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Data Service Options for Spread Spectrum Systems:

Packet Data Services

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1 INTRODUCTION

1.1 General Description

This chapter of IS-707 defines requirements for support of packet data transmission capability on TIA/EIA/IS-95 wideband spread spectrum systems. Packet data transmission is supported on TIA/EIA/IS-95 Traffic Channels using primary or secondary traffic. For packet data transmission using TIA/EIA/IS-95 Traffic Channels, the Non-Transparent Radio Link Protocol specified in IS-707.2 is used.

This standard specifies a packet data bearer service for communication between terminal equipment and a packet interworking function (IWF) via a base station/mobile switching center (BS/MSC). It provides procedures that can apply to multiple packet data services e.g., CDPD and Mobile-IP.

Service Options 7, 4103 and 15 are used to request packet data service through an IWF supporting an Internet standard Point-to-Point Protocol (PPP) interface to network layer protocols (see 4.1 and 4.2). Service Option 8, 4104 and 16 are used to request packet data service through an IWF supporting CDPD data services over a PPP interface (see 4.3). Additional packet data service options may be defined in future revisions to select other types of IWF resources or services.

Packet data service options provide a means of establishing and maintaining Traffic Channels for packet data service. When TIA/EIA/IS-95 service negotiation procedures are used, packet data service can be carried as primary or as secondary traffic. When the service option negotiation procedures of TIA/EIA/IS-95 are used, packet data service can be carried as primary traffic only.

1.2 Terms

Base Station (BS). A station in the Domestic Public Cellular Radio Telecommunications Service, other than a mobile station, used for communicating with mobile stations. Depending upon the context, the term base station may refer to a cell, a sector within a cell, or other part of the cellular system.

BS. See base station.

BS/MSC. The base station and mobile switching center considered as a single functional entity.

CDPD. Cellular Digital Packet Data.

CLNP. Connectionless Network Protocol (See ISO 8473-1988).

Data Circuit-Terminating Equipment (DCE). A DCE connects a DTE to the PSTN. A typical DCE would be a V-series modem.

DTE. Data Terminal Equipment.

IWF. Interworking Function.

IP. Internet Protocol.

IPCP. Internet Protocol Control Protocol (see RFC 1332).

LCP. PPP Link Control Protocol (see RFC 1661).

Mobile IP. Mobile Internet Protocol (See RFC 2002).

Mobile Station. A station in the Domestic Public Cellular Radio Telecommunications Service intended to be used while in motion or during halts at unspecified points. Mobile stations include portable units (e.g., hand-held personal units) and units installed in vehicles.

MSC. Mobile Switching Center.

MT0. Mobile Termination 0.

MT2. Mobile Termination 2.

OSINLCP. OSI Network Layer Control Protocol (see RFC 1377).

PPDN. Public Packet Data Network.

PPP. Point to Point Protocol (see RFC 1661).

PSTN. Public Switched Telephone Network.

RFC. Request for Comments. The generic name of a specification developed by the Internet Engineering Task Force (IETF).

RLP. Radio Link Protocol.

SLIP. Serial Line IP.

TCP. Transmission Control Protocol.

TE2. Terminal Equipment 2.

1.3 References

ANSI/TIA/EIA-617	*Inband DCE Control for Asynchronous DTE–DCE Interfaces.*
	Common Cryptographic Algorithms Revision A.1. An ITAR controlled document subject to restricted distribution. Contact the Telecommunications Industry Association, Washington, D.C., April 25, 1995.
	Interface Specification for Common Cryptographic Algorithms Revision A, Telecommunications Industry Association, Washington, D.C., December 14, 1994.
EIA/TIA-232-E	*Interface Between DTE and DCE Employing Serial Binary Data Interchange.*
EIA/TIA-602	*Serial Asynchronous Automatic Dialing and Control.*
ISO 8473-1988	*Information processing systems -- Data communications -- Protocol for providing the connectionless-mode network service.*
ISO/IEC TR9577-1990	*Information technology -- Telecommunications and information exchange between systems -- Protocol identification in the network layer.*

RFC 791	*Internet Protocol.*
RFC 1055	*Nonstandard for transmission of IP datagrams over serial lines: SLIP.*
RFC 1144	*Compressing TCP/IP Headers for Low-Speed Serial Links.*
RFC 1332	*The PPP Internet Protocol Control Protocol (IPCP).*
RFC 1377	*The PPP OSI Network Layer Control Protocol (OSINLCP).*
RFC 1570	*PPP LCP Extensions.*
RFC 1661	*The Point-to-Point Protocol (PPP).*
RFC 1662	*PPP in HDLC-like Framing.*
RFC 1700	*Assigned Numbers.*
RFC 2002	*IP Mobility Support.*
TIA/EIA/IS-95	*Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System.*
TIA/EIA/IS-658	*Data Services Interworking Function Interface Standard for Wideband Spread Spectrum Digital Cellular System.*
TIA/EIA/IS-732	*Cellular Digital Packet Data System Specification.* Note that this is a series of standards, each of which begins with the designation TIA/EIA/IS-732, and ends with *–partnumber*, where *partnumber* identifies the particular standard within the series.
TSB58	*Administration of Parameter Value Assignments for TIA/EIA Wideband Spread Spectrum Standards.*
TSB74	*Telecommunications Systems Bulletin: Support for 14.4 kbps Data Rate and PCS Interaction for Wideband Spread Spectrum Cellular Systems.*

1.4 Overview of Packet Data Service

1.4.1 Packet Data Service Types and Configurations

Packet Data Service can be of two types. Type 1 Packet Data Service provides packet data connections based on Internet and ISO standard protocol stacks, while Type 2 Packet Data Service provides packet data connections based on CDPD protocol stacks. Two rate sets are supported with two unique service option numbers for each packet data service type.

Type 1 Packet Data Service includes service option connections using either Service Option 7, Service Option 4103 or Service Option 15. Type 2 Packet Data Service includes service option connections using either Service Option 8, Service Option 4104 or Service Option 16.

1.4.2 Protocol Options

This standard provides the requirements for communication protocols on the links between a mobile station and IWF, including requirements for the R_m, U_m and L interfaces.

The Relay Layer provides lower layer communication and packet framing between the entities of the packet data service reference model. Over the R_m interface between the TE2 and the MT2, the Relay Layer is a simple EIA/TIA-232-E interface. Over the U_m interface, the Relay Layer is a combination of Non-Transparent RLP (defined in IS-707.2) and the TIA/EIA/IS-95 protocols. On the L interface, the Relay Layer uses the protocols defined in TIA/EIA/IS-658.

The two options for packet protocol stacks are presented in 1.4.2.1 and 1.4.2.2.

1.4.2.1 Relay Layer R_m Interface Protocol Option

The Relay Layer R_m interface protocol option supports TE2 applications in which the TE2 is responsible for all aspects of packet data service mobility management and network address management (e.g., IPCP and the CDPD registration and authentication protocols).

For the Relay Layer R_m interface protocol option, the packet data service protocol stack is as shown in Figure 1.4.2.1-1.

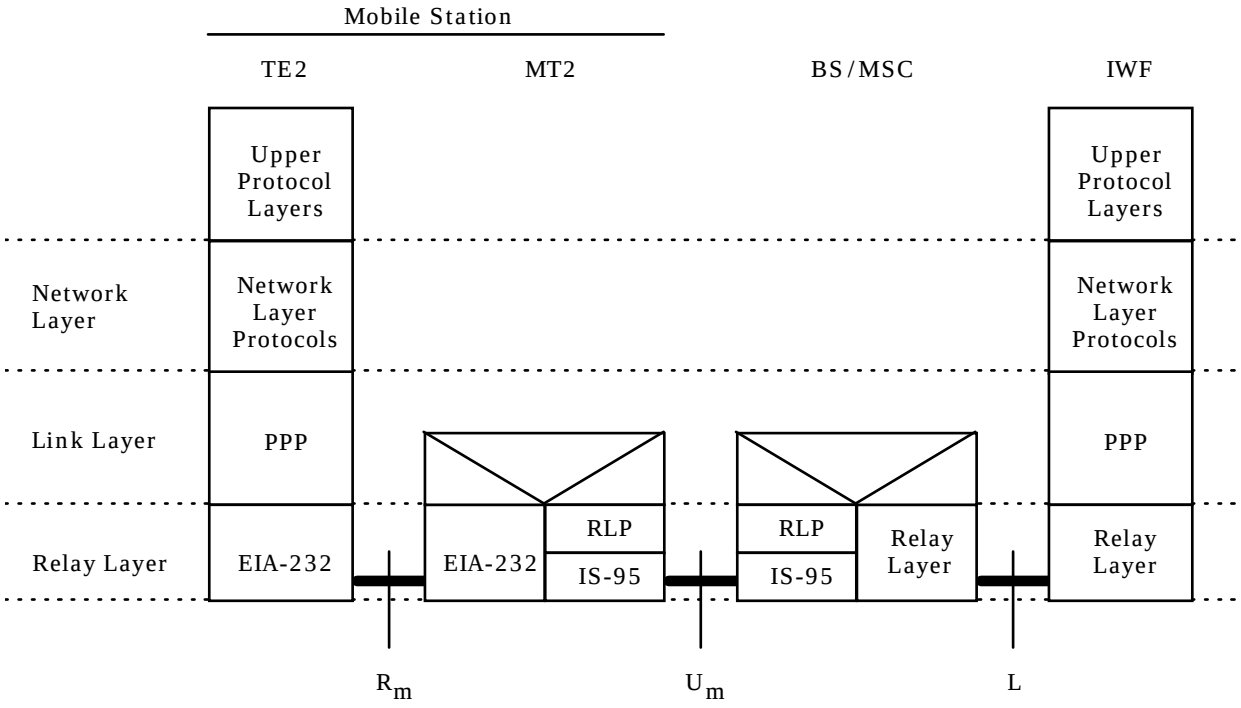

Figure 1.4.2.1-1. Relay Layer R_m Interface Protocol Option

In this protocol option, the Link Layer is implemented using PPP, as defined in RFC 1661. When using the Relay Layer R_m interface protocol option, the Link Layer connection is between the TE2 and the IWF.

The Network Layer includes protocols, such as IP and CLNP, and packet data network registration and authentication protocols, such as MNRP. Recommendations for the use of certain specific protocols are given in Section 4.

1.4.2.2 Network Layer R_m Interface Protocol Option

The Network Layer R_m interface protocol option supports TE2 applications in which the MT2 is responsible for all aspects of packet mobility management and network address management (e.g., IPCP, and the CDPD registration and authentication protocols).

For the Network Layer R_m interface protocol option, the packet data service protocol stack is as shown in Figure 1.4.2.2-1.

