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3RD GENERATION PARTNERSHIP PROJECT 2 "3GPP2"

Upper Layers for cdma2000 Extended Cell High Rate Packet Data Air Interface Specification

Revision 0

Revision History

Revision	Description of Changes	Date
Rev 0 v1.0	Initial Publication	January 2011

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FOREWORD

(This foreword is not part of this Standard)

This standard was prepared by Technical Specification Group C of the Third Generation Partnership Project 2 (3GPP2). This standard is evolved from and is a companion to the cdma2000®[1] standards. This air interface standard provides Medium Access Control and Upper Layers part of the extended cell high rate packet data air interface. Other parts of this standard are:

- Introduction to cdma2000 Extended Cell High Rate Packet Data Air Interface Specification
- Physical Layer for cdma2000 Extended Cell High Rate Packet Data Air Interface Specification

[1] *"cdma2000® is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2. Geographically (and as of the date of publication), cdma2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States."*

FOREWORD

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REFERENCES

The following documents contain provisions, which, through reference in this text, constitute provisions of this document. References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific. For a specific reference, subsequent revisions do not apply. For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP2 document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

Normative References:

[1] 3GPP2 C.S0024-100-C v1.0, Introduction of cdma2000 High Rate Packet Data Air Interface Specification, April 2010.

[2] 3GPP2 C.S0024-200-C v1.0, Physical Layer for cdma2000 High Rate Packet Data Air Interface Specification, April 2010.

[3] 3GPP2 C.S0024-300-C v1.0, Medium Access Control Layer for cdma2000 High Rate Packet Data Air Interface Specification, April 2010.

[4] 3GPP2 C.S0024-400-C v1.0, Connection and Security Layers for cdma2000 High Rate Packet Data Air Interface Specification, April 2010.

[5] 3GPP2 C.S0024-500-C v1.0, Application, Stream and Session Layers for cdma2000 High Rate Packet Data Air Interface Specification, April 2010.

[6] 3GPP2 C.S0098-100-0, Introduction to cdma2000 Extended Cell High Rate Packet Data (xHRPD) Air Interface Specification, January 2011.

[7] 3GPP2 C.S0098-200-0, Physical Layer for cdma2000 Extended Cell High Rate Packet Data (xHRPD) Air Interface Specification, January 2011.

[8] Reserved.

[9] 3GPP2 P.S0001-B v2.0, Wireless IP Network Standard, October 2004.

[10] 3GPP2 C.S0002-E v2.0, Physical Layer Standard for cdma2000 Spread Spectrum Systems, June 2010.

[11] 3GPP2 C.S0005-E v2.0, Upper Layer (Layer 3) Signaling Specification for cdma2000 Spread Spectrum Systems, June 2010.

[12] 3GPP2, Recommended Minimum Performance Standards for Extended Cell High Rate Packet (xHRPD) Data Access Network[2].

[13] 3GPP2, Recommended Minimum Performance Standards for Extended Cell High Rate Packet Data (xHRPD) Access Terminal[2].

[14] FIPS PUB 180-1, Federal Information Processing Standards Publication 180-1.

[2] Editor's Note: The above documents are work in progress and should not be referenced unless and until they is approved and published. Until such time as this Editor's Note is removed, the inclusion of the above documents is for informational purposes only.

REFERENCES

[15] Internet Engineering Task Force (IETF) RFC 2409, The Internet Key Exchange (IKE).

[16] 3GPP2 A.S0009-C v3.0, IOS for HRPD Radio Access Network Interfaces with Session Control in the Packet Control Function, June 2010.

[17] 3GPP2 A.S0008-C v3.0, IOS for HRPD Radio Access Network Interfaces with Session Control in the Access Network, June 2010.

[18] 3GPP2 C.R1001-0 v1.0, Administration of Parameter Value Assignments for cdma2000 Spread Spectrum Standards. (Informative), December 1999.

[19] IETF RFC 2373, IP Version 6 Addressing Architecture.

[20] ITU-T Recommendation E.212, Identification Plan for Land Mobile Stations, 1988.

[21] IETF RFC 3056, Connection of IPv6 Domains via IPv4 Clouds, February 2001.

[22] 3GPP2 C.S0054-A v1.0, cdma2000 High Rate Broadcast-Multicast Packet Data Air Interface Specification, March 2006.

[23] 3GPP2 C.S0057-E v1.0, Band Class Specification for cdma2000 Spread Spectrum Systems, October 2010.

[24] 3GPP2 C.S0004-E v2.0, Signaling Link Access Control (LAC) standard for cdma2000 Spread Spectrum Systems, June 2010.

[25] IETF RFC 1662, PPP in HDLC-like Framing.

[26] 3GPP2 X.S0011-E, cdma2000 Wireless IP Network Standard, November 2009.

[27] 3GPP2 C.S0072-0 v1.0, Mobile Station Equipment Identifier (MEID) Support for cdma2000 Spread Spectrum Systems, August 2005.

[28] 3GPP2 C.S0063-B v1.0, cdma2000 High Rate Packet Data Supplemental Services, May 2010.

[29] 3GPP2 C.S0024-A v3.0, cdma2000 High Rate Packet Data Air Interface Specification, September 2006.

1 MAC LAYER

1.1 Introduction

1.1.1 General Overview

The MAC Layer contains the rules governing operation of the Control Channel, the Access Channel, the Forward Traffic Channel, and the Reverse Traffic Channel.

This section presents the protocols for the MAC Layer. Each of these protocols can be independently negotiated at the beginning of the session.

The MAC Layer contains the following protocols:

- Control Channel MAC Protocol: This protocol builds Control Channel MAC Layer packets out of one or more Security Layer packets, contains the rules concerning access network transmission and packet scheduling on the Control Channel, access terminal acquisition of the Control Channel, and access terminal Control Channel MAC Layer packet reception. This protocol also adds the access terminal address to transmitted packets.
- Access Channel MAC Protocol: This protocol contains the rules governing access terminal transmission timing and power characteristics for the Access Channel.
- Forward Traffic Channel MAC Protocol: This protocol contains the rules governing operation of the Forward Traffic Channel. It dictates the rules the access terminal follows when transmitting the Channel Quality Indicator Channel, along with the rules the access network uses to interpret this channel. The protocol supports variable rate operation of the Forward Traffic Channel.
- Reverse Traffic Channel MAC Protocol: This protocol contains the rules governing operation of the Reverse Traffic Channel. It dictates the rules the access terminal follows to assist the access network in acquiring the Reverse Traffic Channel. It also indicates the rules the access terminal and the access network use to select the transmission rate used over the Reverse Traffic Channel.

1.1.2 Data Encapsulation for the InUse Instances of the MAC Protocols

In the transmit direction, the MAC Layer receives Security Layer packets, adds layer-related headers, trailers, concatenates them in the order to be processed on the receive side, adds padding where applicable, and forwards the resulting packet for transmission to the Physical Layer.

In the receive direction, the MAC Layer receives MAC packets from the Physical Layer and forwards the contained Security Layer packets to the Security Layer in the order received after removing the layer-related headers, trailers, and padding.

Figure 1.1.2-1, Figure 1.1.2-2, Figure 1.1.2-3, and Figure 1.1.2-4 illustrate the relationship between Security Layer packets, MAC packets and Physical Layer packets for the Control Channel, the Access Channel, and the Forward and Reverse Traffic Channels.

