frame and check that it is valid.

— t_{prpt} C-Port Frame Repeat time
The average time it takes a C-Port to repeat a TEST MAC frame.

X.2 Timing measurement formulae

$$TSLMTC > TSLMTR + t_{sfp} + TSLMTP + (n7 - 1)(t_{sfp} + t_{prpt} + t_{sfr}) \quad (X\text{-}1)$$

$$TSLMTC - TSLMTR - t_{sfp} - TSLMTP > (n7 - 1)(t_{sfp} + t_{prpt} + t_{sfr}) \quad (X\text{-}2)$$

$$(t_{sfp} + t_{prpt} + t_{sfr}) < \frac{TSLMTC - TSLMTR - t_{sfp} - TSLMTP}{(n7 - 1)} \quad (X\text{-}3)$$

Because t_{sfp} is very much smaller than (TSLMTC – TSLMTR – TSLMTP), and (n7-1) is approximately n7 in the division, Equation (X-3) simplifies to

$$(t_{sfp} + t_{prpt} + t_{sfr}) < \frac{TSLMTC - TSLMTR - TSLMTP}{n7} \quad (X\text{-}4)$$

X.3 Timing analysis

Worst-case timing analysis occurs when TSLMTC=2.3 s, TSLMTR=250 ms, TSLMTP=30 ms, and n7=1123. Equation (X-4) gives

$$t_{sfp} + t_{prpt} + t_{sfr} < 1.85 \text{ ms} \quad (X\text{-}5)$$

Best-case timing analysis occurs when TSLMTC=2.5 s, TSLMTR=200 ms, TSLMTP=10 ms, and n7=1117. Equation (X-4) gives

$$t_{sfp} + t_{prpt} + t_{sfr} < 2.05 \text{ ms} \quad (X\text{-}6)$$

X.4 Conclusion

The sum ($t_{sfp} + t_{prpt} + t_{sfr}$) gives the average amount of time that the Station and C-Port have to generate, transmit, repeat, receive, and verify the TEST MAC frame during the test phase of the LMT. The equations derived above show that the value of this sum must be < 1.85 ms to guarantee that for any combination of Station and C-Port implementations, the LMT can complete successfully in the time allowed.

Rather than prejudice a Station vs. a C-Port implementation, this 1.85 ms budget should be split equally between the two entities. That is to say that a Station has *on average* 0.925 ms to generate, transmit, receive, parse, and verify each TEST MAC frame. A C-Port has *on average* 0.925 ms to repeat a TEST MAC frame.

Add Annex Y:

Annex Y

(informative)

Auto-detection protocol

HMR using the TXI Access Protocol

This annex provides an optional method for DTR Concentrators to dynamically determine the operational mode (Port mode or Station Emulation mode) of each of its C-Ports. Using this method, manufacturers can develop products that are interoperable with:

— Any 802.5 compliant products that have this capability and adhere to these recommendations;
— DTR Stations supporting the HMR.

Y.1 C-Port Auto-detection FSM overview

The Auto-detection FSM, shown in Figure Y-1, is started when the 9.3 C-Port Join Port Operation Table is active and in its Bypass state (JS=BP). All other 9.3 C-Port Port Operation Tables are inactive.

The Auto-detection FSM is a “supervisory” FSM that modifies the C-Port Policy flag FPOTO to allow Port Management to issue a Connect.PMAC command to the 9.3 C-Port Join Port Operation Table once the Auto-detection protocol has determined the type of C-Port link connection to be made. In order to accomplish this, the Auto-detection FSM makes use of state machine elements defined in this annex.

When the Auto-detection Port Operation Table Y-2 defined in this annex is active:

— All Clause 9 Port Operation Tables are inactive.
— The Auto-detection Interface Signals Port Operation Table Y-3 defined in this annex is active.
— The Registration Request MAC frame recognized by the Auto-detection Port Operation Table Y-2 must be as specified in Clause 10 and Clause 14.

The end result of the Auto-detection process is to allow Port Management to start the 9.3 C-Port Join Port Operation Table with a Connect.PMAC command with an option flag FPOTO value that directs the C-Port to start its operation in Port mode (FPOTO=1) or Station Emulation mode (FPOTO=0).

Abbreviations and acronyms

AMAC = Auto-detection MAC protocol entity

Assumptions and requirements

The Auto-detection FSM, shown shaded in Figure Y-1, assumes that the C-Port is enabled to run the TXI Access Protocol in both Station Emulation mode and Port mode.