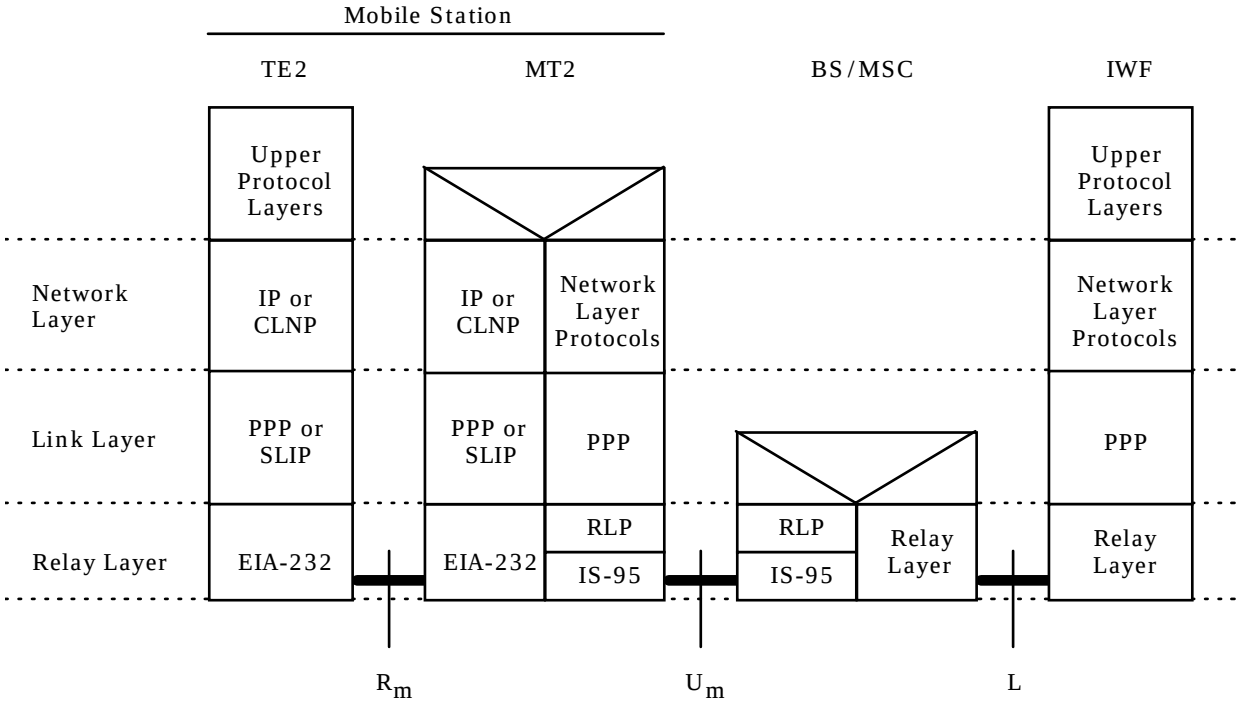

Figure 1.4.2.2-1. Network Layer R_m Interface Protocol Option

In this protocol option, there are independent Link Layer connections between the TE2 and the MT2, and between the MT2 and the IWF. The IWF Link Layer (between the MT2 and the IWF) is implemented using the Internet Point-to-Point Protocol (PPP) defined in RFC 1661.

The R_m Link Layer (between the MT2 and the TE2) should be implemented using the Internet Point-to-Point Protocol (PPP) defined in RFC 1661. Alternatively, the SLIP protocol as defined in RFC 1055 may be used between the MT2 and the TE2 to support the IP network layer protocol.

For this R_m interface protocol option, the Network Layer also provides independent services between the TE2 and the MT2, and between the MT2 and the IWF. The TE2 includes routing protocols, and operates as if locally connected to a network routing server. The MT2 includes both routing and packet data network registration and authentication protocols.

1.4.3 Packet Data Protocol States

1.4.3.1 IWF Link Layer Connection States

The IWF and the mobile station use a Link Layer connection to transmit and receive packet data. The IWF Link Layer connection is opened when a packet data service option is first connected. Once an IWF Link Layer connection is opened, bandwidth (in the form of Traffic Channel assignment) is allocated to the connection on an as-needed basis.

The IWF Link Layer connection can be in any of the following states:

- Closed: The IWF Link Layer connection is closed when the IWF has no Link Layer connection state information for the mobile station.
- Opened: The IWF Link Layer connection is opened when the IWF has Link Layer connection state information for the mobile station. The opened state has two substates:
  - Active: An opened IWF Link Layer connection is active when there is an L interface virtual circuit for the mobile station and the mobile station is on a Traffic Channel with a packet data service option connected.
  - Dormant: An opened IWF Link Layer connection is dormant when there is no L interface virtual circuit for the mobile station, and the mobile station is not on a Traffic Channel with a packet data service option connected.

The BS/MSC and IWF maintain the state of the Link Layer connection as defined above. The mobile station maintains the state of the PPP Link Control Protocol (LCP), and manages the IWF Link Layer connection using the LCP opening and closing procedures defined in RFC 1661.

When the IWF Link Layer Connection is dormant and either the Mobile Station or the BS/MSC has data to send, it is not necessary to re-open the Link Layer Connection or to re-initialize any upper layer protocols, provided the service type has not changed since the link layer last entered the Dormant State. Thus Mobile Stations and BS/MSCs complying with this standard can freely mix packet data service requests using either rate set within a service type.

1.4.3.2 Mobile Station Packet Data Service States

Packet data service processing in the mobile station consists of the following states. Requirements for the transitions between these states are given in 2.2.2.1.1.

- *Inactive State* - In this state, the mobile station does not provide packet data service.
- *Active State* - In this state, the mobile station provides packet data service.

The mobile station performs the packet data service call control function described in 2.2.2.1.2. As illustrated in Figure 1.4.3.2-1, the packet data service call control function consists of the following states:

- *Null State* - The packet data service call control function is in this state when packet data service has not been activated.
- *Initialization/Idle State* - In this state, the mobile station attempts to establish a Traffic Channel for the purpose of initiating packet data service.
- *Initialization/Traffic State* - In this state, the mobile station is communicating with the BS/MSC on a Traffic Channel, and attempts to connect a packet data service option for the purpose of initiating packet data service.
- *Connected State* - In this state, a packet data service option is connected. The mobile station can transfer packet data.
- *Dormant/Idle State* - In this state, the mobile station is not on a Traffic Channel. The mobile station cannot transfer packet data.
- *Dormant/Traffic State* - In this state, the mobile station is communicating with the BS/MSC on a Traffic Channel, but the packet data service option has been disconnected. The mobile station cannot transfer packet data.
- *Reconnect/Idle State* - In this state, the mobile station attempts to establish a Traffic Channel.
- *Reconnect/Traffic State* - In this state, the mobile station is communicating with the BS/MSC on a Traffic Channel, and attempts to connect a packet data service option.

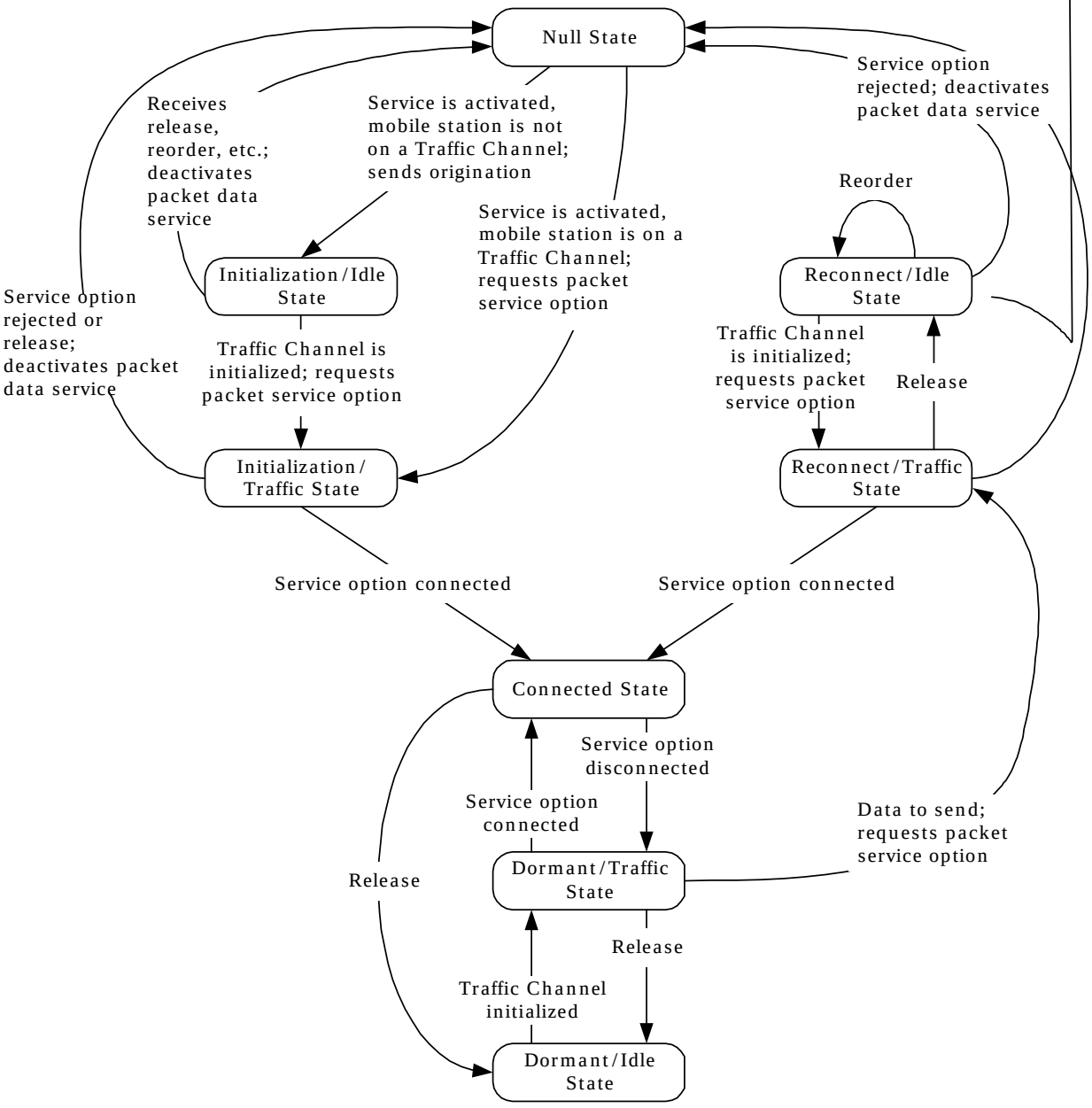

Figure 1.4.3.2-1. Packet Data Service Call Control States in the Mobile Station

1.4.3.3 BS/MSC Packet Data Service States

Packet data service processing in the BS/MSC consists of the following states. Requirements for the transitions between these states are given in 2.2.2.2.1.

- *Inactive State* - In this state, the BS/MSC does not provide packet data service to the mobile station.
- *Active State* - In this state, the BS/MSC provides packet data service to the mobile station.

The BS/MSC performs the packet data service call control function described in 2.2.2.2.2. As illustrated in Figure 1.4.3.3-1, the packet data service call control function consists of the following states:

- *Null State* - In this state, the BS/MSC has no connection of a packet data service option to the mobile station.
- *Paging State* - In this state, the IWF has requested that the BS/MSC connect a packet data service option to the mobile station for the delivery of packet data, and the BS/MSC pages the mobile station.
- *Initialization/Idle State* - In this state, the BS/MSC is awaiting initialization of a Traffic Channel with the mobile station.
- *Initialization/Traffic State* - In this state, the mobile station is on a Traffic Channel. The BS/MSC awaits connection of a packet data service option.
- *Connected* State - In this state, a packet data service option has been connected. Packet data is exchanged with the mobile station.