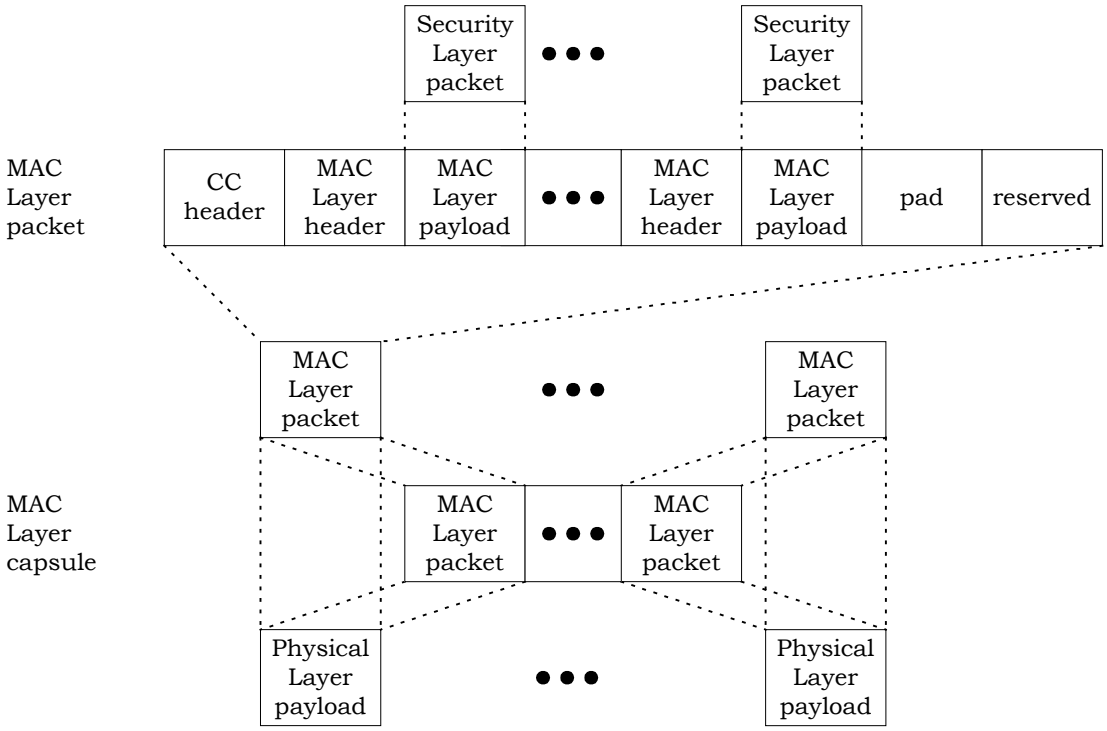

Figure 1.1.2-1. Control Channel MAC Layer Packet Encapsulation

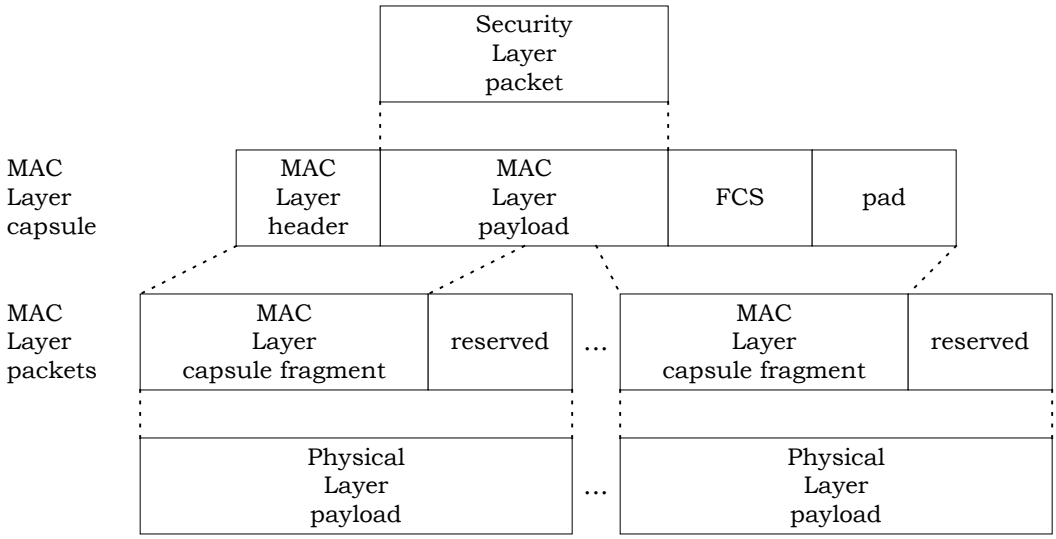

Figure 1.1.2-2. Access Channel MAC Layer Packet Encapsulation

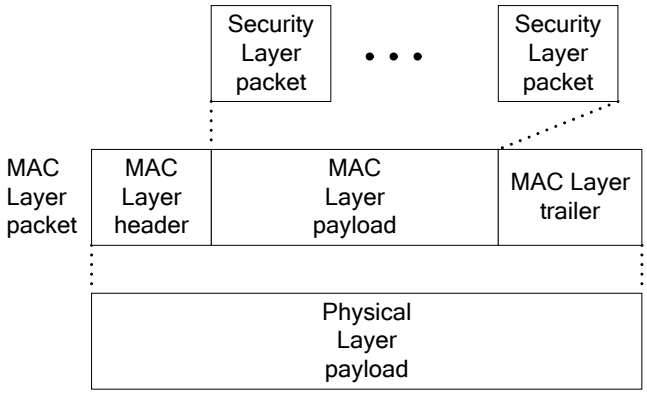

Figure 1.1.2-3. Forward Traffic Channel MAC Layer Packet Encapsulation

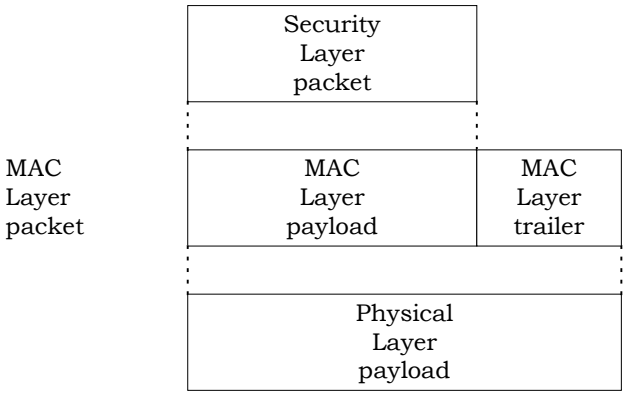

Figure 1.1.2-4. Reverse Traffic Channel MAC Layer Packet Encapsulation

1.2 Default Control Channel MAC Protocol

The Default Control Channel MAC Protocol is same as defined in [3] which also works with xHRPD Subtype 0 Physical Layer Protocol.

1.3 Enhanced Control Channel MAC Protocol

The Enhanced Control Channel MAC Protocol is same as defined in [3] which also works with xHRPD Subtype 0 Physical Layer Protocol.

1.4 xHRPD Subtype 0 Access Channel MAC Protocol

1.4.1 Overview

The xHRPD Subtype 0 Access Channel MAC Protocol provides the procedures and messages required for an access terminal to transmit and an access network to receive the Access Channel. This protocol operates with the xHRPD Subtype 0 Physical Layer Protocol.

This specification assumes that the access network has one instance of this protocol for all access terminals.

This protocol can be in one of two states:

- Inactive State: In this state the protocol waits for an *Activate* command. This state applies only to the access terminal and occurs when the access terminal has not acquired an access network or the access terminal has a connection open.
- Active State: In this state the access terminal transmits and the access network receives the Access Channel.

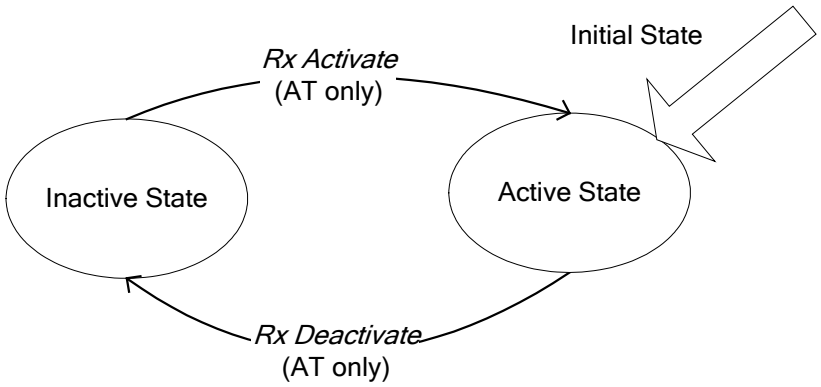

Figure 1.4.1-1. xHRPD Subtype 0 Access Channel MAC Protocol State Diagram

1.4.2 Primitives and Public Data

1.4.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*

1.4.2.2 Return Indications

This protocol returns the following indications:

- *TransmissionSuccessful*
- *TransmissionAborted*
- *TransmissionFailed*
- *TxStarted*
- *TxEnded*
- *SupervisionFailed*
- *MACLayerCapsuleReceived*

1.4.2.3 Public Data

This protocol shall make the following data public:

- Subtype for this protocol
- PowerStep
- OpenLoopAdjust
- ProbeInitialAdjust
- PreambleLength
- AccessSignature field of the next AccessParameters message to be sent by the access network
- MI_{ACMAC}
- MQ_{ACMAC}

1.4.3 Protocol Data Unit

The transmission unit of this protocol is the Access Channel MAC Layer packet. Each Access Channel MAC Layer packet contains part or all of a Security Layer packet.

1.4.4 Protocol Initialization

1.4.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.

1.4.4.2 Protocol Initialization for the InUse Protocol Instance

Upon creation, the InUse instance of this protocol in the access terminal and the access network shall perform the following:

- The value of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- The protocol at the access terminal shall enter the Inactive State.
- The protocol at the access network shall enter the Active State.

1.4.5 Procedures and Messages for the InConfiguration Instance of the Protocol

1.4.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [1]) to define the processing of the configuration messages.

1.4.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.
- If the InUse instance of this protocol has the same subtype as this protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol.
  - The access terminal and the access network shall purge the InConfiguration instance of the protocol.
- If the InUse instance of this protocol does not have the same subtype as this protocol instance, then:
  - The access terminal shall set the initial state for the InConfiguration instance of this protocol to the Active State.
  - The access network shall set the state for the InConfiguration instance of this protocol to the Active State.
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Access Channel MAC Protocol.
- All the public data not defined by this protocol shall be removed from the public data of the InUse protocol.

1.4.5.3 Message Formats

1.4.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x50.

TransactionID The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord The format of this record is specified in [1].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.4.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x51.

TransactionID The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [1]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC	**SLP**	Reliable

Addressing	unicast	**Priority**	40

1.4.6 Procedures and Messages for the InUse Instance of the Protocol

1.4.6.1 Procedures

The protocol constructs one or more packets out of the Security Layer packet as follows:

- The protocol adds the MAC Layer header specified in 1.4.6.2.1 in front of the Security Layer packet,
- The protocol adds the FCS as defined in 1.4.6.2.2,
- The protocol pads the result as defined in 1.4.6.2.3,
- The protocol splits the result into one or more Access Channel MAC Layer capsule fragments,
- The protocol adds the reserved bits, as defined in 1.4.6.2.4, to the capsule fragments to construct the Access Channel MAC Layer packets.

This protocol passes the packets for transmission to the Physical Layer. An example of the packet structure is shown in Figure 1.4.6.1-1.

Received packets are passed for further processing to the Security Layer after concatenation, removing the padding, FCS checking, and removing the MAC layer headers. The value of the SecurityLayerFormat and ConnectionLayerFormat fields shall be passed to the Security Layer with the Security Layer packet.

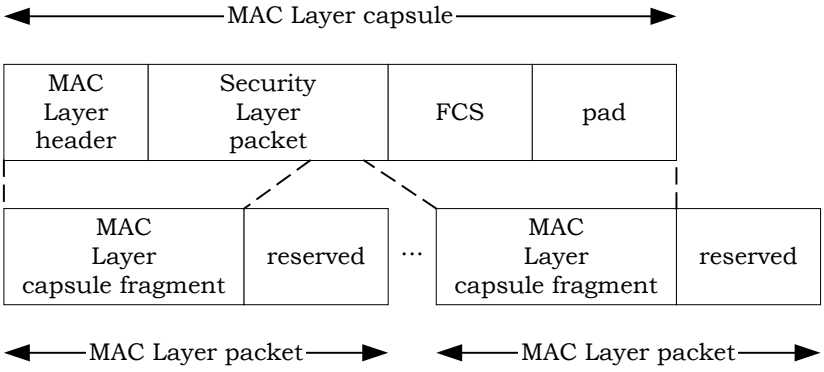

Figure 1.4.6.1-1. Access Channel MAC Packet Structure

1.4.6.1.1 Command Processing

The access network shall ignore all commands.

1.4.6.1.1.1 Activate

If this protocol receives an *Activate* command in the Inactive State,

- The access terminal shall transition to the Active State.
- The access network shall ignore it.

If this protocol receives the command in the Active State it shall be ignored.

1.4.6.1.1.2 Deactivate

If this protocol receives a *Deactivate* command in the Inactive State, it shall be ignored.

If this protocol receives the command in the Active State,

- The access terminal shall transition to the Inactive State.
- The access network shall ignore it.

1.4.6.1.2 Access Channel Structure

The Access Channel consists of one or more reverse link narrowband channels. The number of narrowband channels and the corresponding frequencies designated for Access Channel are specified by the AccessParameter message. The access terminal randomly selects one of the narrowband channels from the designated set of channels to send its access probe. Figure 1.4.6.1.2-1 and Figure 1.4.6.1.2-3 illustrate the access probe structure and the access probe sequence.