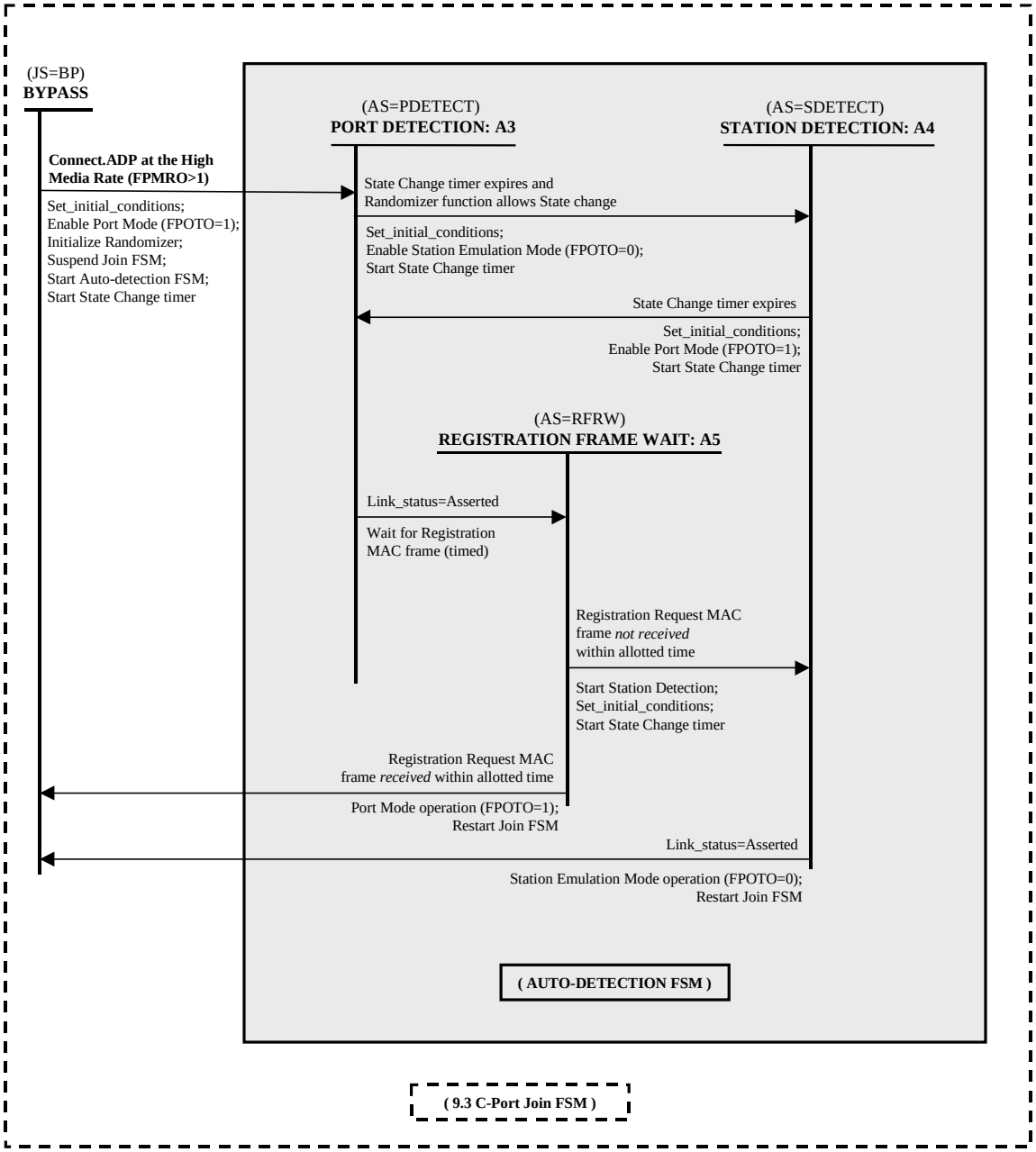

Figure Y.1—Overview Auto-detection FSM (shaded)

Y.1.1 Finite state notation

In addition to the rules outlined in 4.2.1 and 9.1.1.1, the following additional rules are used when evaluating the FSMs in this annex:

a) Actions are considered to occur simultaneously, except for changes to the PMC_Mode (see T.2.1).

b) A delay must be introduced to permit the PMC to respond and the electronics to settle when the FPOTO=0 or FPOTO=1 condition causes a change to the PMC_Mode (see T.2.1). This delay will vary based on the particular implementation used by the manufacturer. The following order is maintained when an action requires a change in the PMC_Mode:

   1) PMC_Mode change;
   2) Delay to permit the PMC to respond and the electronics to settle;
   3) Perform all other actions.

c) The following Port Operation Table "S/T" notations are unique to this annex:

S/T term	Definition of term
J0(A3)	The 9.3 Join Bypass state (J0) enters the Auto-detection Port Detection state (A3).
A4(J0)	The Auto-detection Station Detection state (A4) enters the 9.3 Join Bypass state (J0).
A5(J0)	The Auto-detection Registration Frame Wait state (A5) enters the 9.3 Join Bypass state (J0).

Y.1.2 Abbreviations and notations

The following abbreviations and notations are used in the Auto-detection operation tables and State Machine descriptions:

Auto-detection C-Port Policy Flag Notations

FPOTO = Flag, C-Port Operation Table Option

AMAC Timer Notations

TASC = Timer, AMAC State Change

TARFRW = Timer, AMAC Registration Frame Wait

AMAC Auto-detection State Notations

AS=PDETECT = Port Detection

AS=RFRW = Registration Frame Wait

AS=SDETECT = Station Detection

PMAC Join State Notations

JS=BP = Bypass

Y.1.3 State machine elements

The PMAC machine elements defined in 9.3 are not repeated in this annex. New state machine elements, unique to the AMAC, are defined in Y.1.3.1. Timers, while normally defined in Clause 10 and Clause 14, are defined for the AMAC in this annex.

Y.1.3.1 AMAC timers

The AMAC uses the following timers.

Timer, AMAC State Change (TASC). This timer controls the amount of time the Auto-detection protocol spends in the Port Detection state (AS=PDETECT) and the Station Detection state (AS=SDET) . When the timer expires, the AMAC switches states if the proper conditions are present. The value of the timer is in the range of 2.8 s to 3.2 s.

Timer, AMAC Registration Frame Wait (TARFRW). This timer is used by the Registration Frame Wait state (AS=RFRW) to delay the decision to operate in Port mode, after the Port Detection state (AS=PDETECT) has detected an active link, (PS_STATUS.indication(Link_status=Asserted) until *after* a Registration Request MAC frame has been received. When the timer expires, the AMAC Registration Frame Wait state did not receive a Registration Request MAC frame in the allotted time and restarts the Auto-detection protocol in the Station Detection state (AS=SDETECT). The value of TARFRW is in the range of 5 s to 7 s.

Y.1.3.2 AMAC protocol flags

The AMAC uses no protocol flags.

Y.1.3.3 AMAC states

This subclause explains the operation of the Port Detection, Station Detection, and Registration Frame Waits states.