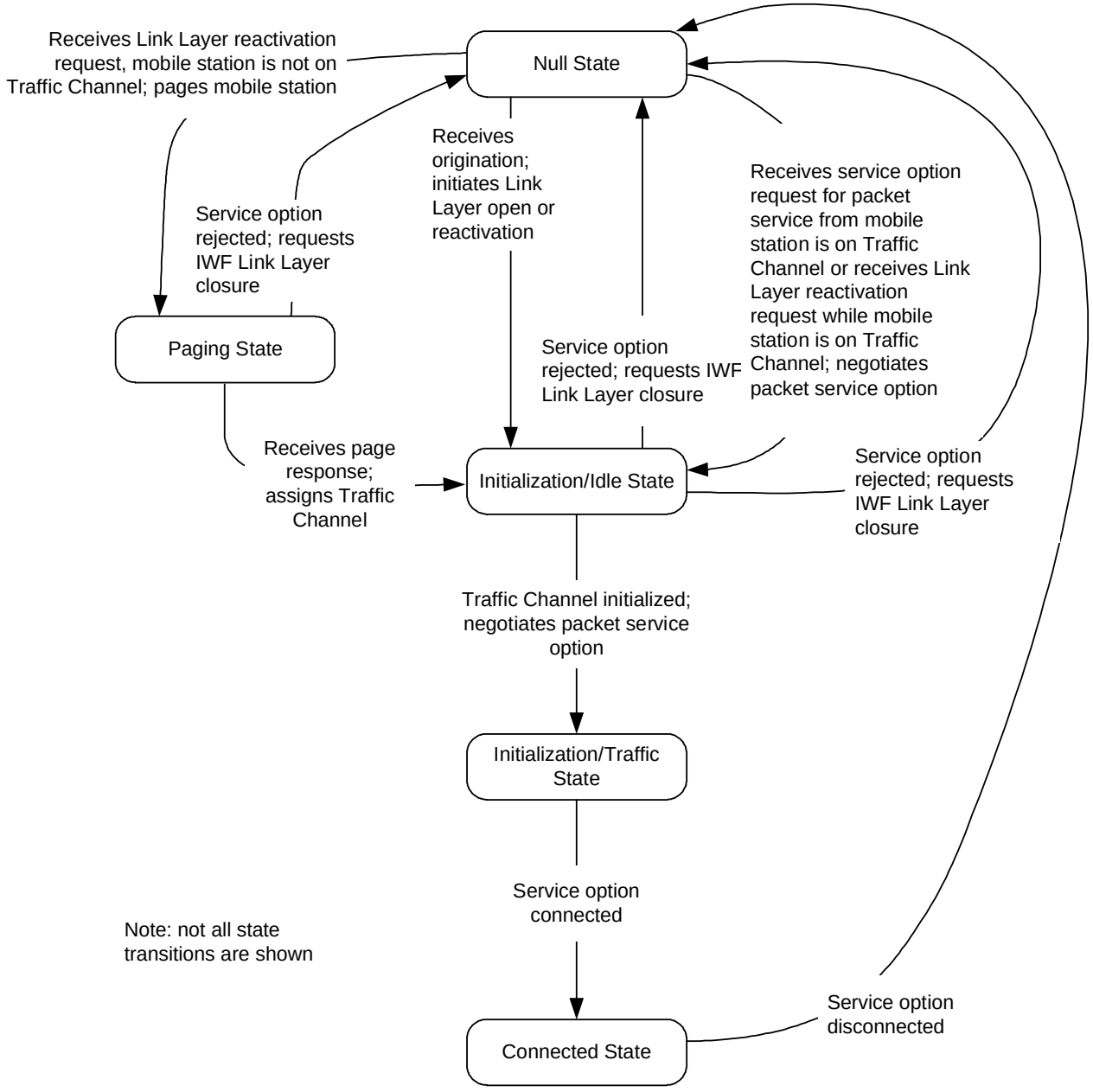

Figure 1.4.3.3-1. Packet Data Service Call Control States in the BS/MSC

2 RELAY LAYER

2.1 Introduction

The Relay Layer spans across the R_m, U_m and L interfaces. See Section 2.1 of IS-707.3 for R_m interface requirements. U_m interface requirements and L interface requirements for the Relay Layer are described in the following sections.

RLP can be carried either as primary traffic or as secondary traffic. The mobile station and the BS/MSC shall support the physical layer, multiplex options, radio link management, and call control protocols as defined in TIA/EIA/IS-95.

At the L interface, the BS/MSC and the IWF can use the protocols recommended in TIA/EIA/IS-658 for transport of end-user data and control information.

2.2 U_m Interface Requirements

2.2.1 RLP Requirements

At the U_m interface, the mobile station and the BS/MSC shall send packet data on the Traffic Channel using the Non-Transparent Radio Link Protocol defined in IS-707.2. In this specification, the Non-Transparent Radio Link Protocol will be called simply RLP.

For Service Options 4103 and 15, mobile stations complying with this standard may support encryption of RLP data frames using the procedures defined in IS-707.2. For Service Options 4104 and 16, mobile stations complying with this standard shall support RLP data frame encryption using the procedures defined in IS-707.2. Packet data encryption shall be performed whenever cellular authentication procedures have been performed during the establishment of a Traffic Channel and RLP data encryption is negotiated (see Section 3.1.1.2.2 of IS-707.2).

2.2.2 Service and Call Control Procedures

2.2.2.1 Mobile Station Procedures

The packet data service states for mobile stations are described in 1.4.3.2. Mobile station states are described in 6.6 of TIA/EIA/IS-95.

When power is applied to the mobile station, the packet data service shall enter the *Inactive State* and the packet data service call control function shall enter the *Null State*.

2.2.2.1.1 Packet Data Service Control Procedures

2.2.2.1.1.1 Inactive State

When the packet data service is in the *Inactive State*, the mobile station does not provide packet data service. The means for determining when the packet data service enters the *Active State* are left to the mobile station manufacturer.

2.2.2.1.1.2 Active State

When the packet data service is in the *Active State*, the mobile station provides packet data service.

While the packet data service is in the *Active State*, the service negotiation procedures described in 6.6.4.1.2 and 7.6.4.1.2 of TIA/EIA/IS-95 can be used to simultaneously connect other service options as primary or secondary traffic. This is intended, for example, to permit the simultaneous and independent connection and disconnection of voice and packet data services. Complete mobile station procedures for invoking and controlling such simultaneous connections require further study, and are left for future revisions of this standard.

Until other procedures are defined, mobile stations can connect a voice call while the packet data service call control function is in the *Connected State* by releasing the Traffic Channel, sending an *Origination Message* containing the voice service option and the dialed digits, and performing service negotiation to connect a service configuration containing voice as primary traffic and packet data as secondary traffic. While voice and packet data service options are connected, the mobile station should process all received and transmitted service-related signaling messages, such as *Flash With Information* and *Alert With Information*, as pertaining only to the voice service.

Mobile stations can disconnect the voice service option by releasing the Traffic Channel, after which the packet data service call control function automatically reconnects the packet data service option as described in 2.2.2.1.2.

2.2.2.1.2 Packet Data Service Call Control Function

2.2.2.1.2.1 Null State

The mobile station packet data service call control function is in the *Null State* whenever the packet data service is in the *Inactive State*.

If the packet data service enters the *Active State*, the mobile station shall perform the following:

- If the Network Layer R_m interface protocol option is selected, and the R_m interface Link Layer is implemented using PPP, the MT2 shall initiate PPP configuration on the R_m interface, using the procedures defined in RFC 1662.
- If the mobile station is in the *Mobile Station Idle State*, the mobile station shall perform the *Mobile Station Origination Operation* as defined in 6.6.2.5 of TIA/EIA/IS-95. The mobile station should include the packet data service option in the SERVICE_OPTION field of the *Origination Message* (see 6.7.1.3.2.4 of TIA/EIA/IS-95). The packet data service call control function shall enter the *Initialization/Idle State* with a packet origination indication.
- If the mobile station is in the *Mobile Station Control on the Traffic Channel State*, the mobile station shall initiate connection of the packet data service option, as described in 2.2.3. The packet data service call control function shall enter the *Initialization/Traffic State*.

- If the mobile station is in any other state or substate, the packet data service call control function shall enter the *Initialization/Idle State* with a mobile station wait indication.

2.2.2.1.2.2 Initialization/Idle State

While the packet data service call control function is in the *Initialization/Idle State*, the mobile station shall perform the following:

- If the mobile station enters the *Mobile Station Control on the Traffic Channel State*, the mobile station shall initiate connection of the packet data service option, as described in 2.2.3. The packet data service call control function shall enter the *Initialization/Traffic State*.
- If the *Initialization/Idle State* was entered with a mobile station wait indication, and the mobile station enters the *Mobile Station Idle State*, the mobile station shall perform the *Mobile Station Origination Operation* as defined in 6.6.2.5 of TIA/EIA/IS-95. The mobile station should include the packet data service option in the SERVICE_OPTION field of the *Origination Message* (see 6.7.1.3.2.4 of TIA/EIA/IS-95). The packet data service call control function shall re-enter the *Initialization/Idle State* with a packet origination indication.
- If the *Initialization/Idle State* was entered with a packet origination indication, the packet data service shall enter the *Inactive State* if any of the following occur:
  - The mobile station enters the *Mobile Station Initialization State;* or
  - The mobile station exits the *System Access State* and enters any state other than the *Mobile Station Control on the Traffic Channel State*.
- If the packet data service enters the *Inactive State*, the packet data service call control function shall enter the *Null State*.

2.2.2.1.2.3 Initialization/Traffic State

While the packet data service call control function is in the *Initialization/Traffic State*, the mobile station shall perform the following:

- The mobile station packet data service call control function shall perform service negotiation or service option negotiation, as described in 6.6.4.1.2 of TIA/EIA/IS-95, to connect the requested service configuration.
- If the packet data service option is connected, the packet data service call control function shall enter the *Connected State*.
- If the mobile station exits the *Mobile Station Control on the Traffic Channel State*, the packet data service shall enter the *Inactive State* and the packet data service call control function shall enter the *Null State*.
- If the packet data service option cannot be connected, the packet data service shall enter the *Inactive State*.
- If the packet data service enters the *Inactive State*, the packet data service call control function shall enter the *Null State*. If no other service option is connected,

the mobile station shall send a *Release Order* and shall enter the *Release Substate* of the *Mobile Station Control on the Traffic Channel State*.

2.2.2.1.2.4 Connected State

When the packet data service call control function enters the *Connected State*, the mobile station begins initialization of the RLP layer (see Section 3.1.1 of IS-707-A.2).

While in the *Connected State*, the mobile station shall perform the following:

- If the mobile station exits the *Mobile Station Control on the Traffic Channel State*, the mobile station shall perform the following:
  - If the mobile station has data to send, the packet data service call control function shall enter the *Reconnect/Idle State* with a channel loss indication.
  - Otherwise, the packet data service call control function shall enter the *Dormant/Idle State*.
- The mobile station shall maintain a packet data inactivity timer. The value of this timer shall not be less than 20 seconds. The timer should be reset whenever a non-idle RLP data frame is sent or received. If the packet data inactivity timer expires, the mobile station should disconnect the packet data service option. To disconnect the packet data service option, the mobile station shall perform the following:
  - If the packet data service option is the only connected service option, the mobile station shall send a *Release Order* and enter the *Release Substate* of the *Mobile Station Control on the Traffic Channel State*.
  - Otherwise, the mobile station shall negotiate a service configuration that does not include the packet data service option.
- If the packet data service option is disconnected and the mobile station remains on the traffic channel, the packet data service call control function shall enter the *Dormant/Traffic State*.
- If the packet data service enters the *Inactive State*, the mobile station shall perform the following:
  - If the Network Layer R_m interface protocol option is selected, the MT2 should close the IWF Link Layer connection (see 3.2.3.4) before disconnecting the packet data service option.
  - If the packet data service option is the only connected service option, the mobile station shall send a *Release Order* and shall enter the *Release Substate* of the *Mobile Station Control on the Traffic Channel State*. Otherwise, the mobile station shall negotiate a service configuration that does not include the packet data service option.
  - The packet data service call control function shall enter the *Null State*.