The Access Channel Cycle specifies the time instants at which the access terminal may start an access probe. An Access Channel probe may only begin at times T such that

(T -12*AccessChannelOffset) mod AccessCycleDuration = 0,

where T is CDMA System Time in slots and AccessChannelOffset is time offset of individual narrowband Access Channel in 20 msec frame. The Access Channel Cycle for each narrowband Access Channel is staggerred in time by its AccessChannelOffset as shown in Figure 1.4.6.1.2-2.

The structure of an individual access probe is shown in Figure 1.4.6.1.2-1. In each access probe, the preamble which consists of only the pilot symbols is first transmitted. After PreambleLength frames (of duration PreambleLength × 20 msec), the probe data is enabled for up to CapsuleLengthMax × 20 msec.

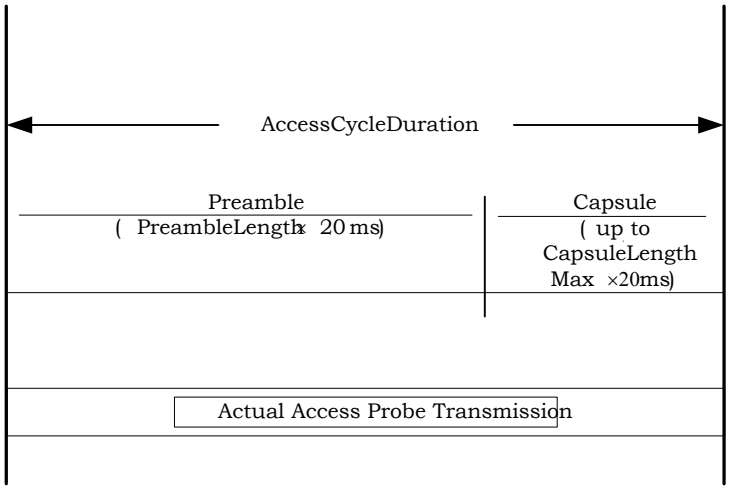

Figure 1.4.6.1.2-1. Access Probe Structure

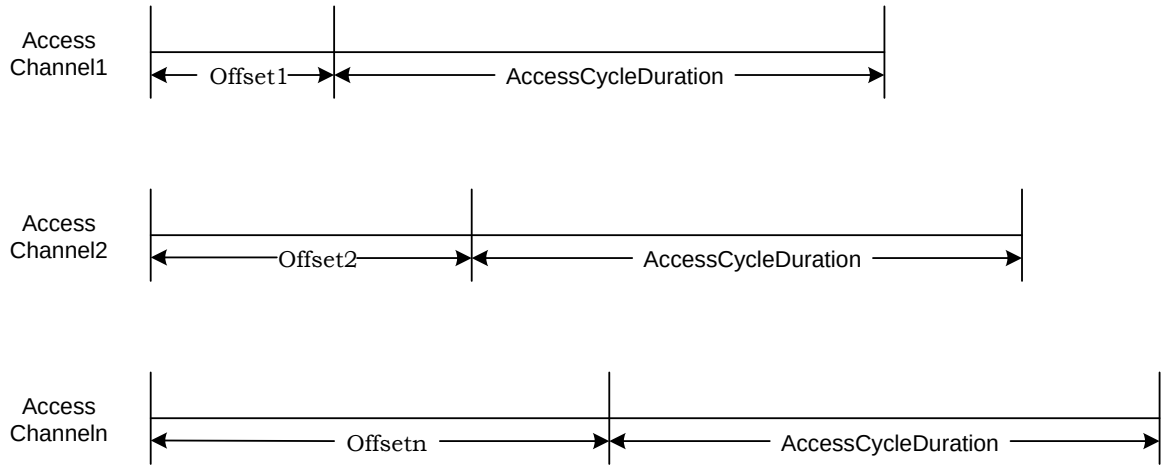

Figure 1.4.6.1.2-2. Time Staggering of Access Channel Cycle of Individual Narrowband Access Channel

Each probe in a sequence is transmitted at increased power until any of the following conditions are met:

- The access terminal receives an ACAck message,
- Transmission is aborted because the protocol received a *Deactivate* command, or
- Maximum number of probes per sequence (ProbeNumStep) has been transmitted.

Prior to the transmission of the first probe, the access terminal performs a persistence test which is used to control congestion on the Access Channel.

Additionally the access terminal performs a persistence test in between probe sequences.

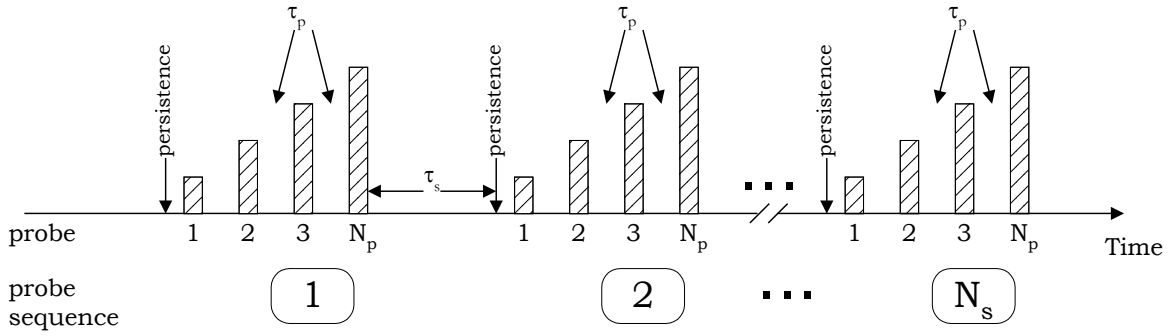

Figure 1.4.6.1.2-3. Access Probe Sequences

1.4.6.1.3 Inactive State

This state applies only to the access terminal.

In this state the access terminal waits for an *Activate* command.

1.4.6.1.4 Active State

In this state the access terminal is allowed to transmit on the Access Channel and the access network is monitoring the Access Channel.

If the protocol receives a *Deactivate* command,

- Access terminal shall:
  - Immediately cease transmitting on the Access Channel if it is in the process of sending a probe.
  - Return a *TransmissionAborted* indication if it was in the process of sending an Access Channel MAC Layer capsule.
  - Transition to the Inactive State.
- Access network shall ignore this command.

All other commands shall be ignored in this state.

1.4.6.1.4.1 Access Terminal Requirements

This protocol enforces a stop-and-wait packet transmission policy over the Access Channel. That is, the access terminal shall not send a new Access Channel MAC Layer capsule before either:

- Receipt of an ACAck message for the previous capsule, or
- Transmission of the previous capsule failed after transmitting ProbeSequenceMax probe sequences for it.

The access terminal shall return a *TxStarted* indication before transmitting the first probe for an Access Channel MAC Layer capsule.[3]

The access terminal shall return a *TxEnded* indication either:

- Simultaneous with a *TransmissionAborted* or a *TransmissionFailed* indication, or
- $T_{ACMPTransaction}$ seconds after a *TransmissionSuccessful* indication.

1.4.6.1.4.1.1 Probe Transmission

The access terminal shall conform to the following rules when sending a probe:

1. Current SectorParameters. The access terminal shall verify that the value of SectorSignature field of the latest QuickConfig message is the same as SectorSignature field of the latest SectorParameters message prior to sending the first probe of the first probe sequence. Both SectorSignature values (one belonging to the QuickConfig message and one belonging to the SectorParameters message) are public data of the Overhead Messages Protocol.

[3] Higher layer protocols use this indication as a notification that there may be an outstanding transaction on the Access Channel; and, therefore, the access terminal should not go to sleep.

2. Current AccessParameters. Prior to sending the first probe of the first probe sequence, the access terminal shall verify that the last AccessParameters message it received is current, according to the last AccessSignature value given as public data by the Overhead Messages Protocol. If the AccessParameters message is not current, the access terminal shall start the AccessParameters supervision timer for $T_{ACMPAPSupervision}$. If the timer expires before it receives the current AccessParameters message, the access terminal shall return a *SupervisionFailed* indication and transition to the Inactive State.

3. ATI Record. The access terminal shall set the ATI and ATIType fields of the ATI Record in the MAC Layer header to TransmitATI.ATI and TransmitATI.ATIType, respectively (TransmitATI is provided as public data by the Address Management Protocol).

4. Probe Power Control. The access terminal shall send the *i*th probe in the probe sequence at a power level given by $X_0+(i\text{-}1)\times$PowerStep, where X_0 represents the access terminal's open-loop mean output power of the Pilot Channel and is given by

   X_0 = - Mean R_X Power (dBm) + OpenLoopAdjust + ProbeInitialAdjust

   and the Mean R_X Power is estimated throughout the transmission of each probe.

5. Probe Structure. When sending a probe, the access terminal shall transmit PreambleLength frames of pilot only, followed by up to CapsuleLengthMax frames of probe data and pilot. The access terminal shall transmit a single Access Channel Capsule per probe. The access terminal shall not change the probe data contents in between probes.

6. PN Code Cover. The access terminal shall use the Access Channel long codes masks for generating the PN sequence to cover the entire probe. The Access Channel PN sequence is specified in[7].

7. Inter-Probe Backoff. If the access terminal receives an ACAck message or it has already transmitted ProbeNumStep (N_P in Figure 1.4.6.1.2-3) probes in this probe sequence, then it shall not send the next probe in this probe sequence. Otherwise, after sending an access probe within an access probe sequence, the access terminal shall perform the following procedures:

   a. Set yTotal to 0,

   b. Generate a pseudo random number y which is a uniformly distributed integer random number between 0 and ProbeBackoff,

   c. Add y to yTotal (i.e., yTotal = yTotal + y),

   d. Compute P = TACMPATProbeTimeout + (yTotal × AccessCycleDuration)

e. Consider the access probe that would start at the first Access Channel Cycle instance that occurs at least P slots after the end of the previous access probe. If any portion of the access probe plus the time interval that is required to receive the corresponding ACAck message (as estimated by the access terminal)[4] overlaps with slots when the access terminal does not receive the Forward Channel, then the access terminal shall transmit the next access probe at the first Access Channel Cycle instance that occurs at least P + T ×AccessCycleDuration) slots after the end of the previous access probe where T is the minimum number of intervals of length AccessCycleDuration that are needed to be added to P in order to ensure that the access probe does not overlap with the slots when the access terminal does not receive the Forward Channel.

f. Otherwise, if condition 'e' is not satisfied, the access terminal shall transmit the next access probe at the first Access Channel Cycle instance that occurs at least P slots after the end of the previous access probe.

1.4.6.1.4.1.2 Access Channel Long Code Mask

The access terminal shall set the Access Channel long masks, MI_{ACMAC} and MQ_{ACMAC} as follows.

The 42-bit mask MI_{ACMAC} shall be as specified in Table 1.4.6.1.4.1.2-1.