Port Detection (PDETECT)

Upon entry to the Port Detection state, the timer TASC is reset and the C-Port Policy flag FPOTO is set to 1, causing the PMC to configure the C-Port so it can support Port mode. The duration of the Port Detection state is controlled by the timer TASC and the randomizer function PRND() (see Y.1.4.4.1).

The Port Detection state waits for the attached link to activate [PS_STATUS.indication(Link_status= Asserted)] and takes one of the following actions:

— If the link becomes active before the timer TASC expires, the Port Detection state exits to the Registration Frame Wait state (AS=RFRW) to determine whether the C-Port can operate in the Port mode.
— If the timer TASC expires before the link becomes active *and* the randomizer function, PRND(), returns with a 1 value, the FSM transitions to the Station Detection state (AS=SDETECT) to determine whether the C-Port can operate in the Station Emulation mode.
— If the timer TASC expires before the link becomes active *and* the randomizer function, PRND(), returns with a 0 value, the FSM starts timer TASC, remains in the Port Detection state, and waits for link activation or another expiration of TASC.

Station Detection (SDET)

Upon entry to the Station Detection state, the timer TASC is reset and the C-Port Policy flag FPOTO is set to 0, causing the PMC to configure the C-Port so it can support Station Emulation Mode. The duration of the Station Detection state is controlled by the timer TASC.

The Station Detection state waits for the attached link to activate [PS_STATUS.indication(Link_status= Asserted)] and takes one of the following actions:

— If the link becomes active before the timer TASC expires, then the Auto-detection protocol has determined the C-Port should operate in the Station Emulation mode. The Station Detection state deactivates the Auto-detection FSM and exits to the 9.3 Join Bypass state (JS=BP) to operate in the Station Emulation mode (FPOTO=0).

— If the timer TASC expires before the link becomes active, then the Auto-detection FSM transitions to the Station Detection state (AS=SDETECT) and starts timer TASC to determine whether the C-Port should operate in the Port mode.

Registration Frame Wait (RFRW)

The purpose of this state is to determine whether the link activation detected in Port Detection is caused by a C-Port in Station Emulation mode or a Station, or is a false activation (e.g., wrapped cable).

Upon entry to the Registration Frame Wait state, the timer TARFRW is reset. In the Registration Frame Wait state, the Auto-detection FSM waits to receive a Registration Request MAC frame and takes one of the following actions:

— If the timer TARFRW expires before receiving the Registration Request MAC frame, then the Port Detection *and* the Registration Frame Wait states have detected an unknown link status condition. The Registration Frame Wait state restarts the Auto-detection protocol by resetting the timer TASC and exiting to the Station Detection state (AS=SDETECT).

— If a Registration Request MAC frame is received before timer TARFRW expires, then the Auto-detection protocol has determined the C-Port should operate in Port mode. The Registration Frame Wait state deactivates the Auto-detection FSM and exits to the 9.3 Join Bypass state (JS=BP) to operate in the Port mode (FPOTO=1).

Y.1.4 Auto-detection operation tables

This subclause specifies the additions to both the 9.3 C-Port Join Port Operation Table and the Auto-detection and Interface Signals Port Operation Tables that are needed to accomplish the Auto-detection protocol.

Y.1.4.1 C-Port Join Port Operation Table additions

The following is an addition to the 9.3 C-Port Join Port Operation Table that allows Management to start the Auto-detection protocol for the HMR.

Table Y.1—C-Port Join Port Operation Table additions

S/T	REF	Event/Event and conditions	Actions/Outputs
J0(A3)	1198	**Connect.ADP** & FPMRO>1 & JS=BP << The 9.3 Join FSM recognizes a Connect requesting the Auto-detection Protocol for the HMR. >>	AS=PDETECT; JS=x; Set_initial_conditions; FPOTO=1; TASC=R << Start in Port mode with no 9.3 FSMs running. >> << Start State Change timer. >> << The Auto-detection Port Operation Table Y-2 determines the operational mode (Port Mode or Station Emulation Mode) in which the C-Port is to operate. >>

Y.1.4.2 Auto-detection Port Operation Table

The following is the Auto-detection protocol C-Port Port Operation Table used to select the mode in which the C-Port is to operate.

Table Y.2—Auto-detection Port Operation Table

S/T	REF	Event/Event and conditions	Actions/Outputs
A5(J0)	2601	**FR_REG_REQ** & AS=RFRW << Registration Request MAC frame received in allotted time. >>	JS=BP; AS=x; Connect.PMAC << Shut down the Auto-detection FSM and restart the 9.3 Join FSM. >> << Port Mode (FPOTO=1). >>
A35	2602	**PM_STATUS.indication (Link_status=Asserted)** & AS=PDETECT << Link becomes operational while in the Port Detection state. >>	AS=RFRW; TARFRW=R << Start the Registration Request MAC frame wait timer to ensure connection to a Station or C-Port in Station Emulation mode. >>
A4(J0)	2603	**PM_STATUS.indication (Link_status=Asserted)** & AS=SDETECT << Link becomes operational while in the Station Detection state. >>	JS=BP; AS=x; Connect.PMAC << Shut down Auto-detection FSM and restart the 9.3 Join FSM. >> << Station Emulation mode (FPOTO=0). >>
A54	2604	**TARFRW=E** & AS=RFRW << Registration Request MAC frame is not received in allotted time. >>	AS=SDETECT; TASC=R << Restart Auto-detection protocol by starting Station Detection, since Port Detection failed.>>
A34	2605	**TASC=E** & AS=SDETECT << State Change time out in Station Detection; start Port Detection. >>	AS=PDETECT; Set_initial_conditions; FPOTO=1; TASC=R << Change to Port mode (FPOTO=1) and start State Change timer. >>
	2606	**TASC=E** & PRND()=0 & AS=PDETECT << State Change time out and randomizer function forces Port Detection to continue. >>	TASC=R << Start State Change timer. >>
A34	2607	**TASC=E** & PRND()=1 & AS=PDETECT << State Change time out in Port Detection and randomizer function allows Station Detection to start. >>	AS=SDETECT; Set_initial_conditions; FPOTO=0; TASC=R << Change to Station Emulation mode (FPOTO=0) and start State Change timer. >>

Y.1.4.3 Auto-detection Interface Signals Port Operation Table

The following is the Interface Signals Port Operation Table used by the Auto-detection protocol.