2.2.2.1.2.5 Dormant/Idle State

While the packet data service call control function is in the *Dormant/Idle State*, the mobile station shall perform the following:

- If the mobile station enters the *Mobile Station Control on the Traffic Channel State*,[1] the packet data service call control function shall enter the *Dormant/Traffic State*.
- The mobile station shall attempt to reconnect the packet data service option, using the procedures specified below, if any of the following occurs:
  - The packet data service has data to send; or
  - The mobile station is in the *Mobile Station Idle State* and detects that the SID or NID of the serving system has changed; or
  - The mobile is in the *Mobile Station Idle State* and detects a non-zero PACKET_ZONE_ID$_s$ that is not currently stored in its packet data zone identifier list (see 2.2.7); or
  - The mobile station enters the *Mobile Station Idle State* after a call release, and the SID or NID of the serving system at the start of the call is unknown, or the SID or NID of the serving system after call release is different from the SID or NID of the serving system at the start of the call.
- The mobile station shall maintain a packet data dormant timer controllable by the BS/MSC (see 2.2.6). The default value for this timer shall be 0 seconds. The timer shall be reset upon entering the *Dormant/Idle State*. The mobile station shall delay any attempt to send an *Origination Message* requesting a packet data service option until the expiration of this timer.
- If the mobile station attempts to reconnect the packet data service option while the packet data service call control function is in the *Dormant/Idle State*, the mobile station shall perform the following:
  - If the mobile station is in the *Mobile Station Idle State*, the mobile station shall perform the *Mobile Station Origination Operation* as defined in 6.6.2.5 of TIA/EIA/IS-95. The mobile station should include the packet data service option in the SERVICE_OPTION field of the *Origination Message* (see 6.7.1.3.2.4 of TIA/EIA/IS-95). The packet data service call control function shall enter the *Reconnect/Idle State* with a packet origination indication.
  - If the mobile station is in any other state or substate, the packet data service call control function shall enter the *Reconnect/Idle State* with a mobile station wait indication.
- If the packet data service enters the *Inactive State*, the packet data service call control function shall enter the *Null State*.

[1]The mobile station can enter the *Mobile Station Control on the Traffic Channel State* as a result of a page from the BS/MSC or an origination of a service by the mobile station.

2.2.2.1.2.6 Dormant/Traffic State

While in the *Dormant/Traffic State*, the packet data service call control function shall perform the following:

- If the packet data service option is connected,[2] the packet data service call control function shall enter the *Connected State* when the mobile station enters the *Conversation Substate*.
- If the mobile station exits the *Mobile Station Control on the Traffic Channel State*, the packet data service call control function shall enter the *Dormant/Idle State*.
- If the packet data service has data to send, or the mobile station has detected a change in the serving system SID or NID or a non-zero PACKET_ZONE_ID$_s$ that is not currently stored in its packet data zone identifier list (see 2.2.7) since the packet data service call control function last entered the *Dormant/Traffic State*, the mobile station shall perform the following:
  - If the service configuration of the mobile station permits connecting a packet data service, the mobile station shall initiate connection of the packet data service option. The packet data service call control function shall enter the *Reconnect/Traffic State*.
  - If the service configuration of the mobile station does not permit connecting a packet data service option, the mobile station may attempt to initiate connection of a packet data service option. If the mobile station attempts to initiate connection of the packet data service option, the mobile station packet data service call control function shall enter the *Reconnect/Traffic State*.
  - If the mobile station does not initiate connection of the packet data service option, either the packet data service call control function may remain in the *Dormant/Traffic State*, or the packet data service may enter the *Inactive State*.
- If the packet data service enters the *Inactive State*, the packet data service call control function shall enter the *Null State*.

2.2.2.1.2.7 Reconnect/Idle State

While the packet data service call control function is in the *Reconnect/Idle State*, the mobile station shall perform the following:

- If the mobile station enters the *Mobile Station Control on the Traffic Channel State*, the mobile station shall initiate connection of the packet data service option, as described in 2.2.3. The packet data service call control function shall enter the *Reconnect/Traffic State*.

[2] A packet data service option can be connected as a result of service negotiation initiated either by the BS/MSC or by the mobile station.

- If the *Reconnect/Idle State* was entered with a mobile station wait indication, and the mobile station enters the *Mobile Station Idle State*, the mobile station shall perform the *Mobile Station Origination Operation* as defined in 6.6.2.5 of TIA/EIA/IS-95. The mobile station should include the packet data service option in the SERVICE_OPTION field of the *Origination Message* (see 6.7.1.3.2.4 of TIA/EIA/IS-95). The packet data service call control function shall re-enter the *Reconnect/Idle State* with a packet origination indication.
- If the *Reconnect/Idle State* was entered with a packet origination indication, and the packet data service option has not been rejected, the packet data service call control function shall re-enter the *Reconnect/Idle State* with a channel loss indication if any of the following occurs:
  - The mobile station enters the *Mobile Station Initialization State;* or
  - The mobile station exits the *System Access State* and enters any state other than the *Mobile Station Control on the Traffic Channel State*.
- If the *Reconnect/Idle State* was entered with a channel loss indication, the mobile station shall perform the following:
  - If the mobile station has data to send, the mobile station may discard the data.[3]
  - If the mobile station has no data to send, and the mobile station has not detected a change in the serving system SID or NID since the packet data service call control function last entered the *Connected State*, and the mobile station has not detected a change in $PACKET\_ZONE\_ID_S$ while in the *Reconnect/Idle State*, the packet data service call control function shall enter the *Dormant/Idle State*. Otherwise, the packet data service call control function shall remain in the *Reconnect/Idle State*, and the mobile station shall perform the remaining actions in this list.
  - The mobile station shall start a reconnect delay timer. The initial length of the reconnect delay timer shall be 4 seconds. For each successive entry or re-entry to the *Reconnect/Idle State* with a channel loss indication, the mobile station shall quadruple the delay length. The maximum delay length is implementation specific, but should not be less than one hour (3600 seconds). When the packet data service call control function enters the *Connected State*, the delay length shall be reset to 4 seconds.

    If the reconnect delay timer expires while the packet data service call control function is in the *Reconnect/Idle State*, the mobile station shall perform the following:

    + If the mobile station is not in the *Mobile Station Idle State*, the mobile station shall wait until the mobile station enters the *Mobile Station Idle State*.

[3] Mobile stations supporting applications that include higher-layer data retransmission protocols should always discard such data.

+ When the mobile station is in the *Mobile Station Idle State*, the mobile station shall perform the *Mobile Station Origination Operation* as defined in 6.6.2.5 of TIA/EIA/IS-95. The mobile station should include the packet data service option in the SERVICE_OPTION field of the *Origination Message* (see 6.7.1.3.2.4 of TIA/EIA/IS-95). The packet data service call control function shall reenter the *Reconnect/Idle State* with a packet origination indication.

- If the mobile station receives a *Release Order* indicating that the packet data service option is rejected, the packet data service shall enter the *Inactive State*.
- If the packet data service enters the *Inactive State*, the packet data service call control function shall enter the *Null State*.

2.2.2.1.2.8 Reconnect/Traffic State

While the packet data service call control function is in the *Reconnect/Traffic State*, the mobile station shall perform the following:

- The mobile station packet data service call control function shall perform service negotiation or service option negotiation, as described in 6.6.4.1.2 of TIA/EIA/IS-95, to connect the requested service configuration.
- If the packet data service option is connected, the packet data service call control function shall enter the *Connected State* when the mobile station enters the *Conversation Substate*.
- If the mobile station exits the *Mobile Station Control on the Traffic Channel State*, the packet data service call control function shall enter the *Reconnect/Idle State* with a channel loss indication.
- If the packet data service option cannot be connected, the packet data service shall enter the *Inactive State*.
- If the packet data service enters the *Inactive State*, the packet data service call control function shall enter the *Null State*.

2.2.2.2 BS/MSC Procedures

2.2.2.2.1 Packet Data Service Control Procedures

2.2.2.2.1.1 Inactive State

When the packet data service is in the *Inactive State*, the BS/MSC does not provide packet data service to the mobile station. The BS/MSC packet data service enters the *Active State* when the IWF Link Layer connection is opened and a packet data service option is connected.

If the BS/MSC packet data service enters the *Inactive State* while the IWF Link Layer connection is open, the BS/MSC should request that the IWF close the Link Layer connection.

2.2.2.2.1.2 Active State

When the packet data service is in the *Active State*, the BS/MSC can provide packet data service to the mobile station.

When the packet data service enters the *Active State*, the BS/MSC should store the mobile station identifier and the connected packet data service type (see 1.4.1). If the BS/MSC supports connections to multiple IWFs, the BS/MSC should also store an IWF identifier, to identify the IWF during re-activation of IWF Link Layer connections that are in the dormant substate (see 1.4.3.1).

The BS/MSC packet data service may enter the *Inactive State* when any of the following occurs:

- The BS/MSC receives a *Registration Message* indicating power-down registration.
- The BS/MSC receives a *Release Order* with a power down indication.
- The BS/MSC determines that the mobile station cannot be paged.
- The mobile station rejects the packet data service option after being paged.
- The mobile station is handed off to another system or service area that is not connected to the same IWF.
- The mobile station is handed off to a non-CDMA service.
- The BS/MSC determines that the mobile station has roamed to another system or service area that is not connected to the same IWF while the Link Layer connection is in the dormant substate.[4]
- The Link Layer connection has been closed.

While the packet data service is in the *Active State*, the service negotiation procedures described in 6.6.4.1.2 and 7.6.4.1.2 of TIA/EIA/IS-95 can be used to simultaneously connect other service options as primary or secondary traffic. This is intended, for example, to permit the simultaneous and independent connection and disconnection of voice and packet data services. Complete BS/MSC procedures for invoking and controlling such simultaneous connections require further study, and are left for future revisions of this standard.

Until other procedures are defined, the BS/MSC can connect a voice call while the packet data service call control function is in the *Connected State* by releasing the Traffic Channel, paging the mobile station, requesting a voice service option, and performing service negotiation to connect a service configuration containing voice as primary traffic and packet data as secondary traffic.[5] While voice and packet data service options are connected, the BS/MSC should process all received and transmitted service-related

[4]Normally a registration cancellation message from the HLR would provide this indication.

[5]If the BS/MSC receives an *Origination Message* from the mobile station, requesting the packet data service option, while the BS/MSC is paging the mobile station, the BS/MSC can send a *Reorder Order* to terminate the mobile station's origination, and can continue paging.

signaling messages, such as *Alert With Information* and *Flash With Information*, as pertaining only to the voice service.

The BS/MSC can disconnect the voice service option by releasing the Traffic Channel, following which the packet data service call control function automatically reconnects the packet data service option as described in 2.2.2.2.2.

2.2.2.2.2 Packet Data Service Call Control Function

2.2.2.2.2.1 Null State

When the BS/MSC packet data service call control function is in the *Null State*, packet data are not exchanged with the mobile station. The following events can occur while the packet data service call control function is in this state:

- The mobile station can request activation of the packet data service by requesting connection of a packet data service option.
- Either the IWF or the mobile station can initiate the reactivation of an open IWF Link Layer connection.
- The IWF can inform the BS/MSC that the Link Layer connection is closed.
- The BS/MSC can initiate transfer of the Link Layer connection to a different IWF.
- If the service configuration of the mobile station does not permit connecting a packet data service option, the BS/MSC can request that the IWF close the Link Layer connection.

2.2.2.2.2.1.1 IWF Initiated Link Layer Connection Reactivation

If the IWF requests reactivation of the Link Layer connection (see 4.2 of TIA/EIA/IS-658), the BS/MSC should perform the following:

- If the mobile station is not on a Traffic Channel, the BS/MSC should page the mobile station, requesting the packet data service option. The packet data service call control function should enter the *Paging State*.
- If the mobile station is on a Traffic Channel, and both the BS/MSC and the mobile station support Traffic Channel service negotiation (see 6.6.4.1.2 and 7.6.4.1.2 of TIA/EIA/IS-95), the BS/MSC should perform the following:
  - If either primary traffic or secondary traffic does not have a connected service option, the BS/MSC should send a *Service Request Message* in accordance with TIA/EIA/IS-95, requesting a valid service configuration (see Table 2.2.3.2.1-1) including the packet data service option, using the traffic type available. The packet data service call control function should enter the *Initialization/Traffic State*.