Table 1.4.6.1.4.1.2-1. Access Channel Long Code Masks

BIT	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
MI_{ACMAC}	1	1	AccessCycleNumber								Permuted (ColorCode | SectorID[23:0])																																	

The 42-bit mask MQ_{ACMAC} shall be derived from the mask MI_{ACMAC} as follows:

$MQ_{ACMAC}[k] = MI_{ACMAC}[k-1]$, for k = 1,..., 41

$MQ_{ACMAC}[0] = MI_{ACMAC}[0] \oplus MI_{ACMAC}[1] \oplus MI_{ACMAC}[2] \oplus MI_{ACMAC}[4] \oplus MI_{ACMAC}[5] \oplus$

$MI_{ACMAC}[6] \oplus MI_{ACMAC}[9] \oplus MI_{ACMAC}[15] \oplus MI_{ACMAC}[16] \oplus MI_{ACMAC}[17] \oplus$

$MI_{ACMAC}[18] \oplus MI_{ACMAC}[20] \oplus MI_{ACMAC}[21] \oplus MI_{ACMAC}[24] \oplus MI_{ACMAC}[25] \oplus$

$MI_{ACMAC}[26] \oplus MI_{ACMAC}[30] \oplus MI_{ACMAC}[32] \oplus MI_{ACMAC}[34] \oplus MI_{ACMAC}[41]$

where the $\oplus$ denotes the Exclusive OR operation, and $MQ_{ACMAC}[i]$ and $MI_{ACMAC}[i]$ denote the i^{th} least significant bit of MQ_{ACMAC} and MI_{ACMAC}, respectively.

In Table 1.4.6.1.4.1.2-1:

- SectorID is given as public data of Overhead Messages Protocol and corresponds to the sector to which the access terminal is sending the access probe.

[4] The turn-around time between the access network receiving an access probe and sending an ACAck message is determined by the access network implementation, but the access terminal may estimate such time interval.

- ColorCode is given as public data of Overhead Messages Protocol and corresponds to the sector to which the access terminal is sending the access probe.
- AccessCycleNumber is defined as follows:

$$\text{AccessCycleNumber} = \text{SystemTime} \bmod 256$$

Where:

- SystemTime is the CDMA System Time in slots corresponding to the slot in which the first access probe preamble for this access probe is sent. Permuted(ColorCode | SectorID[23:0]) is a permutation of the bits in ColorCode | SectorID[23:0] and is defined as follows:

$$\text{ColorCode} \mid \text{SectorID}[23:0] = (S_{31}, S_{30}, S_{29}, \ldots, S_0)$$

$$\text{Permuted}(\text{ColorCode} \mid \text{SectorID}[23:0]) =$$
$$(S_0, S_{31}, S_{22}, S_{13}, S_4, S_{26}, S_{17}, S_8, S_{30}, S_{21}, S_{12}, S_3, S_{25}, S_{16}, S_7, S_{29}, S_{20}, S_{11}, S_2, S_{24},$$
$$S_{15}, S_6, S_{28}, S_{19}, S_{10}, S_1, S_{23}, S_{14}, S_5, S_{27}, S_{18}, S_9).$$

1.4.6.1.4.1.3 Probe Sequence Transmission

The access terminal shall conform to the following rules when sending a probe sequence:

1. The access terminal shall randomly select one of the narrowband channels designated as Access Channel.
2. Transmission of the First Probe.
   - Prior to sending the first probe of the sequence, the access terminal shall perform the following:
     + Persistence Test : For this test, the access terminal shall use the value p as specified by APersistence[i] where i is the class of the access terminal and APersistence[i] is the $(i+1)^{st}$ occurrence of the APersistence field in the AccessParameters message.[5] The value i=2 is reserved for test access terminals. If the access terminal does not have a class defined, it shall use i=0, corresponding to non-emergency access terminals. All other values of i are reserved.

     When p is not zero, the persistence test consists of comparing a uniformly distributed random number x, $0 < x < 1$, (using the procedure specified in [1]) with p. If $x < p$ the test is said to succeed. If the persistence test succeeds or if the number of consecutive unsuccessful persistence tests exceeds $4/p$, the access terminal may transmit in the first upcoming Access Channel Cycle such that no portion of the access probe plus the time interval that is required to

[5] The access terminal's class is configured through means that are outside the scope of this specification.

receive the corresponding ACAck message (as estimated by the access terminal)[6] will overlap with slots when the access terminal does not receive the Forward Channel. If *p* is equal to zero, the access terminal shall return a *TransmissionFailed* indication and end the access.

3. Probe Contents. The access terminal shall not change the data portion of the probe contents between probe sequences.

4. Success Condition. If the access terminal receives an ACAck message it shall stop the probe sequence, including any transmission in progress, and shall return a *TransmissionSuccessful* indication.

5. Failure Condition. If the access terminal has already sent ProbeSequenceMax probe sequences for this access (N_S in Figure 1.4.6.1.2-3), and if it does not receive an ACAck message acknowledging its receipt within ($T_{ACMPATProbeTimeout}$ + $T_{ACMPCycleLen}$) slots after the end of the last access probe, or if the interval between two adjacent probes in the access attempt is greater than $T_{ACMPATProbeTimeout}$ + max(ProbeBackoff, ProbeSequenceBackoff) × AccessCycleDuration + $T_{ACMPMaxDelayPrevProbe}$ slots[7], then the access terminal shall return a *TransmissionFailed* indication and abort the access.

6. Inter-Sequence Backoff. The access terminal shall generate a uniformly distributed integer random number *k* between 0 and ProbeSequenceBackoff. The access terminal shall wait for τ_S = (*k* × AccessCycleDuration) + $T_{ACMPATProbeTimeout}$ slots from the end of the last probe of the previous sequence before repeating this sequence.

1.4.6.1.4.2 Access Network Requirements

The access network should send an AccessParameters message at least once every $N_{ACMPAccessParameters}$ slots.

The access network should send an ACAck message in response to every Access Channel MAC Layer capsule it receives. The message should be sent within $T_{ACMPANProbeTimeout}$ slots of receipt of the packet. The access network shall return a *MACLayerCapsuleReceived* indication upon sending an ACAck message.

The access network should monitor and control the load on the Access Channel. The access network may control the load by adjusting the access persistence vector, APersistence, sent as part of the AccessParameters message.

1.4.6.2 Header and Message Formats

1.4.6.2.1 MAC Layer Header

The access terminal shall place the following header in front of the Security Layer packet:

---

[6] The turn-around time between the access network receiving an access probe and sending an ACAck message is determined by the access network implementation, but the access terminal may estimate such time interval.

[7] E.g., because the access terminal has tuned to the frequency associated with another air-interface.

Field	Length (bits)
Length	8
SessionConfigurationToken	16
SecurityLayerFormat	1
ConnectionLayerFormat	1
Reserved	4
ATI Record	34

Length — The access terminal shall set this field to the combined length, in octets, of the Security Layer packet and this MAC Layer header. excluding the Length field.

SessionConfigurationToken — The access terminal shall set this field to the value of the SessionConfigurationToken which is public data of the Session Configuration Protocol.

SecurityLayerFormat — The access terminal shall set this field to '1' if security layer packet is either authenticated or encrypted; otherwise, the access terminal shall set this field to '0'.

ConnectionLayerFormat — The access terminal shall set this field to '1' if the connection layer packet is Format B; otherwise, the access terminal shall set this field to '0'.

Reserved — The access terminal shall set this field to zero. The access network shall ignore this field.

ATI Record — Access Terminal Identifier Record. The access terminal shall set this field to the record specifying the access terminal's ID specified by TransmitATI.ATI and TransmitATI.ATIType. This record is defined in [1].

1.4.6.2.2 FCS

The FCS shall be calculated using the standard CRC-CCITT generator polynomial:

$$g(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x^1 + 1$$

The FCS shall be equal to the value computed by the following procedure and the logic shown below:

- All shift register elements shall be initialized to logical zeros.
- Switches shall be set in the up position.

- Register shall be clocked once for each bit of Access Channel MAC Layer Capsule, excluding the FCS and padding bits. The Access Channel MAC Layer Capsule is read in order from MSB to LSB, starting with the MSB of the MAC Layer header
- Switches shall be set in the down position so that the output is a modulo-2 addition with a '0' and the successive shift register inputs are '0'.
- Register shall be clocked an additional 32 times for the 32 FCS bits.

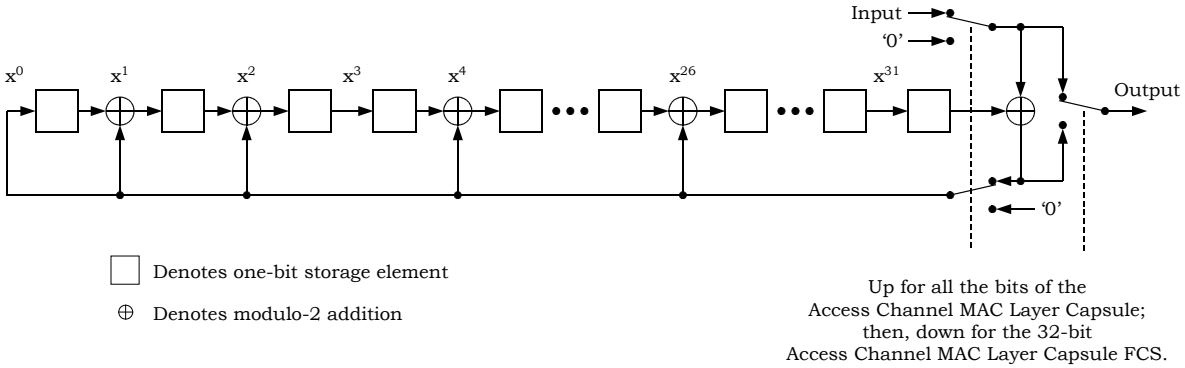

Figure 1.4.6.2-1. Access Channel MAC Layer Capsule FCS

1.4.6.2.3 Padding Bits

The access terminal shall add sufficient padding so that the Access Channel MAC capsule, including all payload, FCS, padding, and headers, is the smallest possible integer multiple of 232 bits. The access terminal shall set the padding bits to '0'. The access network shall ignore the padding bits.

1.4.6.2.4 Reserved Bits

The access terminal shall add 2 reserved bits to each Access Channel capsule fragment.

The access terminal shall set the reserved bits to '0'. The access network shall ignore the reserved bits.

1.4.6.2.5 ACAck

The access network sends the ACAck message to acknowledge receipt of an Access Channel MAC Layer capsule.

Field	Length (bits)
MessageID	8

MessageID The access network shall set this field to 0x00.

Channels	CC	**SLP**	Best Effort
Addressing	unicast	**Priority**	10

1.4.6.2.6 AccessParameters

The AccessParameters message is used to convey Access Channel information to the access terminals.