Table Y.3—Auto-detection Interface Signals Port Operation Table

S/T	REF	Event/Event and conditions	Actions/Outputs
	2401	**FPOTO=0**	PM_CONTROL.request (PMC_Mode=Station_emulation_mode)
	2402	**FPOTO=1**	PM_CONTROL.request (PMC_Mode=Port_mode)

Y.1.4.4 Precise specification of terms

This section provides a precise specification of terms used by the Auto-detection operation tables. These specifications are for the “Event/Event and conditions” and “Actions/Outputs” columns.

Y.1.4.4.1 Precise specification of "Event/Event and conditions"

The following definitions are applied to the terms used for events in the FSMs and Auto-detection operation tables.

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
{term1} > {term2}	Term 1 is greater than term 2.
{flag}=0	The specified flag is set to zero (false).
{flag}=1	The specified flag is set to one (true).
{timer}=E	The specified timer has expired.

The following additional items of relevance are used in the tables:

— **&** means "and."
— Values are in hexadecimal notation unless otherwise indicated.

Precise specification of "Event/Event and conditions"	
Event or condition term	**Meaning of this term**
AS=state	The Auto-detection is in the specified state.
Connect.ADP	The C-Port receives this command from C-Port Management to start the Auto-detection FSM that determines the proper setting of FPOTO. The Auto-detection FSM acts as a C-Port Management proxy and, once it has determined the correct value of FPOTO, issues a Connect.PMAC command to C-Port Management. The C-Port Management response is to issue the appropriate Connect.PMAC to the 9.3 Join FSM with the value of FPOTO provided by the Auto-detection FSM.
PS_STATUS.indication (Link_status=Asserted)	The PHY indicates that the link is active (9.8).
PRND()=value	This is the randomizer function used to control when the Active Detection state (AS=ADET) is entered from the Passive Detection state (AS=PDETECT). Valid values are 0 and 1. Implementations of PRND() should ensure that the following conditions are met: — The function returns with a value of 1 at least 25% of the time. This is required to reduce the time it takes for the Auto-detection FSM to detect a connection to a concentrator. — Two C-Ports using the same randomizer functions do not remain synchronized for an extended period of time.

Y.1.4.4.2 Precise specification of "Actions/Outputs"

The following definitions are applied to the terms used for actions and outputs in the FSMs and Auto-detection operation tables.

Unless otherwise specified, the following terms and operations are defined:	
Expression	**Meaning of expression**
variable = value	Set the variable to the specified value.
{timer}=R	The specified timer is set to its initial value and started.

The following additional items of relevance are used in the tables:

— **&** means "and."
— Values are in hexadecimal notation unless otherwise indicated.

Precise specification of "Actions/Outputs"	
Action or output term	**Meaning of this term**
AS=state	The Auto-detection FSM changes to the indicated state.
AS=x	The Auto-detection FSM changes to the unspecified state (not active).
Connect.PMAC	The C-Port receives this command from the Auto-detection FSM to start the process to join the network. The Auto-detection FSM is permitted to act as a management proxy to determine the value of FPOTO and direct Port Management to issue a Connect.PMAC command with this FPOTO value.
JS=x	The 9.3 Join FSM changes to the unspecified state (not active).
PM_CONTROL.request (PMC_Mode=Port_mode)	Request the PHY to change the PMC to support Port mode operation (see Y.2.1).
PM_CONTROL.request (PMC_Mode=Station_emulation_mode)	Request the PHY to change the PMC to support Station Emulation mode (see Y.2.1).
Set_initial_conditions	The C-Port shall set all PMAC flags to zero, set all PMAC coun-ters to zero, and stop all timers. The Monitor FSM and Transmit FSM are not specified. The PS_CONTROL.request(Medium_rate) and PM_CONTROL.request(Medium_rate) shall indicate to the PHY the value of FPMRO.

Y.1.5 MAC interface service specification

The following service primitives specify the required information that is passed between the AMAC and the PMC. This service specification is solely for the purpose of explaining Auto-detection operation tables operation and does not imply any particular implementation. This service specification is in *addition* to the PMAC service specification defined in 9.7.1.2.2.

PM_CONTROL.request

The following primitive is used by the AMAC to request certain actions of the PMC:

PM_CONTROL.request [PMC_Mode]

PMC_Mode is specified as one of the following.

Port_mode
Station_emulation_mode

When generated: The AMAC generates a PM_CONTROL.request for each PMC action request.

Effect of receipt: The PHY performs the appropriate action, as follows:

— When Port_mode is requested, the C-Port's PHY is connected to the media as a C-Port.
— When Station_emulation_mode is requested, the C-Port's PHY is connected to the media as a Station.

Add Annex Z:

Annex Z

(informative)

Auto-negotiation for High-speed Token Ring

The use of Auto-negotiation for Token Ring is under study. A new selector field value is used to distinguish 802.5 from [802.3] devices. The use of Auto-negotiation is difficult for new protocols because of the hard-wired nature of the resolution function. An improvement of the Auto-negotiation procedure could remove this difficulty. This improvement is to add a bit (or interrupt) that informs higher levels (initially software) that the partner advertisement register has been properly set from the reception of a valid partner ability frame. At this point, the higher level could take over the resolution process from the PHY. In the absence of such an improvement, Auto-negotiation will be disabled by Token Ring devices.