- If other service options are already connected as both primary and secondary traffic, the BS/MSC may send a *Service Request Message* in accordance with TSB74, requesting a service configuration in which the packet data service option replaces one of the previously connected service options. If the BS/MSC sends a *Service Request Message*, the packet data service call control function should enter the *Initialization/Traffic State*. Otherwise, the BS/MSC may inform the IWF that the Link Layer connection has been deactivated or may request that the IWF close the Link Layer connection. The packet data service call control function should remain in the *Null State*.

- If the mobile station is on a Traffic Channel, and either the BS/MSC or the mobile station does not support Traffic Channel service negotiation, but both support Traffic Channel service option negotiation, the BS/MSC should perform the following:
  - If there is no connected service option, the BS/MSC should send a *Service Option Request Order* in accordance with TIA/EIA/IS-95, requesting the packet data service option. The packet data service call control function should enter the *Initialization/Traffic State*.
  - If there is a connected service option, the BS/MSC may send a *Service Option Request Order* in accordance with TIA/EIA/IS-95, requesting the packet data service option. If the BS/MSC sends a *Service Option Request Order*, the packet data service call control function should enter the *Initialization/Traffic State*. Otherwise, the BS/MSC should inform the IWF that the Link Layer connection has been deactivated, and the packet data service call control function should remain in the *Null State*.

2.2.2.2.2.1.2 Mobile Station Originated Link Layer Connection Activation

If the BS/MSC receives an *Origination Message* requesting a packet data service option from the mobile station, the BS/MSC should perform the following:

- If the service option requested by the mobile station indicates a packet data service type (see 1.4.1) that is not supported, the BS/MSC should send a *Release Order* rejecting the requested service option in accordance with TIA/EIA/IS-95. If the IWF Link Layer connection is open, the BS/MSC should request that the IWF close the Link Layer connection. The packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.
- Otherwise, the BS/MSC should perform the following:
  - If IWF resources are temporarily unavailable due to congestion or equipment outage, the BS/MSC should not send a message indicating that the service option has been rejected, as this can inhibit packet data service origination attempts. The BS/MSC should send a *Reorder Order* to the mobile station. The packet data service call control function should remain in the *Null State*, and the BS/MSC should not perform the remaining actions in this list.

- If the packet data service is in the *Active State*, and the requested service option is supported but indicates a packet data service type that is different from the stored packet data service type (see 2.2.2.2.1.2), the BS/MSC should request that the IWF close the Link Layer connection, and the packet data service should enter the *Inactive State*. The packet data service call control function should remain in the *Null State*, and the BS/MSC should assign the mobile station to a Traffic Channel following the procedures of TIA/EIA/IS-95.
- If the requested packet data service option indicates the same packet data service type as the stored packet data service type, the BS/MSC should perform the following:
  + If the requested service option and multiplex option are supported and traffic channel resources are available, the BS/MSC should assign the mobile station to a Traffic Channel following the procedures of TIA/EIA/IS-95.
  + If the requested service option or multiplex option is not supported or if traffic channel resources are not available, the BS/MSC should send to the mobile station a *Channel Assignment Message* with the ASSIGN_MODE field set to '100' and the GRANTED_MODE field set to '00'. Subsequently, the BS/MSC should perform service negotiation to establish a suitable service configuration.
  + If the IWF Link Layer connection is open, the BS/MSC should request that the IWF reactivate the Link Layer connection.
- If the IWF Link Layer connection is closed, the BS/MSC should request that the IWF open a Link Layer connection for the mobile station.
- The packet data service call control function should enter the *Initialization/Idle State*.

2.2.2.2.2.1.3 Mobile Station Negotiated Link Layer Connection Activation

If the BS/MSC supports service negotiation and the BS/MSC receives a Traffic Channel *Service Request Message* requesting a service configuration including a packet data service option, or if the BS/MSC supports service option negotiation and the BS/MSC receives a Traffic Channel *Service Option Request Order* requesting a packet data service option, the BS/MSC should perform the following:

- If the service option requested by the mobile station indicates a packet data service type (see 1.4.1) that is not supported, the BS/MSC should reject the requested service option in accordance with TIA/EIA/IS-95. If the IWF Link Layer connection is open, the BS/MSC should request that the IWF close the Link Layer connection. The packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.
- If the packet data service is in the *Active State*, and the requested service option is supported but indicates a packet data service type that is different from the stored packet data service type (see 2.2.2.2.1.2), the BS/MSC should perform the following:

- The BS/MSC should request that the IWF close the Link Layer connection, and the packet data service should enter the *Inactive State*.
- When the IWF Link Layer connection is closed, the BS/MSC should request that the IWF open a new Link Layer connection for the mobile station.
- The packet data service call control function should enter the *Initialization/Traffic State*.

• If the requested service option indicates the same packet data service type as the stored packet data service type, the BS/MSC should perform the following:

- If the IWF Link Layer connection is open, the BS/MSC should request that the IWF reactivate the Link Layer connection.
- If the IWF Link Layer connection is closed, the BS/MSC should request that the IWF open a Link Layer connection for the mobile station.
- The packet data service call control function should enter the *Initialization/Traffic State*.

2.2.2.2.2.1.4 IWF Link Layer Closure

If the IWF informs the BS/MSC that the Link Layer connection has been closed, the packet data service should enter the *Inactive State*, and the packet data service call control function should remain in the *Null State*.

2.2.2.2.2.1.5 IWF Transfer

If the BS/MSC transfers the Link Layer connection to a new IWF, the BS/MSC should perform the following:

• The BS/MSC should request that the current IWF close the Link Layer connection. The BS/MSC packet data service should enter the *Inactive State*.

• The BS/MSC should then request that the new IWF open a Link Layer connection for the mobile station. When the IWF Link Layer connection is opened, the BS/MSC should perform the procedures for IWF Initiated Link Layer connection Reactivation, as defined in 2.2.2.2.2.1.1.

2.2.2.2.2.2 Paging State

When the BS/MSC packet data service call control function is in the *Paging State*, the BS/MSC should perform the following:

• If the BS/MSC receives a *Page Response Message* containing a valid, non-zero service option number, the BS/MSC should assign the mobile station to a Traffic Channel, following the procedures of TIA/EIA/IS-95. The packet data service call control function should enter the *Initialization/Idle State*.

• If the BS/MSC receives a *Page Response Message* with an invalid service option, the BS/MSC should send a *Release Order* rejecting the requested service option in accordance with TIA/EIA/IS-95. If the IWF Link Layer connection is open, the BS/MSC should request that the IWF close the Link Layer connection. The packet

data service should enter the *Inactive State*, and packet data service call control function should enter the *Null State*.

- If the BS/MSC does not receive a *Page Response Message* or if the BS/MSC receives a *Page Response Message* with the service option number set to zero, the BS/MSC may request that the IWF close the Link Layer connection. If the BS/MSC requests that the IWF close the Link Layer connection, the packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.

2.2.2.2.2.3 Initialization/Idle State

When the BS/MSC packet data service call control function is in the *Initialization/Idle State*, the BS/MSC should perform the following:

- If the BS/MSC initializes a Traffic Channel for the mobile station, the BS/MSC should negotiate connection of a packet data service option. The packet data service call control function should enter the *Initialization/Traffic State*.
- If the packet data service option requested by the mobile station is not supported, the BS/MSC should send a *Release Order* rejecting the requested service option in accordance with TIA/EIA/IS-95. If the IWF Link Layer connection is open, the BS/MSC should request that the IWF close the Link Layer connection. The packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.
- If the requested service option is temporarily unavailable, the BS/MSC may send a *Reorder Order* to the mobile station to indicate that the service is temporarily unavailable. If a *Reorder Order* is sent while the packet data service is in the *Active State*, the BS/MSC should inform the IWF that the Link Layer connection has been deactivated. If a *Reorder Order* is sent while the packet data service is in the *Inactive State*, the BS/MSC should request that the IWF close the Link Layer connection, if open. The packet data service call control function should enter the *Null State*.
- If the IWF informs the BS/MSC that the Link Layer connection has been closed, the packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.

2.2.2.2.2.4 Initialization/Traffic State

When the BS/MSC packet data service call control function enters the *Initialization/Traffic State*, the BS/MSC should perform service negotiation or service option negotiation, as described in 7.6.4.1.2 of TIA/EIA/IS-95, to connect the requested service configuration.

If the BS/MSC has sent a *Channel Assignment Message* to the mobile station with the ASSIGN_MODE field set to '100' and the GRANTED_MODE field set to '00' (see 2.2.2.2.2.1.2 and 2.2.2.2.2.1.3), the BS/MSC may propose an alternate service configuration.

If the BS/MSC supports authentication, it may complete a Unique Challenge of the mobile station (see 6.3.12.1.5 of TIA/EIA/IS-95) before providing packet data services to the mobile station.

If a service configuration including a packet data service option is connected, the packet data service call control function should enter the *Connected State*.

If the IWF informs the BS/MSC that the Link Layer connection has been closed, the packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*. If no other service options are connected, the BS/MSC should release the Traffic Channel.

If a service configuration including a packet data service option cannot be connected, the BS/MSC should perform the following:

- If no other service options are connected, the BS/MSC should release the Traffic Channel.
- If the IWF Link Layer connection is open, the BS/MSC should request that the IWF close the Link Layer connection.
- The packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.

If the Traffic Channel is released, the BS/MSC should perform the following:

- If the IWF Link Layer connection is open, the BS/MSC should inform the IWF that the Link Layer connection has been deactivated.
- The packet data service call control function should enter the *Null State*.

2.2.2.2.2.5 Connected State

When the BS/MSC packet data service call control function enters the *Connected State*, the BS/MSC should perform the following:

- The BS/MSC should perform RLP initialization in accordance with IS-707.2. Upon completing RLP initialization, the BS/MSC should transfer octets in sequence between the RLP layer and the IWF.
- If the packet data service is in the *Inactive State*, the packet data service should enter the *Active State*.

If the IWF informs the BS/MSC that the Link Layer connection has been closed, the BS/MSC should perform the following:

- The packet data service should enter the *Inactive State*, and the packet data service call control function should enter the *Null State*.
- If no other service options are connected, the BS/MSC should release the Traffic Channel. Otherwise, the BS/MSC should negotiate a service configuration that does not include the packet data service option.

If the BS/MSC transfers the Link Layer connection to a new IWF, the BS/MSC should perform the following:

- The BS/MSC should request that the current IWF close the Link Layer connection. The BS/MSC packet data service should enter the *Inactive State*. The packet data service call control function should remain in the *Connected State*, but data received

from the mobile station should be discarded until the packet data service enters the *Active State*.

- The BS/MSC should then request that the new IWF open a Link Layer connection for the mobile station. When the IWF Link Layer connection is opened, the BS/MSC packet data service should enter the *Active State*.

While the packet data service call control function is in the *Connected State*, the BS/MSC should maintain a packet data inactivity timer. The timer should be reset whenever non-idle RLP data frames are sent or received. If the packet data inactivity timer expires, the BS/MSC should perform the following:

- If no other service options are connected, the BS/MSC should release the Traffic Channel. Otherwise, the BS/MSC should disconnect the packet data service option by negotiating a service configuration that does not include the packet data service option.

If the Traffic Channel is released or the packet data service option is disconnected, the BS/MSC should inform the IWF that the Link Layer connection has been deactivated. The packet data service call control function should enter the *Null State*.

2.2.3 Initialization and Connection of Packet Data Service Options

Packet data service options shall be negotiated and connected using the service configuration and negotiation procedures defined in 6.6.4.1.2 and 7.6.4.1.2 of TIA/EIA/IS-95. Either service negotiation or service option negotiation, as defined in TIA/EIA/IS-95, can be used to negotiate and connect a packet data service option. Mobile stations that support Service Option 15 shall also support Service Option 7 and Service Option 4103. Mobile Stations that support Service Option 16 shall also support Service Option 8 and Service Option 4104.