Field	Length (bits)
MessageID	8
AccessCycleDuration	8
AccessSignature	16
OpenLoopAdjust	8
ProbeInitialAdjust	5
ProbeNumStep	4
PowerStep	4
PreambleLength	3
CapsuleLengthMax	4

$N_{ACMPAPersist}$ occurrences of the following field:

{

APersistence	6

}

AccessChannelRecordCount	4

AccessChannelRecordCount occurences of the following field:

{0

AccessChannelRecord	24

NumOfNarrowBandChannels (see [6]) occurences of the following field:

{1

AccessChannelOffset	8

}1

}0

MaxPathDelay	0 or 8
Reserved	variable

MessageID The access network shall set this field to 0x01.

AccessCycleDuration

The access network shall set this field to the duration of an Access Channel Cycle in units of 20 msec frames.

AccessSignature — AccessParameters message signature. The access network shall change this field if the contents of the AccessParameters message change.

OpenLoopAdjust — The access network shall set this field to the negative of the nominal power to be used by access terminals in the open loop power estimate, expressed as an unsigned value in units of 1 dB. The value used by the access terminal is -1 times the value of this field.

ProbeInitialAdjust — The access network shall set this field to the correction factor to be used by access terminals in the open loop power estimate for the initial transmission on the Access Channel, expressed as a two's complement value in units of 1 dB.

ProbeNumStep — The access network shall set this field to the maximum number of access probes access terminals are to transmit in a single access probe sequence. The access network shall set this field to a value in the range [1 ... 15].

PowerStep — Probe power increase step. The access network shall set this field to the increase in power between probes, in resolution of 0.5 dB. The access terminal shall support all the valid values specified by this field.

PreambleLength — The access network shall set this field to the length in 20 msec frames of the access probe preamble in the range [4 … 7]. The access terminal shall support all the valid values specified by this field.

CapsuleLengthMax — Access Channel Max Capsule length. The access network shall set this field to the maximum number of frames in an Access Channel Capsule. The access network shall set this field to a value in the range [2 … 15]. The access terminal shall support all the valid values specified by this field.

APersistence — Access persistence vector. If a value in this vector is 0x3F, the access terminal shall use zero as the corresponding persistence probability; otherwise, if the value of this field, n, not equal to 0x3F, the access terminal shall use $2^{-n/4}$ as the corresponding persistence probability.

AccessChannelRecordCount

Number of access channel records. Access network shall set this field to the number of access channel records supported by a sector. Each

channel record may contain more than one (up to 15 channels for a single 1.25MHz carrier) consecutive narrowband access channels.

AccessChannelRecord

Access Channel record. Access network shall set this field to channel record (see [6]) corresponding to the narrowband access channel frequency in this sector.

AccessChannelOffset

AccessChannelOffset in time. The offset is specified as an array of size equal to the number of narrowband access channels in a channel record. Each 8-bit entry of the array denotes the time offset of the access channel cycle for each narrowband access channel in units of 20 msec frames (12 slots).

MaxPathDelay Maximum round-trip path delay in unit of 4 slots period. This is the optional field and shall contain a non-zero value if included.

Reserved Number of bits in this field is equal to the number needed to make the message length an integer number of octets. The access network shall set this field to zero. The access terminal shall ignore this field.

Channels	CC	**SLP**	Best Effort
Addressing	Broadcast	**Priority**	30

1.4.6.3 Interface to Other Protocols

1.4.6.3.1 Commands

This protocol does not issue any commands.

1.4.6.3.2 Indications

This protocol does not register to receive any indications.

1.4.7 Configuration Attributes

The following complex attributes and default values are defined (see [1] for attribute record definition).

1.4.7.1 InitialConfiguration Attribute

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A

One or more of the following attribute value record:

{

ValueID	8	N/A
ProbeSequenceMax	4	3
ProbeBackoff	4	4
ProbeSequenceBackoff	4	8
Reserved	4	N/A

}

Length — Length of the complex attribute in octets. The access network shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — Parameter set identifier. The access network shall set this field to 0x00.

ValueID — The access network shall set this field to an identifier assigned to this complex attribute. The access network should change this field for each set of values for this complex attribute.

ProbeSequenceMax — Maximum number of probe sequences. The access network shall set this field to the maximum number of probe sequences for a single access attempt. The access network shall set this field to a value in the range [1 … 15]. The access terminal shall support all the valid values specified by this field.

ProbeBackoff — Inter-probe backoff. The access network shall set this field to the upper limit of the backoff range (in units of AccessCycleDuration) that the access terminal is to use between probes. The access terminal shall support all the valid values specified by this field.

ProbeSequenceBackoff — Inter-probe sequence backoff. The access network shall set this field to the upper limit of the backoff range (in units of AccessCycleDuration) that the access terminal is to use between probe sequences. The access terminal shall support all the valid values specified by this field.

Reserved — The access network shall set this field to zero. The access terminal shall ignore this field.

1.4.8 Protocol Numeric Constants

Constant	Meaning	Value
$N_{ACMPType}$	Type field for this protocol	[5]
$N_{ACMPxHRPDS0}$	Subtype field for this protocol	0x0000
$N_{ACMPAPersist}$	Number of different persistence values	4
$N_{ACMPAccessParameters}$	The recommended maximum number of slots between transmission of two consecutive AccessParameters message.	3 * $T_{ACMPCycleLen}$
$T_{ACMPAPSupervision}$	AccessParameters supervision timer	12 * $T_{ACMPCycleLen}$
$T_{ACMPATProbeTimeout}$	Time to receive an acknowledgment at the access terminal for a probe before sending another probe	128 + 4*MaxPathDelay slots
$T_{ACMPANProbeTimeout}$	Maximum time to send an acknowledgment for a probe at the access network	96 slots
$T_{ACMPTransaction}$	Time for access terminal to wait after a successful transmission before returning a *TxEnded* indication	1 second
$T_{ACMPCycleLen}$	Length of Control Channel Cycle used by the Access Channel MAC Protocol	256 slots
$T_{ACMPMaxDelayPrevProbe}$	A constant that determines the time for the access terminal to wait until after transmitting an access probe in the access attempt before returning a *TransmissionFailed* indication	300 slots

1.4.9 Session State Information

The Session State Information record (see [1]) consists of parameter records.

The parameter records for this protocol consist of only the configuration attributes of this protocol.

1.5 xHRPD Subtype 0 Forward Traffic Channel MAC Protocol

1.5.1 Overview

The xHRPD Subtype 0 Forward Traffic Channel MAC Protocol provides the procedures and messages required for an access network to transmit and an access terminal to receive the Forward Traffic Channel. Specifically, this protocol addresses Forward Traffic Channel addressing and Forward Traffic Channel rate control. This protocol operates with the xHRPD Subtype 0 Physical Layer Protocol.

The access network maintains an instance of this protocol for every access terminal.

This protocol operates in one of two states:

- Inactive State: In this state, the access terminal is not assigned a Forward Traffic Channel. When the protocol is in this state, it waits for an *Activate* command.
- Variable Rate State: In this state, the access network transmits the Forward Traffic Channel at a variable rate, as a function of the access terminal's CQI value.

The protocol states and allowed transitions between the states are shown in Figure 1.5.1-1. The rules governing these transitions are provided in sections 1.5.6.1.3, and 1.5.6.1.4 for transitions out of the Inactive State, and Variable Rate State.

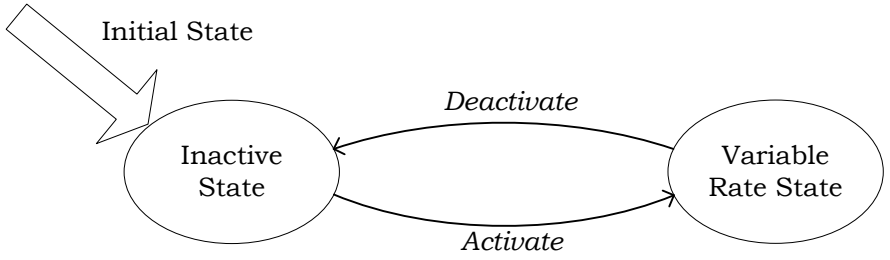

Figure 1.5.1-1. xHRPD Subtype 0 Forward Traffic Channel MAC Protocol State Diagram

1.5.2 Primitives and Public Data

1.5.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*

1.5.2.2 Return Indications

This protocol returns the following indication:

- *SupervisionFailed*

1.5.2.3 Public Data

This protocol shall make the following data public:

- Subtype for this protocol

1.5.3 Protocol Data Unit

The transmission unit of this protocol is a Forward Traffic Channel MAC Layer packet. Each packet consists of one Security Layer packet.

1.5.4 Protocol Initialization

1.5.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.

1.5.4.2 Protocol Initialization for the InUse Protocol Instance

Upon creation, the InUse instance of this protocol in the access terminal and the access network shall perform the following:

- The value of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- The protocol at the access terminal and the access network shall enter the Inactive State.

1.5.5 Procedures and Messages for the InConfiguration Instance of the Protocol

1.5.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [1]) to define the processing of the configuration messages.

1.5.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.
- If the InUse instance of this protocol has the same subtype as this protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol.
  - The access terminal and the access network shall purge the InConfiguration instance of the protocol.
- If the InUse instance of this protocol does not have the same subtype as this protocol instance, then the access network and the access terminal shall perform the following in the order specified:
  - The access terminal and the access network shall set the initial state for the InConfiguration instance of this protocol to the Inactive State.
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Forward Traffic Channel MAC Protocol.
- All the public data not defined by this protocol shall be removed from the public data of the InUse protocol.

1.5.5.3 Message Formats

1.5.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x50.

TransactionID — The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord — The format of this record is specified in [1].

Channels	FTC RTC

SLP	Reliable

Addressing	unicast	**Priority**	40

1.5.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x51.

TransactionID The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [1]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.5.6 Procedures and Messages for the InUse Instance of the Protocol

1.5.6.1 Procedures

The protocol constructs a Forward Traffic Channel MAC Layer packet out of the Security Layer packet by adding the MAC Layer trailer as defined in 1.5.6.2.1.

The protocol then sends the packet for transmission to the Physical Layer. The packet structure is shown in Figure 1.5.6-1.

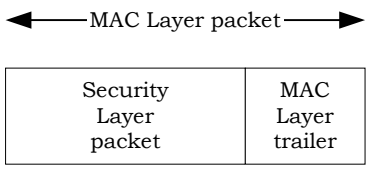

Figure 1.5.6-1. Forward Traffic Channel MAC Layer Packet Structure

If the MACLayerFormat field of the MAC Layer trailer is equal to '1', received packets are passed for further processing to the Security Layer after removing the layer-related trailer.