Z.1 Differences from [802.3] Annexes 28A, 28B, and 28C

Z.1.1 Differences from Annex 28A, “Selector field definitions”

The following selector field definition is used for IEEE 802.5 high-speed operation:

0	0	0	1	1	IEEE 802.5

Z.1.2 Differences from Annexes 28B, “Selector base page definition”

The use of the technology field is reserved for future use in 802.5 applications.

Z.1.3 Differences from Annexes 28C, “Next page message code field definitions”

The use of the technology field is reserved for future use in 802.5 applications.

Add Annex AA:

Annex AA

(informative)

Differences from ANSI/IEEE Std 802.5, 1998 Edition (Base standard) and ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition (Amendment 1)

Purpose

The purpose of this annex is to identify major differences between this version of the International standard and the combination of the Base and Amendment 1 standards. A listing of the changes made, including the correction of errors found and elaboration of text, is specified below. Each subclause includes a brief description and rationale for the change(s). These changes were made to extend DTR to support 100 Mbit/s operation using the TXI Access Protocol.

NOTE—During the development of the 100 Mbit/s standard, extensive references were made to the Base and Amendment 1 standards. Several minor errors were found in these standards, which needed to be corrected to accurately use those sections in describing 100 Mbit/s operation. These errors were corrected and, in a few cases, fostered additional minor changes and elaboration to prevent these standards from becoming inconsistent with the sections requiring updates to properly describe 100 Mbit/s operation. In some cases, clarification of the existing text was appropriate for properly describing 100 Mbit/s operation, and this clarification was best done in a global manner to include 4 Mbit/s and 16 Mbit/s operation.

Change Overview

Each of the following change descriptions identify the subclause being changed, followed by the name of the subclause. For example, AA.1 defines the changes made to 1.2 with the title “Normative references.”

AA.1 1.2 Normative references

References to the appropriate 100 Mbit/s PHY standards are added.

AA.2 1.3 Definitions

Definitions were added to allow control of the PHY by the Media Independent Interface (MII), and for the term “HMR” and the title case term “Station.”

AA.3 1.6 Conformance requirements

The conformance requirements specified by ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, 1.8, were inaccurate and made references to functions specified in nonexistent subclauses.

Subclause 1.6 has been rewritten by using Annex A (normative) as the basis of conformance. Further, it provides a guide for implementation of the 4 Mbit/s and 16 Mbit/s DTR using the TKP or TXI Access Protocols, and the 100 Mbit/s DTR using the TXI Access Protocol.

AA.4 2.2.2 100 Mbit/s C-Port and Station functional organization and data flow

This subclause was added to specify the 100 Mbit/s C-Port and Station functional organization and data flow for Twisted Pair media and Fibre Optic media. Included are a definition of the interfaces used at 100 Mbit/s and two overview figures of the C-Port and Station, one for the Twisted Pair media and one for the Fibre Optic media.

AA.5 9. Dedicated Token Ring

Configuration functions

A new Policy flag notation was added for media rate (FSMRO and FPMRO) to include definitions for 4 Mbit/s, 16 Mbit/s, and 100 Mbit/s. These flags, which are defined in 14.5 (see AA.33), are used to control the operation of the Station Operation Tables defined in 9.2 and the Port Operation Tables defined in 9.3.

The above C-Port and Station Policy flags are examined *only* upon exit from the Bypass state (JS=BP). The standard *does not* allow the Port and Station Operation Tables to change the value of Policy flags. Because the Trade-up function (see AA.15) may require the media rate to be increased, it was necessary to have equivalent protocol flags that can be changed. The protocol flag FPMR is set with the value of the Policy flag FPMRO, and the protocol flag FSMR is set with the value of the Policy flag FSMRO. Subclauses 9.2.3.2 (see AA.24) and 9.3.3.2 (see AA.30) define these protocol flags.

Clause 9 structure

The structure of Clause 9 was updated to include the HMR by changes to 9.1, 9.2, 9.3, and 9.7; and a new 9.8 was added that specifies the HMR PHY functions.

AA.6 9.1 DTR TXI and TKP Access Protocol support

Item 2 was modified to include pointers to the following new functional descriptions:

a) LMT;
b) Trade-up protocol;
c) Remove Alert protocol.

AA.7 9.1.1.1 FSM notation

Items e and f in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, were rewritten for the following reasons:

a) To clarify frame data transmission specification in the ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, standard.
b) To change C-Port and Station control signal names for the transmission of fill data. (Fill data is defined as the idle pattern for all media rates.)

   The ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, and this standard use the condition FPTI (C-Port) and FSTI (Station) to control the transmission of fill. When FPTI=0 or FSTI=0, the transmitter *stops* transmitting fill; and when FPTI=1 or FSTI=1, the transmitter *starts* transmitting fill using the following PS_CONTROL.request or PM_CONTROL.request signals:

   1) When the Port Operation Table event FPTI=0 occurs, the transmitter uses the control signals PS_CONTROL.request(Repeat_mode=Repeat) or PM_CONTROL.request(Repeat_mode=Repeat) to *stop* transmitting fill.
   2) When the Station Operation Table is supporting a Station *and* the event FSTI=0 occurs, the transmitter uses the control signal PS_CONTROL.request(Repeat_mode=Repeat) to *stop* transmitting fill.

3) When the Station Operation Table is supporting a C-Port in Station Emulation Mode *and* the event FSTI=0 occurs, the transmitter uses the control signals PS_CONTROL.request(Repeat_mode=Repeat) or PM_CONTROL.request(Repeat_mode=Repeat) to *stop* transmitting fill.