The mobile station shall initiate connection of a packet data service option by performing one of the following:

- By requesting the packet data service option in either a *Page Response Message* or an *Origination Message*.
- If the service option negotiation procedure is performed, by sending a *Service Option Request Order* requesting the packet data service option.
- If the service negotiation procedure is performed, by sending a *Service Request Message* requesting a service configuration that includes the packet data service option using primary or secondary traffic.

After initiating connection of a packet data service option, the mobile station shall connect the service option as specified in 2.2.3.1 or 2.2.3.2 as appropriate.

2.2.3.1 Procedures Using Service Option Negotiation

2.2.3.1.1 Mobile Station Procedures

Upon successfully completing negotiation for the packet data service option, the mobile station shall connect the packet data service option in accordance with the following requirements:

- If service option negotiation is completed when the mobile station receives a *Service Option Response Order*, then the mobile station shall connect the service option at the explicit or implicit action time associated with the *Service Option Response Order*.
- If service option negotiation is completed as a result of the mobile station sending a *Service Option Response Order*, then the mobile station shall connect the service option at the implicit or explicit action time associated with the most recently received *Service Option Request Order* from the BS/MSC.

If a packet data service option is connected when the mobile station enters the *Waiting for Mobile Station Answer Substate* or the packet data service option becomes connected when the mobile station is already in the *Waiting for Mobile Station Answer Substate*, then the mobile station should send a *Connect Order* to the BS/MSC as a message requiring acknowledgment, without waiting for the user to explicitly command the call to be answered.[6] The mobile station shall enter the *Conversation Substate*.

Table 2.2.3.1.1-1 shows the implicit service configuration when service option negotiation is used to connect Service Option 7, 8, 4103 or 4104.

Table 2.2.3.1.1-1. Implicit Service Configuration for Service Options 7, 8, 4103 and 4104

Service Configuration Attribute	Default Selection
Forward Multiplex Option	Multiplex Option 1
Reverse Multiplex Option	Multiplex Option 1
Forward Transmission Rates	All rates enabled
Reverse Transmission Rates	All rates enabled
Forward Traffic Type	Primary Traffic
Reverse Traffic Type	Primary Traffic

[6] When the mobile station is implemented as a MT2-TE2 pair, the MT2 should not send a *Connect Order* unless the TE2 is connected to the MT2.

2.2.3.1.2 BS/MSC Procedures

The BS/MSC should wait until the action time associated with the most recently transmitted *Service Option Response Order* or *Service Option Request Order* before connecting the packet data service option.

2.2.3.2 Procedures Using Service Negotiation

2.2.3.2.1 Mobile Station Procedures

The mobile station performs service negotiation for packet data service options as described in 6.6.4.1.2 of TIA/EIA/IS-95. The mobile station shall only propose service configurations for Service Option 7 or 8 with attributes as specified in Table 2.2.3.2.1-1. The mobile station shall not accept a service configuration including Service Option 7 or 8 that is not consistent with Table 2.2.3.2.1-1. The default service configuration for Service Options 7 and 8 shall be as shown in Table 2.2.3.1.1-1. The mobile station shall only propose service configurations for Service Option 4103 or 4104 with attributes as specified in Table 2.2.3.2.1-2. The mobile station shall not accept a service configuration including Service Option 4103 or 4104 that is not consistent with Table 2.2.3.2.1-2. The default service configuration for Service Options 4103 and 4104 shall be as shown in Table 2.2.3.1.1-1.

The mobile station shall only propose service configurations for Service Option 15 or 16 with attributes specified in Table 2.2.3.2.1-3. The mobile station shall not accept a service configuration including Service Option 15 or 16 that is not consistent with Table 2.2.3.2.1-3. The default service configuration for Service Options 15 and 16 shall be as shown in Table 2.2.3.2.1-3

Table 2.2.3.2.1-1. Valid Service Configuration Attributes for Service Options 7 and 8

Service Configuration Attribute	Valid Selections
Forward Multiplex Option	Multiplex Option 1
Reverse Multiplex Option	Multiplex Option 1
Forward Transmission Rates	Primary Traffic: Rates 1, 1/2 and 1/8 required, Rate 1/4 not required by Service Options 7 and 8. Secondary Traffic: Rate 1 required, Rates 1/2, 1/4 and 1/8 not required by Service Options 7 and 8.
Reverse Transmission Rates	Primary Traffic: Rates 1, 1/2 and 1/8 required, Rate 1/4 not required by Service Options 7 and 8. Secondary Traffic: Rate 1 required, Rates 1/2, 1/4 and 1/8 not required by Service Options 7 and 8.
Forward Traffic Type	Primary or Secondary Traffic
Reverse Traffic Type	Shall be identical to the Forward Traffic Type

Table 2.2.3.2.1-2. Valid Service Configuration Attributes for Service Options 4103 and 4104

Service Configuration Attribute	Valid Selections
Forward Multiplex Option	Multiplex Option **1**, 2
Reverse Multiplex Option	Multiplex Option **1**, 2
Forward Transmission Rates	Primary Traffic: Rates 1, 1/2 and 1/8 required, Rate 1/4 not required by Service Options 4103 and 4104. Secondary Traffic: Rate 1 required, Rates 1/2, 1/4 and 1/8 not required by Service Options 4103 and 4104.
Reverse Transmission Rates	Primary Traffic: Rates 1, 1/2 and 1/8 required, Rate 1/4 not required by Service Options 4103 and 4104. Secondary Traffic: Rate 1 required, Rates 1/2, 1/4 and 1/8 not required by Service Options 4103 and 4104.
Forward Traffic Type	**Primary** or Secondary Traffic
Reverse Traffic Type	Shall be identical to the Forward Traffic Type

Table 2.2.3.2.1-3. Valid Service Configuration Attributes for Service Options 15 and 16

Service Configuration Attribute	Valid Selections
Forward Multiplex Option	Multiplex Option 1,**2**,
Reverse Multiplex Option	Multiplex Option 1,**2**,
Forward Transmission Rates	All rates enabled
Reverse Transmission Rates	All rates enabled
Forward Traffic Type	**Primary** or Secondary Traffic
Reverse Traffic Type	Shall be identical to the Forward Traffic Type

If a packet data service option is connected when the mobile station enters the *Waiting for Mobile Station Answer Substate*, or if a packet data service option becomes connected while the mobile station is in the *Waiting for Mobile Station Answer Substate*, the mobile station should automatically send a *Connect Order* to the BS/MSC as a message requiring acknowledgment without waiting for the user to explicitly command the call to be answered, except when the service configuration includes any service option that requires

user answer.[6] If the mobile station sends a *Connect Order*, the mobile station shall enter the *Conversation Substate*.

2.2.3.2.2 BS/MSC Requirements

The BS/MSC shall propose service configurations for Service Option 7 or 8 with attributes as specified in Table 2.2.3.2.1-1. The BS/MSC shall reject any service configuration for Service Option 7 or 8 with attributes not consistent with Table 2.2.3.2.1-1.

The BS/MSC shall propose service configurations for Service Option 4103 or 4104 with attributes as specified in Table 2.2.3.2.1-2. The BS/MSC shall reject any service configuration for Service Option 4103 or 4104 with attributes not consistent with Table 2.2.3.2.1-2.

The BS/MSC shall propose service configurations for Service Option 15 or 16 with attributes as specified in Table 2.2.3.2.1-3. The BS/MSC shall reject any service configuration for Service Options 15 or 16 with attributes not consistent with Table 2.2.3.2.1-3.

2.2.4 Optional Zone-Based Registration or Reconnection

The BS/MSC may require the mobile station to register or reconnect the packet data service when packet data service is in the *Active State*, the mobile station is in the *Mobile Station Idle State*, and the mobile station detects a change in the registration zone (see 6.6.5.1.5 of TIA/EIA/IS-95).

The BS/MSC shall enable and disable zone based registration or zone based reconnection in the mobile station through the *Service Option Control Order* or the *Service Option Control Message*. The default state within the mobile station for both zone based registration and zone based reconnection shall be disabled. The BS/MSC may enable either zone based registration or zone based reconnection but not both simultaneously. Once zone based registration or zone based reconnection is enabled by the BS/MSC, the mobile station shall either register or reconnect the packet data service option (depending upon the feature enabled), on detection of a change in Registration Zone, and shall disable the enabled feature when one of the following events occurs:

- The mobile station receives a *Service Option Control Order* or *Service Option Control Message* disabling the enabled feature.
- The mobile station detects a change in the SID of the serving system.
- Packet data service enters the *Inactive State*.

If service negotiation is used, the BS/MSC may send a *Service Option Control Message* (see 7.7.3.3 of TIA/EIA/IS-95) to enable or disable zone based registration or zone based reconnection within the mobile station. The *Service Option Control Message* shall include the type-specific fields shown in Table 2.2.4-1.

Table 2.2.4-1. ORDQ Format and Type-Specific Fields for Zone-Based Registration/Reconnection

Field	Length (bits)
ZREG_CNTL	3
RESERVED	2
FIELD_TYPE	3

ZREG_CNTL - Zone based registration/reconnection control.

The BS/MSC shall set this field to the ZREG_CNTL value from Table 2.2.4-2 corresponding to the zone-based function that the mobile station is to perform.

RESERVED - Reserved bits.

The BS/MSC shall set this field to '00'.

FIELD_TYPE - Type-specific field designator.

The BS/MSC shall set this field to '001'.

The ZREG_CNTL field shall be set appropriately as specified in Table 2.2.4-2. If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to '001' and the ZREG_CNTL field is not equal to a value defined in Table 2.2.4-2, the mobile station shall reject the message by sending a *Mobile Station Reject Order* with the ORDQ field set equal to '00000100'.

Table 2.2.4-2. Zone Based Registration/Reconnection Control Field

ZREG_CNTL (binary)	Mobile Station Action
'000'	Disable zone-based functions
'001'	Enable zone-based registration
'010'	Enable zone-based reconnection
All other ZREG_CNTL values are reserved.	

If service option negotiation is used, the BS/MSC may send a *Service Option Control Order* (see 7.7.4 of TIA/EIA/IS-95-A) to enable or disable zone based registration or zone based reconnection within the mobile station. The Order Qualification Code (ORDQ) of the *Service Option Control Order* shall be formatted as shown in Table 2.2.4-1. If the mobile station receives a *Service Option Control Order* for the service option with FIELD_TYPE set to '001' and the ZREG_CNTL field is not equal to a value defined in Table 2.2.4-2, the mobile station shall reject the order by sending a *Mobile Station Reject Order* with the ORDQ field set equal to '00000100'.

2.2.5 Optional Packet Data Dormant Timer Control

The BS/MSC may require a mobile station to establish a value for the Packet Data Dormant Timer. If this feature is enabled, a mobile station shall not originate a packet data service option until the timer has exceeded the value established by the BS/MSC.

The BS/MSC shall enable and control this feature in the mobile station through the *Service Option Control Message*. The default state within the mobile station for BS/MSC control of the packet data dormant timer shall be disabled. When this feature is disabled, the mobile station should set its packet data dormant timer to the default value of 0 seconds. The mobile station shall disable BS/MSC control of the dormant timer when one of the following events occurs:

- The mobile station receives a *Service Option Control Message* disabling BS/MSC control.
- The mobile station detects a change in the SID of the serving system.
- Packet data service enters the *Inactive State*.

If service negotiation is used, the BS/MSC may send a *Service Option Control Message* (see 7.7.3.3 of TIA/EIA/IS-95) to control this feature. The *Service Option Control Message* shall include the type-specific fields shown in Table 2.2.6-1.