The access terminal shall discard the MAC packet if the MACLayerFormat field of the MAC Layer trailer is equal to '0'. The ConnectionLayerFormat field within the MAC Layer trailer shall be passed to the Security Layer with the Security Layer packet.

1.5.6.1.1 Command Processing

1.5.6.1.1.1 Activate

If this protocol receives an *Activate* command in the Inactive State, the access terminal and the access network shall transition to the Variable Rate State.

If this protocol receives the command in any other state it shall be ignored.

1.5.6.1.1.2 Deactivate

If the protocol receives a *Deactivate* command in the Variable Rate State,

- The access terminal shall cease monitoring the Forward Traffic Channel, shall cease transmitting the CQI Channel, and shall transition to the Inactive State.
- The access network should cease transmitting the Forward Traffic Channel to this access terminal, should cease receiving the CQI channel from this access terminal, and should transition to the Inactive State.

If this command is received in the Inactive State it shall be ignored.

1.5.6.1.2 Forward Traffic Channel Addressing

Transmission on the Forward Traffic Channel is time division multiplexed. At any given time, the channel is either being transmitted or not; and, if it is being transmitted, it is addressed to a single user. When transmitting the Forward Traffic Channel, the access network uses the MACIndex to identify the target access terminal.

Requirements for Forward Traffic Channel addressing are part of the Physical Layer.

1.5.6.1.3 Inactive State

When the protocol is in the Inactive State, the access terminal and the access network wait for an *Activate* command.

1.5.6.1.4 Variable Rate State

In the Variable Rate State, the access network transmits at the rate dictated by the CQI Channel transmitted by the access terminal.

The access terminal shall perform the supervision procedures described in 1.5.6.1.5.1 in the Variable Rate State.

1.5.6.1.4.1 CQI and Packet Transmission Requirements

The access terminal uses the CQI value to specify the requested transmission rate. Two types of CQI formats shall be supported. The first type is the 4-bit CQI format. Using this CQI format, an access terminal can request a data rate from the entire set of forward link data rates ranging from 38.4 kbps to 3.072 Mbps. The second type of CQI format uses two

bits for CQI. It is intended for those terminals whose link budget can support only a subset of forward link data rates and/or whose return link rates are low, i.e., 640 bps or 1.2 kbps. The choice of CQI format is based on the terminal capability indicated in the RouteUpdate message.

4-bit CQI Format

The access terminal shall set the CQI value to a 4-bit CQI index, ranging from 0x0 to 0xe. The CQI index 0 is also known as the null-rate CQI. Each CQI index is associated with a Rate Metric, a Span and a list of Single User transmission formats, as shown in Table 1.5.6.1.4.1-1.

2-bit CQI Format

The access terminal shall set the CQI value to a 2-bit CQI index, ranging from 0x0 to 0x3. Each CQI index is associated with a Rate Metric, a Span and a list of Single User transmission formats, as shown in Table 1.5.6.1.4.1-1 where the CQI values 0x0 to 0x3 in 2-bit format map to CQI values 0x1 to 0x4 in 4-bit format.

1.5.6.1.4.1.1 Access Terminal Requirements

The access terminal shall obey the following rules when transmitting the CQI:

- Access terminal shall use CQIPeriod number of 20-ms reverse link frames to send a single CQI value. The CQI value is defined to take effect after CQIDelay number of frames from the frame boundary that the access terminal sends this new CQI value at , and stay in effect for CQIPeriod frames (see [7]).
- For an access terminal, the CQI value it transmits shall not change in slots other than T such that:

  $$(T_{AT}\text{- FrameOffset} - \text{CQIDelay in slots}) \bmod (\text{CQIPeriod} * 12 \text{ slots/frame}) = 0,$$

  where T_{AT} is the CDMA system time in slots observed at the access terminal.

  The forward link serving data rate to this access terminal shall not change in slots other than T such that

  $$(T - \text{FrameOffset}) \bmod (\text{CQIPeriod} * 12 \text{ slots/frame}) = 0$$

  where T the local CDMA system time observed either at access network or access terminal.
- Access terminal shall set the CQI to one of the valid values in Table 1.5.6.1.4.1-1, corresponding to the rate it requests.
- Access terminal shall set the CQI to the maximum value that channel conditions permit. The access terminal uses the null rate if the channel conditions do not permit even the lowest non-null rate.

Table 1.5.6.1.4.1-1. CQI Value Specification

CQI value	Rate (kbps)	Packet Length (Slots)
0x0	null rate	N/A
0x1	38.4	16
0x2	76.8	8
0x3	153.6	4
0x4	307.2	2
0x5	307.2	4
0x6	614.4	1
0x7	614.4	2
0x8	921.6	2
0x9	1228.8	1
0xa	1228.8	2
0xb	1843.2	1
0xc	2457.6	1
0xd	1536	2
0xe	3072	1
0xf	Invalid	N/A

1.5.6.1.4.1.2 Access Network Requirements

The access network shall obey the following rules when processing the CQI and sending a packet to the access terminal:

- If the access network transmits a MAC Layer packet to the access terminal starting in slot T, it shall use a packet type and transmission format compatible with the CQI value in effect at slot T.

1.5.6.1.5 Supervision Procedures

1.5.6.1.5.1 CQI Supervision

The access terminal shall perform supervision on the CQI as follows:

- The access terminal shall set the CQI supervision timer for $T_{FTCMCQISupervision}$ when it transmits a null rate CQI.
- The access terminal shall disable the timer if the CQI supervision timer is active and any of the following conditions is true:
  - the access terminal requests a non-null rate

– the access terminal successfully receives a Forward Traffic Channel packet addressed to the access terminal's unicast address and the value of the NullRateCQI38.4Enable attribute is equal to 0x0001.

- The access terminal may disable the timer if the CQI supervision timer is active and the access terminal successfully receives a Control Channel packet.
- If the CQI supervision timer expires, the access terminal shall disable the Reverse Traffic Channel transmitter and set the Reverse Traffic Channel Restart timer for time $T_{FTCMPRestartTx}$.
- If the access terminal generates consecutive non-null rate CQI values for more than $N_{FTCMPRestartTx}$ slots or successfully receives a packet, the access terminal shall disable the Reverse Traffic Channel Restart timer and shall enable the Reverse Traffic Channel transmitter.
- If the Reverse Traffic Channel Restart timer expires, the access terminal shall return a *SupervisionFailed* indication and transition to the Inactive State.

1.5.6.1.5.2 ForwardTrafficValid Monitoring

The access terminal shall monitor the bit associated with its MACIndex in the ForwardTrafficValid63To0 field made available by the Overhead Messages Protocol. If the Overhead Messages Protocol does not provide a ForwardTrafficValid63To0 field associated with the access terminal, then the access terminal shall behave as if the field were set to '0'. If this bit is set to 0, the access terminal shall return a *SupervisionFailed* indication and transition to the Inactive State.

1.5.6.2 Trailer and Message Formats

1.5.6.2.1 MAC Layer Trailer

The access network shall set the MAC Layer Trailer as follows:

Field	Length (bits)
ConnectionLayerFormat	1
MACLayerFormat	1

ConnectionLayerFormat

The access network shall set this field to '1' if the connection layer packet is Format B; otherwise, the access network shall set this field to '0'.

MACLayerFormat The access network shall set this field to '1' if the MAC layer packet contains a valid payload; otherwise, the access network shall set this field to '0'.

1.5.6.3 Interface to Other Protocols

1.5.6.3.1 Commands Sent

This protocol does not issue any commands.

1.5.6.3.2 Indications

This protocol registers to receive the following indication:

- *PhysicalLayer.ForwardTrafficCompleted*

1.5.7 Configuration Attributes

The following attributes and default values are defined (see [1] for attribute record definition).

1.5.7.1 Simple Attributes

The negotiable simple attribute for this protocol is listed in Table 1.5.7.1-1. The access terminal shall use as defaults the values in Table 1.5.7.1-1 that are typed in ***bold italics***.

Table 1.5.7.1-1. Configurable Values

Attribute ID	Attribute	Values	Meaning
0xfd	NullRateCQI38.4Enable	***0x0000***	The access network will not serve an access terminal requesting the null rate.
		0x0001	The access network may serve an access terminal requesting the null rate at 38.4 kbps.
		All other values	Reserved

The access terminal shall support the default value of these attributes.

1.5.8 Protocol Numeric Constants

Constant	Meaning	Value
$N_{FTCMPType}$	Type field for this protocol	[5]
$N_{FTCMPxHRPDS0}$	Subtype field for this protocol	0x0000
$N_{FTCMPRestartTx}$	Number of consecutive slots of non-null rate CQIs to re-enable the Reverse Traffic Channel transmitter once it is disabled due to CQI supervision failure.	16
$T_{FTCMCQISupervision}$	CQI supervision timer	240 ms
$T_{FTCMPRestartTx}$	Reverse Channel Restart Timer	12 Control Channel cycles

1.5.9 Session State Information

The Session State Information record (see [1]) consists of parameter records.

The parameter records for this protocol consist of only the configuration attributes of this protocol.

1.6 xHRPD Subtype 1 Forward Traffic Channel MAC Protocol

1.6.1 Overview

The xHRPD Subtype 1 Forward Traffic Channel MAC Protocol provides the procedures and messages required for an access network to transmit and an access terminal to receive the Forward Traffic Channel. Specifically, this protocol addresses Forward Traffic Channel addressing and Forward Traffic Channel rate control. This protocol operates with the xHRPD Subtype 0 Physical Layer Protocol.

The access network maintains an instance of this protocol for every access terminal.

This protocol operates in one of two states:

- Inactive State: In this state, the access terminal is not assigned a Forward Traffic Channel. When the protocol is in this state, it waits for an *Activate* command.
- Variable Rate State: In this state, the access network transmits the Forward Traffic Channel to the access terminal, in accordance with the CQI Channel received from the access terminal.

The protocol states and allowed transitions between the states are shown in Figure 1.6.1-1. The rules governing these transitions are provided in sections 1.6.6.1.7, and 1.6.6.1.8 for transitions out of the Inactive State, and Variable Rate State.