4) When the Port Operation Table event FPTI=1 occurs, the transmitter uses the control signals PS_CONTROL.request(Repeat_mode=Fill) or PM_CONTROL.request(Repeat_mode=Fill) to *start* transmitting fill.

5) When the Station Operation Table is supporting a Station *and* the event FSTI=1 occurs, the transmitter uses the control signal PS_CONTROL.request(Repeat_mode=Fill) to *start* transmitting fill.

6) When the Station Operation Table is supporting a C-Port in Station Emulation Mode and the event FSTI=1 occurs, the transmitter uses the control signals PS_CONTROL.request(Repeat_mode=Fill) or PM_CONTROL.request(Repeat_mode=Fill) to *start* transmitting fill.

The names of the above PS_CONTROL.request or PM_CONTROL.request control signals have been changed to be in line with the actual operation being performed by the transmitter. The new PS_CONTROL.request or PM_CONTROL.request signal names are as shown in the following tables.

— "Transmit_mode=No_fill" to cause the transmitter to *stop* transmitting fill, as shown in the following table:

Event	Signal name used in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition	Signal name used in this standard
FPTI=0	PS_CONTROL.request(Repeat_mode=Repeat) **or** PM_CONTROL.request(Repeat_mode=Repeat)	PS_CONTROL.request(Transmit_mode=No_fill) **or** PM_CONTROL.request(Transmit_mode=No_fill)
FSTI=0 and FIPTXIS=0	PS_CONTROL.request(Repeat_mode=Repeat)	PS_CONTROL.request(Transmit_mode=No_fill)
FSTI=0 and FIPTXIS=1	PS_CONTROL.request(Repeat_mode=Repeat) **or** PM_CONTROL.request(Repeat_mode=Repeat)	PS_CONTROL.request(Transmit_mode=No_fill) **or** PM_CONTROL.request(Transmit_mode=No_fill)

— "Transmit_mode=Fill" to cause the transmitter to *start* transmitting fill, as shown in the following table:

Event	Signal name used in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition	Signal name used in this standard
FPTI=1	PS_CONTROL.request(Repeat_mode=Fill) **or** PM_CONTROL.request(Repeat_mode=Fill)	PS_CONTROL.request(Transmit_mode=Fill) **or** PM_CONTROL.request(Transmit_mode=Fill)
FSTI=1 and FIPTXIS=0	PS_CONTROL.request(Repeat_mode=Fill)	PS_CONTROL.request(Transmit_mode=Fill)
FSTI=1 and FIPTXIS=1	PS_CONTROL.request(Repeat_mode=Fill) **or** PM_CONTROL.request(Repeat_mode=Fill)	PS_CONTROL.request(Transmit_mode=Fill) **or** PM_CONTROL.request(Transmit_mode=Fill)

NOTES (for the above tables)
1—When FIPTXIS=0, the Station Operation Tables in 9.2 are operating as a Station.
2—When FIPTXIS=1, the Station Operation Tables in 9.2 are operating as a C-Port in Station Emulation Mode.
3—The FPTI event and the PM_CONTROL.request signal occur only in the Port Operation Tables in 9.3.

AA.8 9.1.1.5 Join, Monitor, and Transmit interaction

The starting conditions were expanded to include the following Port and Station Operation Table assumptions not specified in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition:

a) The LMT and Monitor functional addresses shall be set to 0.
b) The transmit and receive queues shall be flushed.

AA.9 9.1.1.6 PMAC and SMAC Frame and Token signals

The definitions for the HMR frame signals were added.

AA.10 9.1.1.9 Interpreting the FSMs

Some transitions within the Port and Station Operation Tables, which appear to be redundant, are actually different. Examples are provided to illustrate why they are different.

AA.11 9.1.4 TXI registration

The TXI Access Protocol registration process was changed to provide support for the 100 Mbit/s Trade-up function (see AA.15).

AA.12 9.1.6 Lobe Media Test (LMT)

A new Policy flag, FSLMTO, was added to allow the Station to use one of two LMT functions. In addition to the TXI_TEST used in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, (described in this standard in 9.1.6.1), a new lobe test is defined which is suitable for use at any media rate (described in 9.1.6.2).

AA.13 9.1.8 TXI transmit function

The definition of the Station and C-Port TXI Access Protocol transmit function, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to 4 Mbit/s and 16 Mbit/s.

Definitions of the Station and C-Port HMR TXI Access Protocol transmit function were added.

AA.14 9.1.10.1 Beacon transmit state (MS=STBN or MS=PTBN)

The definition of Beacon Type 2, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to 4 Mbit/s and 16 Mbit/s.

The definition of Beacon Type 5, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to 4 Mbit/s and 16 Mbit/s.

A definition of Beacon Type 5 for the HMR was added.

AA.15 9.1.14 HMR Trade-up protocol

A new subclause was added to define the HMR Trade-up protocol used by the C-Port and Station. This protocol allows links capable of operation at 100 Mbit/s to switch to that media rate if they initially come up at a lower media rate.

AA.16 9.1.15 Remove Alert protocol (TXI Access Protocol at the HMR only)

A new subclause was added to define the Remove Alert protocol used by the C-Port and Station operating at the HMR. The Remove Alert function allows either the C-Port to inform the Station or the Station to inform the C-Port that an unexpected condition has been detected forcing its entry into the Bypass state.

The intention of the Remove Alert function is to allow local management (either C-Port or Station) to understand that the entity on the other end of the link has stopped participating in the TXI Access Protocol and prevent false error conditions from being reported.

AA.17 9.1.16 C-Port in Port Mode using the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

The definition of the C-Port in Port Mode using the TKP Access Protocol, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to 4 Mbit/s and 16 Mbit/s.

AA.18 9.1.17 C-Port in Station Emulation Mode using the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

The definition of the C-Port in Station Emulation Mode using the TKP Access Protocol, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to 4 Mbit/s and 16 Mbit/s.