Table 2.2.6-1. Type-Specific Fields for Data Dormant Timer Control

Field	Length (bits)
DORM_CNTL	3
RESERVED	2
FIELD_TYPE	3
DORM_TIME	0 or 8

DORM_CNTL - Dormant Timer control.

The BS/MSC shall set this field to the DORM_CNTL value from Table 2.2.6-2 corresponding to the function that the mobile station is to perform.

RESERVED - Reserved bits.

The BS/MSC shall set this field to '00'.

FIELD_TYPE - Type-specific field designator.

The BS/MSC shall set this field to '011'.

DORM_TIME - Value of packet data dormant timer.

If DORM_CNTL is set to '001', the BS/MSC shall include this field and set it to the DORM_TIME value from Table 2.2.6-3 corresponding to the value of the packet data dormant timer to be used by the mobile station.

The DORM_CNTL field shall be set appropriately as specified in Table 2.2.6-2. If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to '011' and the DORM_CNTL field is not equal to a value defined in Table 2.2.6-2, the mobile station shall reject the message by sending a *Mobile Station Reject Order* with the ORDQ field set equal to '00000100'.

If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to '011' and the DORM_CNTL field set to '000', the mobile station shall disable BS/MSC control of the minimum dormant timer value.

If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to '011' and the DORM_CNTL field set to '001', and the mobile station supports a packet data dormant timer, the mobile station shall enable BS/MSC control of the timer and set the minimum value of the dormant timer to the value specified in the DORM_CNTL field. If the current value of the mobile station's dormant timer is less than the value specified in the DORM_TIME, the mobile station shall set the value of its packet data dormant timer to the value specified in DORM_TIME.

If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to '011' and the mobile station does not support a packet data dormant timer, the mobile station shall reject the message by sending a *Mobile Station Reject Order* with the ORDQ field set equal to '00000110'.

When this feature is enabled, the mobile station's packet data dormant timer shall not be set to a value less than the minimum value specified in the most recently received *Service Option Control Message*. If the mobile station provides a means for user configuration of the dormant timer, and the user attempts to set the value of the timer to a value less than minimum specified value, the mobile station should provide the user with an error indication. The means for providing the error indication is left to the manufacturer.

Table 2.2.6-2. Dormant Timer Control Field

DORM_CNTL (binary)	**Mobile Station Action**
'000'	Disable BS/MSC control of minimum dormant timer
'001'	Set the minimum dormant timer value to value specified in DORM_TIME field
All other DORM_CNTL values are reserved.	

Table 2.2.6-3. Minimum Value of Mobile Station Dormant Timer

DORM_TIME (binary)	Description
'00000000'	Dormant mode not supported by BS/MSC
'00000001' through '11111111'	Minimum mobile station packet data dormant timer value in tenths of seconds.

2.2.6 Optional Packet Zone Reconnection Control

The BS/MSC may require the mobile station to reconnect the packet data service when the packet data service is in the *Active State*; the packet data call control function is in the *Dormant / Idle State, Reconnect/Idle State, or Dormant/Traffic State*; and the mobile station detects a change in the non-zero packet data services zone identifier.

Packet zone based reconnection causes a mobile station to reconnect the packet data service whenever it moves into a new packet data zone not on its internally stored list of visited packet data zones. A packet data zone is added to the list whenever the mobile station connects the packet data service while in the zone, and is deleted when the number of more recently visited zones is equal to the maximum number of zones retained by the mobile station.

The BS/MSC shall enable packet zone based reconnection in the mobile station by transmitting a non-zero packet data services zone identifier (PACKET_ZONE_ID). The BS/MSC may disable the packet zone based reconnection function in the mobile station by sending a *Service Option Control Message* disabling the enabled feature. The BS/MSC may re-enable the function in the mobile station by sending a *Service Option Control Message* enabling the feature. The BS/MSC may control the number of entries a mobile station is to retain in its list of visited packet data zones and may clear the list by sending a *Service Option Control Message*.

The default state within the mobile station for the packet zone based reconnection feature shall be disabled. The mobile shall enable the feature upon initial detection of a non-zero packet data services zone identifier ($PACKET\_ZONE\_ID_S$). The mobile station shall then add the packet data services zone identifier to its stored list of visited packet data zones. Upon enabling the packet zone reconnection feature, the mobile station shall set the length of the packet zone list to one entry until commanded otherwise by the base station. The mobile station shall provide memory for storing up to 15 zone identifiers.

The mobile station shall maintain the list of visited packet data service zone identifiers in most recently visited order sequence with the current zone contained in the first entry of the list. Entries shall be removed from the list in least recently visited order.

The mobile station shall disable the feature and clear its list of visited packet data service zone identifiers when one of the following occurs:

- The mobile station receives a *Service Option Control Message* disabling the feature.
- The mobile station detects a PACKET_ZONE_ID$_s$ field of value '00000000'.
- The mobile station determines that the BS/MSC does not support packet zones.
- Packet data service enters the *Inactive State*.
- The mobile station detects a change in SID.

Once disabled, the mobile station shall re-enable the feature upon detection of a non-zero PACKET_ZONE_ID$_s$ or upon receipt of a *Service Option Control Message* enabling the feature.

If service negotiation is used, the BS/MSC may send a *Service Option Control Message* (see 7.7.3.3 of TSB74) to control this feature. The *Service Option Control Message* shall include the type-specific fields shown in Table 2.2.7-1.

Table 2.2.7-1. Type-Specific Fields for Packet Connection Control

Field	Length (bits)
PKT_CON_CNTL	3
RESERVED	2
FIELD_TYPE	3
RESERVED	0 or 4
PKT_ZONE_LIST_LEN	0 or 4

PKT_CON_CNTL - Packet Zone Connection Control.

The BS/MSC shall set this field to the PKT_CON_CNTL value from Table 2.2.7-2 corresponding to the function that the mobile station is to perform.

RESERVED - Reserved bits.

The BS/MSC shall set this field to '00'.

FIELD_TYPE - Type-specific field designator.

The BS/MSC shall set this field to '100'.

RESERVED - Reserved bits.

The BS/MSC shall set this field to '0000' if PKT_CON_CNTL is set to '001' or '010'. The BS/MSC shall omit this field if PKT_CON_CNTL is any other value.

PKT_ZONE_LIST_LEN - Packet data zone identifier list length.

The BS/MSC shall include this field if PKT_CON_CNTL is set to ‘’001’ or ‘010’ to specify the number of packet data service zone identifiers the mobile station is to retain in its packet data zone identifier list. This field shall be within the range ‘0001’ through ‘1111’, inclusive.

The BS/MSC shall set the PKT_CON_CNTL appropriately as specified in Table 2.2.7-2.

- The BS/MSC shall set the value of PKT_CON_CNTL to ‘000’ to disable the packet zone based reconnection feature in the mobile station.
- The BS/MSC shall set the value of PKT_CON_CNTL to ‘001’ to enable packet zone based reconnection feature in the mobile station. The BS/MSC shall also include the PKT_ZONE_LIST_LEN field in the type-specific fields of the *Service Option Control Message* to specify the number of packet data service zone identifiers the mobile station is to store in its internal list.
- The BS/MSC shall set the value of PKT_CON_CNTL to ‘010’ to clear the packet data service zone identifier list within the mobile station. The BS/MSC shall also include the PKT_ZONE_LIST_LEN field in the type-specific fields of the *Service Option Control Message* to specify the number of packet data service zone identifiers the mobile station is to store in its internal list.
- The BS/MSC shall set the value of the PKT_CON_CNTL to ‘011’ to request the mobile station to transfer its internally stored packet data services zone identifier list to the BS/MSC.

Table 2.2.7-2. Packet Zone Connection Control Field

PKT_CON_CNTL (binary)	**Mobile Station Action**
‘000’	Disable packet zone connection control
‘001’	Enable packet zone connection control
‘010’	Clear the packet data zone identifier list
‘011’	Transfer the packet data zone identifier list to BS/MSC
All other PKT_CON_CNTL values are reserved.	

If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to ‘100’ and the PKT_CON_CNTL field is not equal to a value defined in

Table 2.2.7-2, the mobile station shall reject the message by sending a Mobile Station Reject Order with the ORDQ field set equal to '00000100'.

If the mobile station receives a *Service Option Control Message* for the service option with FIELD_TYPE set to '100' and the PKT_CON_CNTL field is equal to a value defined in Table 2.2.7-2, the mobile station shall perform the following actions:

- If the value of PKT_CON_CNTL field is set to '000', the mobile station shall disable the packet zone based reconnection feature and clear its list of stored packet data service zone identifiers.
- If the value of the PKT_CON_CNTL field is set to '001', and the packet zone based reconnection feature is currently disabled, the mobile station shall enable the feature. The mobile station shall set the number of entries in its packet data services zone identifier list to the value specified in the PKT_ZONE_LIST_LEN field of the *Service Option Control Message*.
- If the value of the PKT_CON_CNTL field is set to '001', and the packet zone based reconnection feature is currently enabled, the mobile station shall set the number of entries in its packet data services zone identifier list to the value specified in the PKT_ZONE_LIST_LEN field of the *Service Option Control Message*. If the value of the PKT_ZONE_LIST_LEN is greater than or equal to the number of existing entries in the list, the mobile station shall retain the current list entries. If the value of the PKT_ZONE_LIST_LEN represents a decrease in the number of list entries, the mobile station shall delete the least recently visited zone list entries.
- If the value of the PKT_CON_CNTL field is set to '010', the mobile station shall clear its packet data service zone identifier list. The mobile station shall set the number of entries in its packet data services zone identifier list to the value specified in the PKT_ZONE_LIST_LEN field of the *Service Option Control Message*.
- If the value of the PKT_CON_CNTL field is set to '011', the mobile station shall transfer the contents of its stored packet data services zone identifier list to the BS/MSC. The mobile station shall transfer the list using a *Service Option Control Message* including the type-specific fields shown in Table 2.7.7-3.

Table 2.2.7-3. Type-Specific Fields for Packet Zone Connection Response

Field	Length (bits)
PKT_CON_RESP	3
RESERVED	2
FIELD_TYPE	3
RESERVED	4
PKT_ZONE_LIST_LEN	4

The mobile station shall include PKT_ZONE_LIST_LEN occurrences of the following record:

PACKET_ZONE_ID	8

PKT_CON_RESP - Packet Zone Connection Response.

The mobile station shall set this field to '000'.

RESERVED - Reserved bits.

The mobile shall set this field to '00'.

FIELD_TYPE - Type-specific field designator.

The mobile shall set this field to '100'.

RESERVED - Reserved bits.

The mobile station shall set this field to '0000'.

PKT_ZONE_LIST_LEN - Packet Data Zone Identifier List Length.

The mobile station shall set this field to specify the number of reported packet data service zone identifiers within the *Service Option Control Message*. This field shall be within the range of '0001' through '1111', inclusive.

PACKET_ZONE_ID - Packet data services zone identifier.

The mobile station shall set this field to the packet data services zone identifier for each entry in its stored packet data zone identifier list.

2.3 L Interface

2.3.1 Logical Connections

The L interface provides a path for transport of end-user data, and a signaling path for communicating control information. L interface protocols should be as recommended in TIA/EIA/IS-658.

2.3.2 Mobile Data

The L interface supports IWF Link Layer connections to mobile stations. Each opened IWF Link Layer connection can be active or dormant (see 1.4.4.1). When the IWF Link Layer connection is activated, an L interface virtual circuit is established.

The IWF or BS/MSC initiates release of the L interface virtual circuit for the mobile station when the IWF Link Layer connection is deactivated. The IWF may initiate release of the L interface virtual circuit for the mobile station when the IWF Link Layer connection is closed. The BS/MSC may request that the IWF close the Link Layer connection while initiating release of the L Interface virtual circuit.