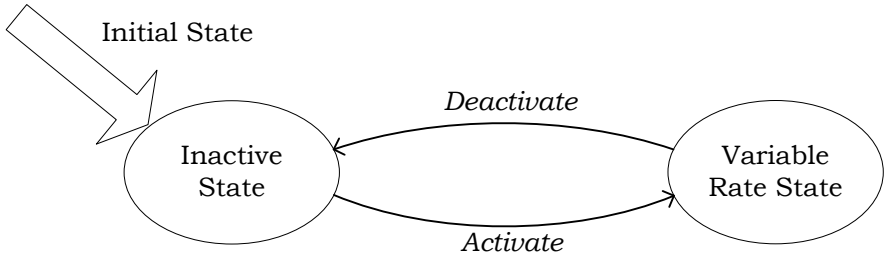

Figure 1.6.1-1. xHRPD Subtype 1 Forward Traffic Channel MAC Protocol State Diagram

1.6.2 Primitives and Public Data

1.6.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*

1.6.2.2 Return Indications

This protocol returns the following indication:

- *SupervisionFailed*

1.6.2.3 Public Data

This protocol shall make the following data public:

- Subtype for this protocol
- CQIPeriod
- CQIDelay
- MultiUserPacketsEnabled
- State of the xHRPD Subtype 1 Forward Traffic Channel MAC Protocol (Inactive State or Variable Rate State)

1.6.3 Protocol Data Unit

The transmission unit of this protocol is a Forward Traffic Channel MAC Layer packet. Each Forward Traffic Channel MAC Layer packet consists of zero or more Security Layer packets.

1.6.4 Protocol Initialization

1.6.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.

1.6.5 Procedures and Messages for the InConfiguration Instance of the Protocol

1.6.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [1]) to define the processing of the configuration messages.

1.6.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.
- The value of the following public data of the InUse protocol shall be set to the corresponding attribute value of the InConfiguration protocol instance:
  - MultiUserPacketsEnabled
- If the InUse instance of this protocol has the same subtype as this protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol.
  - The access terminal and the access network shall purge the InConfiguration instance of the protocol.
- If the InUse instance of this protocol does not have the same subtype as this protocol instance, then the access network and the access terminal shall perform the following in the order specified:
  - The access terminal and the access network shall set the initial state for the InConfiguration instance of this protocol to the Inactive State.
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Forward Traffic Channel MAC Protocol.
- All the public data not defined by this protocol shall be removed from the public data of the InUse protocol.

1.6.5.3 Message Formats

1.6.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x50.

TransactionID — The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord — The format of this record is specified in [1].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.6.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x51.

TransactionID — The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord — An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [1]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.6.6 Procedures and Messages for the InUse Instance of the Protocol

1.6.6.1 Procedures

At the access network, the Forward Traffic Channel MAC Protocol encapsulates zero or more Security Layer packets into a MAC Layer packet and passes the MAC Layer packet for transmission to the Physical Layer Protocol, along with the Preamble MAC Index and Transmission Format of the Forward Traffic Channel. The choice of Transmission Format is governed by the CQI information received from the access terminal.

1.6.6.1.1 MAC Layer Packet

The MAC Layer packet is the basic unit of data provided by the Forward Traffic Channel MAC protocol to the Physical Layer Protocol. The MAC Layer packets shall be of one of the following two types:

- Single User Simplex
- Multi-User

The access network shall not transmit a Multi-User packet to the access terminal if the MultiUserPacketsEnabled attribute is set to 0x00.

Single User Simplex packets are also referred to as Single User packets. The structure of a MAC Layer packet is shown in Figure 1.6.6.1.1-1. The MAC Layer packet consists of the following (in order):

- MAC Layer Header (which may be empty)
- MACHeaderDelimiter (if required)
- MAC Layer Payload
- PAD (if required)
- MAC Layer Trailer

The size of a MAC Layer packet takes on a discrete set of values, as shown in Figure 1.6.6.1.1-1.

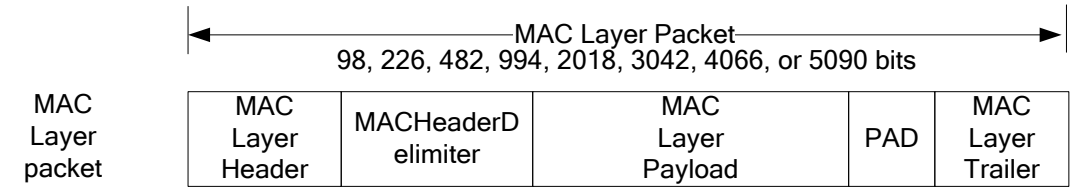

Figure 1.6.6.1.1-1. xHRPD Subtype 1 Forward Traffic Channel MAC Layer Packet Structure

The MAC Layer payload consists of zero or more Security Layer packets addressed to zero or more access terminals. The MAC Layer Header (if included), MACHeaderDelimiter (if included), and MAC Layer Trailer are used to provide information needed to parse the contents of the MAC Layer Payload and to specify the type of the MAC Layer packet (Single User Simplex, or Multi-User).

The MAC Layer payload may be followed by padding, which consists of a sequence of all '0's. The size of the padding sequence is chosen such that the overall size of the MAC Layer packet is one of 98, 226, 482, 994, 2018, 3042, 4066, or 5090 bits.

1.6.6.1.1.1 Description of MAC Layer packet types

A Single User Simplex MAC Layer packet is used to carry one Security Layer packet in its payload and is addressed to one access terminal. The MAC Layer Payload size equals the size of the MAC Layer Packet minus the size of the MAC Layer Trailer. A Single User Simplex packet consists of the following (in order):

- An empty MAC Layer Header
- A MAC Layer Payload consisting of one Security Layer packet
- No PAD

The Security Layer packet in a Single User Simplex packet contains a Format A or Format B Connection Layer packet.

A Multi-User MAC Layer Packet is used to carry in its payload, zero or more Security Layer packets addressed to zero or more access terminals. A Multi-User packet consists of the following (in order):

- Non-empty MAC Layer Header
- MACHeaderDelimiter (if required)
- MAC Layer Payload consisting of zero or more (max of eight) Security Layer packets
- PAD (if required)
- MAC Layer Trailer

Each Security Layer packet in a Multi-User packet contains a Format A or Format B Connection Layer packet.

1.6.6.1.1.2 Construction of MAC Layer packets

The structure of Single User Simplex MAC packets and Multi-User MAC packets are shown in Figure 1.6.6.1.1.2-1, and Figure 1.6.6.1.1.2-2 respectively. The type of MAC Layer packet may be inferred from the Preamble MAC Index and the MAC Layer Trailer. When the Preamble MAC Index is set to the MAC Index assigned to the access terminal, the MAC Layer Trailer field indicates a Single User Simplex packet if equal to '01' or '11'. For Single-User MAC packets, the values of '00' and '10' for the MAC Trailer are reserved. The access terminal shall not pass the payload of the Single-User Simplex MAC packet to the higher layer if the MAC Layer Trailer is set to '00' or '10'.

When the Preamble MAC Index is set to a Multi-User Preamble MAC Index as specified in 1.6.6.1.2, the access network shall set the MAC Trailer to '00'. For Multi-User MAC packets, the values for the MAC Trailer other than '00' are reserved. The access terminal shall not pass the payload of the Multi-User MAC packet to the higher layer if the MAC Layer Trailer associated with the Multi-User packet is set to any value other than '00'.

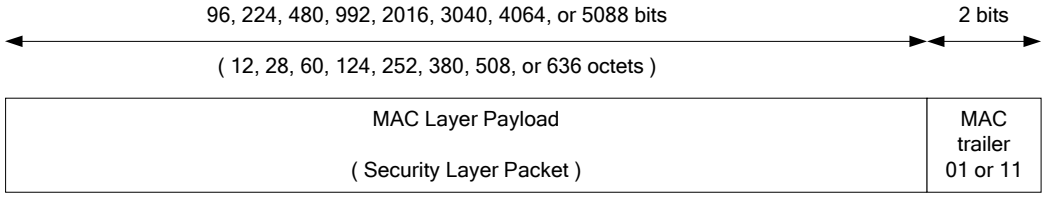

Figure 1.6.6.1.1.2-1 Format of Forward Traffic Channel Single User Simplex MAC Layer Packet

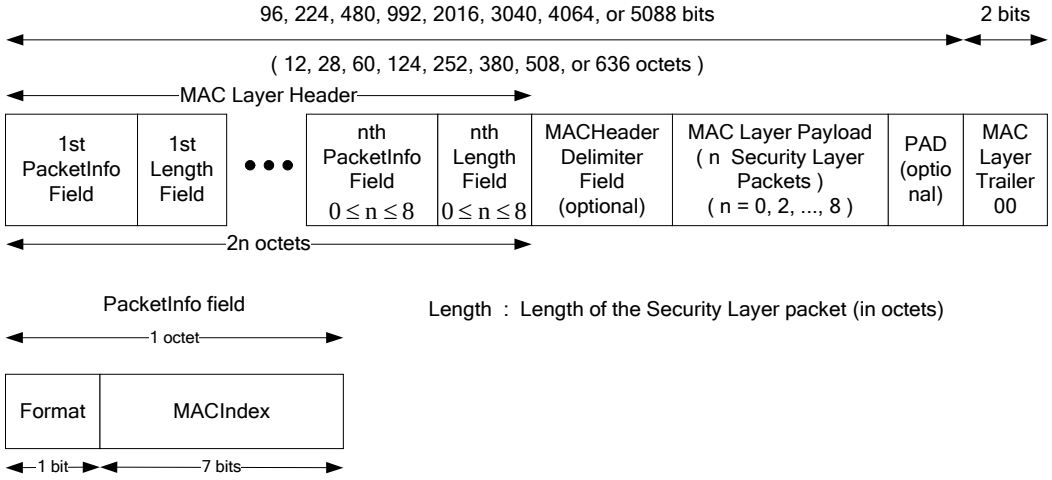

Figure 1.6.6.1.1.2-2 Format of Forward Traffic Channel Multiuser MAC Layer Packet

The access network shall construct a Single User Simplex MAC Layer packet as shown below:

Field	Length (bits)
Security Layer Packet	96, 224, 480, 992, 2016, 3040, 4064, or 5088
MAC Layer Trailer	2

Security Layer Packet

The access network shall set this field to a Security Layer packet from the Security Protocol, containing a Format A or a Format B Connection Layer packet.

MAC Layer Trailer — If the Security Layer packet contains a Format B Connection Layer Packet, the access network shall set this field to '11'. Otherwise, the access network shall set this field to '01'.

The access network shall construct a Multi-User MAC Layer packet as shown below.

Field	**Length (bits)**
n occurrences ($0 \le n \le 8$) of the following two fields:	
PktInfo	8
Length	8
MACHeaderDelimiter	0 or 8
n occurrences ($0 \le n \le 8$) of the following field:	
Security Layer Packet	$8 \times i$, where i is the value of the corresponding Length field
Pad	As needed
MAC trailer	2

PktInfo — For $1 \le i \le n$, the i^{th} occurrence of this field as shown below.

Field	Length (bits)
Format	1
MACIndex	7

Format — If the i^{th} Security Layer packet contains a Format B Connection Layer packet, the access network shall set the i^{th} occurrence of this field to '1'. Otherwise, the access network shall set the i^{th} occurrence of this field to '0'.