AA.19 9.1.18 DTR Station using the TKP Access Protocol (4 Mbit/s and 16 Mbit/s)

The definition of the DTR Station using the TKP Access Protocol, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to 4 Mbit/s and 16 Mbit/s.

AA.20 9.2 Station TXI Access Protocol specification

A seventh table was added to the Station Operation Tables to define the LMT when the policy flag FSLMTO is set to 1 (see AA.12).

AA.21 9.2.1.1 Station Join FSM overview

The Join overview Figure 9.2-1 was modified to show the transitions necessary to support the Trade-up and Remove Alert functions (see AA.15 and AA.16, respectively).

AA.22 9.2.2 Specifications—abbreviations and notations

The necessary counter, flag, state, and timer abbreviations were added for 100 Mbit/s operation.

AA.23 9.2.3.1 SMAC counters

Definitions of the new counters CSLTF and CSRAT were added. CSLTF is used at any media rate when FSLMTO is set to 1, and CSRAT is used at the HMR.

The definition of the counter CSTFQ, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, was changed to limit it to operate at 4 Mbit/s and 16 Mbit/s only.

AA.24 9.2.3.2 Station protocol flags

A definition was added for the new flag FSPDC (control over Phantom drive) for 100 Mbit/s operation.

A definition was added for the new flag FSHMRTUA (which indicates the Trade-up function is active) for 4 Mbit/s and 16 Mbit/s operation.

Definitions for the new flags FSMR and FSPDA were added. FSMR is the media rate flag (see AA.5), and FSPDA indicates whether Phantom Drive is being used by the Station.

The definitions of the flags FSRRC, FSSL, FSSLD, and FTI, defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, were changed to limit them to 4 Mbit/s and 16 Mbit/s operation only.

The definitions of flags FSWF and FSWFA (control over wire fault), defined in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, were changed so that the flags are active only when FSPDA is set to 1.

The definition of flag FSTXC (control over the crystal used by the transmit function) was expanded to support 100 Mbit/s.

AA.25 9.2.4.1 Station Join states

Definitions were added for the new Join states required for the Trade-up function (see AA.15) used by 4 Mbit/s and 16 Mbit/s operation, and the Remove Alert function (see AA.16) used by 100 Mbit/s operation as follows:

a) Join State JE, Station HMR Trade-up (JS=SHMRTU);
b) Join State JF, Station Remove Alert Wait (JS=SRAW).

AA.26 9.2.5 TXI Access Protocol SMAC specification

The following changes were made to the Station Operation Tables, defined in 9.2.5.1 through 9.2.5.6, which are used by the Station or the C-Port operating in Station Emulation Mode.

a) A new subclause, 9.2.5.7 LMT transitions for FSMLTO=1, was added to define the new LMT and its Station Operation Table when the Option flag FSLMTO is equal to 1 (see AA.12).
b) The following new counters were defined. These are variable to accommodate implementations:
    1) CSLTF governs the number of TEST MAC frames to be transmitted by the LMT when the Policy flag FSLMTO is equal to 1 (see AA.16).
    2) CSRAT governs the number of Remove Alert MAC frames to be transmitted by the Remove Alert function (see AA.16).

c) A new media rate Policy flag FSMRO, and its equivalent protocol flag FSMR, were added (see AA.5) to control the operation of all media-rate-sensitive transitions.

d) Transitions were added to support the Trade-up function (see AA.15).

e) Transitions were added to support the Remove Alert function (see AA.16).

f) The definition of the signals used by the Station Operation Tables to control the transmission of fill (see AA.7) was changed.

g) The FR_WITH_ERR signal in the Station Error Handling Station Operation Table (9.2-4) was changed to FR_WITH_ERR(E=0) to make ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, agree with the definition of Line Error defined in ANSI/IEEE Std 802.5, 1998 Edition, 3.6.7.

AA.27 9.3.1.1 C-Port Join FSM overview

The Join overview Figure 9.3-1 was modified to show the transitions necessary to support the Remove Alert and Trade-up functions.

AA.28 9.3.2 Abbreviations and notations

Abbreviations were added for the counters, flags, states, and timers for 100 Mbit/s operation.

AA.29 9.3.3.1 PMAC counters

The following new counters were added: CPLTF (used at any media rate when FSLMTO is set to 1) and CPRAT (used at the HMR).

AA.30 9.3.3.2 PMAC Protocol flags

Definitions of the new flags for 100 Mbit/s operation were added. The definition of flag FPTXC (crystal control for the C-Port) was modified to support 100 Mbit/s operation.

AA.31 9.3.3.3.1 C-Port Join states

Definitions were added for the states required for the Trade-up function (see AA.15) and Remove Alert (see AA.16) function used by 100 Mbit/s operation.

AA.32 9.3.4 C-Port Port Operation Tables

The following changes were made to the Port Operation Tables defined in 9.3.4.1 through 9.3.4.6, which are used to support the C-Port's Port Mode.

a) A definition of counter CPRAT was added. This counter defines the number of Remove Alert MAC frames to be transmitted by the Remove Alert function.

b) A new media rate Policy flag FPMRO, and its equivalent protocol flag FPMR, were added (see AA.5) to control the operation of all media-rate-sensitive transitions.

c) Transitions were added to support the Trade-up function (see AA.15).

d) Transitions were added to support the Remove Alert function (see AA.16).

e) Transitions were added to support the LMT function (see AA.12) when the Station's policy flag FSLMTO is set to 1 and the PMAC repeat path is active. This LMT function is defined in 9.1.6.2.

f) The definition of the signals used by the Port Operation Tables controlling transmission of fill were changed (see AA.7).

g) The FR_WITH_ERR signal in the C-Port Error Handling Port Operation Table (9.3-4) was changed to FR_WITH_ERR(E=0) to make ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, agree with the definition of Line Error defined in ANSI/IEEE Std 802.5, 1998 Edition, 3.6.7.