3 LINK LAYER

3.1 Link Layer Protocols

The IWF maintains a separate instance of the Link Layer protocol for each mobile station having an opened IWF Link Layer connection.

The Link Layer protocol used for Service Options 4103, 4104, 15 and16 shall be the Internet Point-to-Point Protocol (PPP), in accordance with RFC 1661. The TE2, MT2 (Network Layer R_m interface protocol option only) and IWF shall support the PPP Link Control Protocol (LCP) defined in RFC 1661 and the LCP extensions defined in RFC 1570.

The instances of PPP shall support control escaping in accordance with 4.2 of RFC 1662. When the Relay Layer R_m interface protocol option is selected, the MT2 shall not perform control escaping, and the provisions of section 6 of RFC 1662 do not apply to the MT2.

The IWF Link Layer shall support negotiation of async control character mapping as defined in RFC 1662. The IWF should not request control character mapping, but should perform control character mapping if negotiated by the mobile station.

If PPP is used as the R_m interface Link Layer, the R_m interface Link Layer shall support negotiation of async control character mapping as defined in RFC 1662. If software flow control is used on the R_m interface, the TE2 shall negotiate mapping for the XON and XOFF control characters. To provide the maximum throughput, the TE2 should negotiate mapping only for the minimum number of control characters necessary for proper operation. When the Network Layer R_m interface protocol option is selected, the MT2 should not request control character mapping on the R_m interface, but shall perform control character mapping on that interface if negotiated by the TE2.

The TE2 and MT2 shall frame PPP packets sent on the R_m interface using the asynchronous framing protocol defined in RFC 1662.

The MT2 shall frame PPP packets sent on the U_m interface using the octet-synchronous framing protocol defined in RFC 1662, except that there shall be no inter-frame time fill (see 4.4.1 of RFC 1662). That is, no flag octets shall be sent between a flag octet that ends one PPP frame and the flag octet that begins the subsequent PPP frame. When the Relay Layer R_m interface protocol option is selected, the MT2 shall perform the necessary framing conversion,[7] except that the MT2 shall not perform asynchronous control character mapping, and the provisions of section 6 of RFC 1662 do not apply to the MT2. The IWF shall perform asynchronous control character mapping on L interface data in accordance with the provisions of Section 6 of RFC 1662, in the same manner as if an asynchronous to synchronous framing conversion were performed between the BS/MSC and the IWF.

The IWF shall frame PPP packets sent on the L interface using the octet-synchronous framing protocol defined in RFC 1662, except that there shall be no inter-frame time fill

[7] Framing conversion in the MT2 consists of the insertion and removal of start bits, stop bits, and mark characters (see 4.4.2 and 4.5.2 of RFC 1662).

(see 4.4.1 of RFC 1662). That is, no flag octets shall be sent between a flag octet that ends one PPP frame and the flag octet that begins the subsequent PPP frame.

The BS/MSC shall pass octets between the L interface and the MT2 without any framing conversion.

PPP provides a means for interfacing to multiple protocols. The BS/MSC and TE2 may support any subset of the protocols having a PPP Assigned Protocol Number (see "Internet Assigned Numbers"[8]). Requirements for support of Internet Protocol, ISO protocols and CDPD options are given in 4.1 through 4.3.

All PPP frames with an unknown or unsupported protocol number should be rejected, using the procedures defined in RFC 1661.

3.2 Link Layer Connections

3.2.1 IWF Link Layer Connection Opening

If the Network Layer R_m Interface Protocol option is selected, and the mobile station packet data service call control function enters the *Connected State* while the U_m interface PPP LCP is not in the Opened state, the MT2 shall initiate PPP configuration according to the protocol defined in RFC 1661. When the PPP LCP enters the Opened state, the PPP Link Layer shall send an establishment indication to higher protocol layers. If PPP is implemented on the R_m interface, the MT2 shall initiate PPP configuration on the R_m interface according to the protocol defined in RFC 1661.

If the Relay Layer R_m Interface Protocol option is selected, when the mobile station packet data service enters the *Active State* the MT2 should send a physical layer establishment indication to the TE2 (see Section 2.1.1 and Section 5 of TIA/EIA/IS-707.3). If the PPP LCP in the TE2 is not in the Opened state, the TE2 shall initiate PPP configuration according to the protocol defined in RFC 1661. When the PPP LCP enters the Opened state, PPP shall send an establishment indication to higher protocol layers.

When an IWF Link Layer connection is in the active substate and the PPP LCP is not in the Opened state, the IWF Link Layer shall initiate PPP configuration according to the protocol defined in RFC 1661. When the PPP LCP enters the Opened state, PPP shall send an establishment indication to higher protocol layers. After a PPP establishment indication, all supported network layer protocols shall be configured using the appropriate network control protocols (see Section 4).

3.2.2 IWF Link Layer Connection Maintenance

While the IWF Link Layer is in the Active substate, either the mobile station or the BS/MSC may release the Traffic Channel. Procedures for re-establishing the Traffic Channel are given in 2.2.2. When the Traffic Channel is released, the BS/MSC should inform the IWF that the Link Layer connection has been deactivated. When the IWF is informed of a Link Layer connection deactivation, the IWF Link Layer connection shall enter the dormant substate, unless it is closed as specified in 3.2.3.1.

[8]Currently RFC 1700.

3.2.3 IWF Link Layer Connection Closure

3.2.3.1 BS/MSC Closure

The BS/MSC should request that the IWF close the Link Layer connection when the packet data service enters the *Inactive State* (see 2.2.2.2.1.2).

3.2.3.2 IWF Closure

The IWF should close the Link Layer connection when it receives an LCP Terminate-Request message from the mobile station or when the BS/MSC requests that the Link Layer connection be closed. The IWF should also close the Link Layer connection when it determines that the mobile station is no longer in its service area. When closing the Link Layer connection after receiving an LCP Terminate-Request message from the mobile station, the IWF should first complete the procedures for closing PPP defined in RFC 1661. The IWF should not send an LCP Terminate-Request to the mobile station if the BS/MSC requests that the IWF Link Layer connection be closed.

If the IWF initiates closure of the Link Layer connection while the Link Layer connection is active, it should send an LCP Terminate-Request to the mobile station. If the Network Layer R_m interface protocol option is selected, the MT2 packet data service should enter the *Inactive State* when the MT2 receives an LCP Terminate-Request.

When the IWF closes the Link Layer connection, it should discard the PPP connection state information for the mobile station.

The IWF should inform the BS/MSC when the Link Layer connection is closed.

3.2.3.3 TE2 Closure

Causes for TE2 closure of the IWF Link Layer connection are implementation dependent. If PPP is implemented on the R_m interface, TE2 manages the Link Layer connection using the PPP LCP opening and closing procedures defined in RFC 1661.

When the Network Layer R_m interface protocol option is selected, and the SLIP protocol is used between the TE2 and the MT2, the MT2 may close the IWF Link Layer connection when circuit 108/2 is deasserted (provided that the &D parameter is not set to zero (see Table 7.1.1-1 of TIA/EIA/IS-707.3)).

If the PPP protocol is supported in the TE2 and the TE2 closes the IWF Link Layer connection, the TE2 shall follow the procedures for closing PPP defined in RFC 1661. If the Network Layer R_m interface protocol option is selected, then when the PPP connection to the TE2 is closed, the MT2 shall close the PPP connection to the IWF using the procedures defined in RFC 1661, and then the packet data service shall enter the *Inactive State*.

3.2.3.4 MT2 Closure

If the Network Layer R_m interface protocol option is selected, the MT2 manages the Link Layer connection using the PPP LCP opening and closing procedures defined in RFC 1661. The MT2 cannot initiate closure of the IWF Link Layer connection when the Relay Layer R_m interface protocol option is selected.

If the Network Layer R_m interface protocol option is selected, the MT2 should close the IWF Link Layer connection, if opened, when the packet data service enters the *Inactive State*. If the MT2 supports circuit 108/2 (or equivalent function provided by In-Band Control Service), the MT2 may close the Link Layer connection when circuit 108/2 is deasserted for longer than a period of time which is to be determined by the implementation.

If the Network Layer R_m interface protocol option is selected, and PPP is implemented as the Link Layer protocol on the R_m interface, the MT2 should close the PPP LCP on the R_m interface when the packet data service enters the *Inactive State*.

4 NETWORK LAYER

4.1 Internet Protocol Support

Support of the Internet Protocol (IP) Network Layer (as defined in RFC 791) is optional. The following requirements apply for an IWF and mobile station that support an IP network interface. To select IP interworking via a PPP Link Layer, the mobile station should request Service Option 7, Service Option 4103 or Service Option 15.

For Service Options 7, 4103 and 15, the IWF Link Layer shall support the following PPP protocol numbers:

0x0021 Internet Protocol

0x002d Van Jacobson Compressed TCP/IP

0x002f Van Jacobson Uncompressed TCP/IP

0x8021 Internet Protocol Control Protocol

For Service Options 7, 4103 and 15, the mobile station shall support the IP Control Protocol (IPCP) defined in RFC 1332. The mobile station shall support Van Jacobson TCP/IP header compression (RFC 1144). Van Jacobson TCP/IP header compression shall be configured through IPCP negotiation.

4.2 ISO Protocol Support

Support of the ISO Network Layer protocols, such as the Connectionless Network Protocol (CLNP) as defined in ISO-8473, is optional. The following requirements apply for an IWF and mobile station that support an OSI network interface. To select OSI interworking via a PPP Link Layer, the mobile station should request Service Option 7, Service Option 4103 or Service Option 15.

For Service Options 7, 4103 and 15, the IWF Link Layer shall support the following PPP protocol numbers:

0x0023 OSI Network Layer[9]

0x8023 OSI Network Layer Control Protocol (OSINLCP)

For Service Options 7, 4103 and 15, the mobile station shall support the PPP OSI Network Layer Control Protocol (OSINLCP) defined in RFC 1377.

4.3 CDPD Application Support

Support of CDPD applications (see IS-732) is optional. The following requirements apply for an IWF and mobile station that support CDPD applications. To select CDPD

[9]As discussed in RFC 1377, the specific OSI protocol is determined according to the first octet in each Network Protocol Data Unit (NPDU), which is the Network Layer Protocol Identifier (NLPID), defined in ISO/TR 9577.

interworking via a PPP Link Layer, the mobile station shall request Service Option 8, Service Option 4104 or Service Option 16.

For Service Options 8, 4104 and 16, the PPP Layer shall support the following PPP protocol numbers:

0x4003 Mobile Network Registration Protocol (MNRP)

The PPP Layer shall also support the protocol numbers required for either the IP or ISO protocol interface, or both, in accordance with 4.1 and/or 4.2, respectively.

For Service Options 8, 4104 and 16, either the TE2 (if the Relay Layer R_m interface protocol option is selected) or the MT2 (if the Network Layer R_m Interface Protocol option is selected) shall support the Mobile Network Registration Protocol (MNRP) defined in Part 507 of IS-732, including the authentication parameters and procedures defined in Part 406 of IS-732. MNRP Registration shall be performed after a PPP establishment indication is received. A successful MNRP Registration (including ESH and ISC) shall take place before the network layer control protocols (IPCP or OSINLCP) may begin negotiation. While an IWF Link Layer connection is open for Service Option 4104 or 16, the mobile station shall respond to MNRP query messages (ESQ). If the MT2 or the TE2 closes the IWF Link Layer connection, the entity performing the closure should perform MNRP deregistration (ESB) before closing the IWF Link Layer.

An IWF supporting Serviec Option 8, Service Option 4104 or Service Option 16 shall support CDPD protocols at and above the Network Layer.[10] Requirements for the CDPD protocols are given in IS-732.

[10]That is, all CDPD protocol layers above the SNDCP layer.