AA.33 9.7 C-Port specific components and specifications

Subclause 9.7 has been replaced and expanded as follows:

— Subclause 9.7.1, comprising the original 9.7, contains the definitions for the C-Port repeat path, MAC Interface Service Specification, and C-Port PMC Specification for 4 and 16 Mbit/s operation. Minor clarifications have been made to the PM_STATUS.indication and PM_CONTROL.request service primitive specifications.
— Subclause 9.7.2 contains the definitions for the C-Port repeat path, MAC Interface Service Specification, and C-Port PMC Specification for 100 Mbit/s operation.
— Subclause 9.7.3 contains a placeholder for 1000 Mbit/s operation.

AA.34 9.8 Physical Layer definition for HMR

This new subclause provides definitions for 100 Mbit/s and 1000 Mbit/s Physical Layers as follows:

— Subclause 9.8.1 contains an overview of, and a statement of objectives for, the 100 Mbit/s PHY. It specifies the 802.5 sublayers with reference to the [802.3] and FDDI standards given in 1.2 (Normative references).
— Subclause 9.8.1.1 contains the specification of 100 Mbit/s Service Primitives (common), which define the transfer of data between the PMC, PSC, MAC, and PMAC/SMAC.
— Subclause 9.8.1.2 contains the Media Independent PHY specifications (PSC), with reference and exceptions to [802.3].
— Subclause 9.8.1.3 contains the Twisted Pair media dependent specifications (TP-PMD), with reference and exceptions to [TP-PMD].
— Subclause 9.8.1.4 refers the reader to the new subclause 13.9, 100 Mbit/s PMCs, which contains the Fibre Optic media dependent specifications (FO-PMC).
— Subclause 9.8.2 contains a placeholder for the 1000 Mbit/s PHY.

AA.35 11 DTR Station and C-Port Management

This clause replaces Clause 11 in ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition. It contains updates to the Management primitives and the DTR MIB to support HMR operation.

AA.36 13.9 100 Mbit/s PMCs

This new subclause defines the PMCs of the Fibre Optic Station and C-Port attachment PHY to be used for 100 Mbit/s transmission.

It comprises the Fibre Optic media dependent specifications (FO-PMC) with reference and exceptions to [FO-PMD].

AA.37 14 Formats and facilities for HMR

This new clause defines the new sequence definitions and field descriptions used for HMR operation. It also notes the changes from Clause 3 (ANSI/IEEE Std 802.5, 1998 Edition) and Clause 10 (ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition) to MAC frames, System Timers, and Policy flags and variables when used for HMR operation.

AA.38 Annex A, Protocol Implementation Conformance Statement (PICS) proforma

Annex A contains a new PICS that was formed from the PICS in ANSI/IEEE Std 802.5, 1998 Edition, combined with the PICS from ANSI/IEEE Std 802.5r, 1998 Edition, and ANSI/IEEE Std 802.5j, 1998 Edition, and updated to support 100 Mbit/s operation.

AA.39 Annex K, DTR Concentrator functional description

Annex K was updated to support 100 Mbit/s operation.

AA.40 Annex L, DTR Station and the C-Port in Station Emulation Mode using the TXI Access Protocol

Annex L was updated to agree with the changes made to the Station Operation Tables contained in 9.3 (see AA.26).

AA.41 Annex M, C-Port in Port Mode using the TXI and TKP Access Protocols

Annex M was updated to agree with the changes made to the Station Operation Tables contained in 9.3 (see AA.32).

AA.42 Annexes N, O, Q, and R—title changes

The titles of Annexes N, Q, and R were changed to indicate that these annexes pertain only to operation at the 4 Mbit/s and 16 Mbit/s media rates. The title of Annex O was changed to indicate that the annex pertains only to operation at 16 Mbit/s. No technical changes were made.

AA.43 Annex T, Auto-detection Protocol 4 Mbit/s and 16 Mbit/s using the TXI and TKP Access Protocols

Annex T was updated to modify the Auto-detection Operation Tables (T.1.4) so that this Auto-detection scheme operates at 4 Mbit/s and 16 Mbit/s only, and to clarify how Auto-detection operates (T.1).

AA.44 Annex U, 100 Mbit/s PHY design using 802.3 100BASE-X PHY implementations

This new annex lists the minimal requirements on, and specific functions not required from, a 100BASE-X PHY implementation as it is used by 100 Mbit/s Token Ring.

AA.45 Annex V, Group MAC address hashing

This new annex specifies a method of filtering group addresses using a hash function.

AA.46 Annex W, 100 Mbit/s PHY designs using MII variants

This new annex was added to provide guidance to physical media device vendors who may design new components in the future that utilize new interfaces that are either MII variants or non-MII implementations. Its purpose is to define a set of features that currently exist in the IEEE 802.3-1998 standard MII and that

are optional for 100BASE-X operation, but which are required for 100 Mbit/s DTR. It also outlines what enhancements would be needed to support 100 Mbit/s DTR operation.

AA.47 Annex X, LMT (FSMLTO=1) timing considerations

This new annex analyzes the timing requirements of a Station or C-Port implementing the LMT, when FSLMTO=1.

AA.48 Annex Y, Auto-detection protocol HMR using the TXI Access Protocols

This new annex defines the auto-detection protocol that operates only at the HMR.

AA.49 Annex Z, Auto-negotiation for High-speed Token Ring

This new annex has been added to inform the reader that the use of auto-negotiation for Token Ring is under study. It describes a new selector field value that is used to distinguish [802.5] from [802.3] devices, and then defines the differences from [802.3] Annexes 28A, 28B, and 28C.