MACIndex — The i^{th} occurrence of this field shall be set to MACIndex of the access terminal to which the i^{th} Security Layer packet is addressed. The access network shall use the MACIndex assigned to the access terminal by the sector transmitting this MAC Layer packet.

Length — The i^{th} occurrence of this field shall be set to the length, in octets, of the i^{th} Security Layer packet in this MAC Layer payload.

MACHeaderDelimiter

This field shall not be included if the sum of the lengths of the Security Layer Packets, MAC header, and MAC trailer equals the size of the corresponding MAC Layer packet. This field shall be included if the MAC Layer Packet size exceeds the sum of the length of the Security Layer Packets, MAC header, and MAC trailer by one or more octets. If included this field shall be set to '00000000'.

Security Layer Packet

Security Layer packet from the Security Protocol, containing a Format A or Format B Connection Layer packet.

Pad — The access network shall set the size of this field to the size of the MAC Layer packet minus the size of MAC Layer header (2n octets), MACHeaderDelimiter (if included), payload and trailer (2 bits). The access network shall set the value of this field to all '0's. The receiver shall ignore this field.

MAC trailer — Forward Traffic Channel Medium Access Control trailer. The access network shall set this field to '00'.

The MAC Layer payload consists of n Security Layer packets, where n is an integer from zero to eight. The MAC Layer header consists of n PktInfo fields and n Length fields The MACHeaderDelimiter is included if the MAC Layer Packet size exceeds the sum of the length of the Security Layer Packets, MAC header, and MAC trailer by one or more octets. If included this field shall be set to '0000000'. The Pad bits are included if the size of the MAC Layer Packet exceeds the sum of the lengths of the Security Layer packets, MAC header, MACHeaderDelimiter (if included), and MAC trailer.

1.6.6.1.2 Preamble MAC Index

The Forward Traffic Channel transmits at most one MAC Layer Packet at any given time. The transmission of a MAC Layer packet on the Forward Traffic Channel is preceded by the transmission of a Preamble MAC Index. The Preamble MAC Index preceding a Single User MAC Layer packet specifies the address of the Single User MAC Layer packet. The Preamble MAC Index preceding a Multi-User MAC Layer packet specifies the MAC Layer Packet Size of the Multi-User MAC Layer packet.

When transmitting a Single User MAC Layer packet to an access terminal on the Forward Traffic Channel, the access network shall set the Preamble MAC Index to the MACIndex assigned to the access terminal by the transmitting sector. When transmitting a Multi-User MAC Layer packet on the Forward Traffic Channel, the access network shall set the Preamble MAC Index based on the size of the packet, in accordance with Table 1.6.6.1.2-1.

Table 1.6.6.1.2-1 Preamble MAC Index of Multi-User MAC packets

MAC Layer Packet Size (bits)	Preamble MAC Index
98, 226, 482, or 994	66
2018	67
3042	68
4066	69
5090	70

1.6.6.1.3 Forward Traffic Channel Addressing

A Single User Simplex MAC Layer packet is addressed to one access terminal, while different Security Layer packets embedded in a Multi-User MAC Layer packet may be addressed to different access terminals. When transmitting a Single User Simplex packet, the MACIndex of the access terminal is indicated by the Preamble MAC Index. When transmitting a Multi-User packet, the MACIndex of the access terminal is specified in the PktInfo field of the MAC Layer Header, corresponding to the Security Layer packet being addressed to the access terminal.

1.6.6.1.4 Transmission Format of the Forward Traffic Channel

After constructing a MAC Layer packet, the protocol sends the MAC Layer packet along with a preamble MAC Index and a transmission format to the Physical Layer. The Physical Layer protocol encapsulates the MAC Layer packet in a Physical Layer packet and embeds the preamble MAC Index in a packet preamble. The packet preamble and the Physical Layer packet are transmitted on the Forward Traffic Channel in accordance with the transmission format specified by the Forward Traffic Channel MAC protocol.

The transmission format of the Forward Traffic Channel is represented by an 3-tuple of numbers, whose components are defined as follows:

- Physical Layer Packet Size: the total number of bits in the Physical Layer packet, which encapsulates the MAC Layer packet.
- Transmit Duration: the maximum number of slots over which the Physical Layer packet is transmitted on the Forward Link.
- Preamble Length: the number of chips of the packet preamble, which precedes the transmission of the Physical Layer packet.

The Data Rate of a transmission format may be computed by dividing the Physical Layer Packet Size by the Transmit Duration. For example, the transmission format represented by the 3-tuple (512, 4, 256) has a Data Rate of 76.8 kbps.

A transmission format is defined to be consistent with a MAC Layer packet if the size of the MAC Layer packet is equal to the Physical Layer Packet Size of the transmission format, less 30 bits (FCS + Tail). Table 1.6.6.1.4-1 provides the set of all transmission formats

defined by the Forward Traffic Channel MAC protocol, as well as the list of all transmission formats consistent with MAC Layer packets of each size.

Table 1.6.6.1.4-1 List of all Transmission Formats Consistent with each MAC Layer Packet Size

MAC Layer Packet Size (bits)	List of consistent Transmission Formats (Physical Layer Packet Size (bits), Transmit Duration (slots), Preamble Length (chips))
98	(128, 16, 1024), (128, 8, 512), (128, 4, 256), (128, 2, 128), (128, 1, 64)
226	(256, 16, 1024), (256, 8, 512), (256, 4, 256), (256, 2, 128), (256, 1, 64)
482	(512, 16, 1024), (512, 8, 512), (512, 4, 256), (512, 2, 128), (512, 1, 64), (512, 2, 64), (512, 4, 128)
994	(1024, 16, 1024), (1024, 8, 512), (1024, 4, 256), (1024, 2, 128), (1024, 1, 64), (1024, 2, 64), (1024, 4, 128)
2018	(2048, 4, 128), (2048, 2, 64), (2048, 1, 64)
3042	(3072, 2, 64), (3072, 1, 64)
4066	(4096, 2, 64), (4096, 1, 64)
5090	(5120, 2, 64), (5120, 1, 64)

When passing the MAC Layer packet and Transmission Format from the MAC Layer Protocol to the Physical Layer Protocol, the access network shall specify a Transmission Format that is consistent with the MAC Layer packet.

1.6.6.1.5 CQI Channel

The access terminal transmits the CQI Channel in the Variable Rate State. The CQI Channel transmission consists of a CQI value. The access terminal uses the CQI value to specify the requested data rate on the Forward Traffic Channel. Two types of CQI formats shall be supported. The first type is the 4-bit CQI format. Using this CQI format, an access terminal can request a data rate from the entire set of forward link data rates ranging from 38.4 kbps to 3.072 Mbps. The second type of CQI format uses two bits for CQI. It is intended for those terminals whose link budget can support only a subset of forward link data rates and/or whose return link rates are low, i.e., 640 bps or 1.2 kbps. The choice of CQI format is based on the terminal capability indicated in the RouteUpdate message.

4-bit CQI Format

The access terminal shall set the CQI value to a 4-bit CQI index, ranging from 0x0 to 0xe. The CQI index 0 is also known as the null-rate CQI. Each CQI index is associated with a Rate Metric, a Span, a list of Single User transmission formats and a list of Multi-User transmission formats, as shown in Table 1.6.6.1-2. Among the Single User transmission formats associated with a CQI index, the transmission format with the largest Physical Layer Packet Size is defined to be the canonical transmission format of the CQI index. In Table 1.6.6.1-2, the canonical transmission format of each CQI index is typed in ***bold italics***. The Rate Metric and Span of a non-zero CQI index are equal to the Data Rate (in

kbps) and Transmit Duration (in slots) respectively, of the canonical transmission format of the CQI index.

Table 1.6.6.1-2 Rate Metric, Span and Lists of Associated Transmission Formats

CQI Index	Rate Metric (kbps)	Span (slots)	List of Associated Single User Transmission Formats	List of Associated Multi-User Transmission Formats
0x0	0	16	(128, 16, 1024), (256, 16, 1024), (512, 16, 1024), ***(1024, 16, 1024)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256)
0x1	38.4	16	(128, 16, 1024), (256, 16, 1024), (512, 16, 1024), ***(1024, 16, 1024)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256)
0x2	76.8	8	(128, 8, 512), (256, 8, 512), (512, 8, 512), ***(1024, 8, 512)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256)
0x3	153.6	4	(128, 4, 256), (256, 4, 256), (512, 4, 256), ***(1024, 4, 256)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256)
0x4	307.2	2	(128, 2, 128), (256, 2, 128), (512, 2, 128), ***(1024, 2, 128)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256)
0x5	307.2	4	(512, 4, 128), (1024, 4, 128), ***(2048, 4, 128)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128)
0x6	614.4	1	(128, 1, 64), (256, 1, 64), (512, 1, 64), ***(1024, 1, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256)
0x7	614.4	2	(512, 2, 64), (1024, 2, 64), ***(2048, 2, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128)
0x8	921.6	2	(1024, 2, 64), ***(3072, 2, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128), (3072, 2, 64)
0x9	1228.8	1	(512, 1, 64),	(128, 4, 256), (256, 4, 256),

CQI Index	Rate Metric (kbps)	Span (slots)	List of Associated Single User Transmission Formats	List of Associated Multi-User Transmission Formats
			(1024, 1, 64), ***(2048, 1, 64)***	(512, 4, 256), (1024, 4, 256), (2048, 4, 128)
0xa	1228.8	2	***(4096, 2, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128), (3072, 2, 64), (4096, 2, 64)
0xb	1843.2	1	(1024, 1, 64), ***(3072, 1, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128), (3072, 2, 64)
0xc	2457.6	1	***(4096, 1, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128), (3072, 2, 64), (4096, 2, 64)
0xd	1536	2	***(5120, 2, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128), (3072, 2, 64), (4096, 2, 64), (5120, 2, 64)
0xe	3072	1	***(5120, 1, 64)***	(128, 4, 256), (256, 4, 256), (512, 4, 256), (1024, 4, 256), (2048, 4, 128), (3072, 2, 64), (4096, 2, 64), (5120, 2, 64)

2-bit CQI Format

The access terminal shall set the CQI value to a 2-bit CQI index, ranging from 0x0 to 0x3. Each CQI index is associated with a Rate Metric, a Span, a list of Single User transmission formats and a list of Multi-User transmission formats, as shown in Table 1.6.6.1-2 where the CQI values 0x0 to 0x3 in 2-bit format map to CQI values 0x1 to 0x4 in 4-bit format.

The canonical packet size of a CQI index is defined to be the Physical Layer Packet Size of the canonical transmission format of that CQI index. A Single User Transmission Format associated with a CQI index shown in Table 1.6.6.1-2 is defined to be compatible with the CQI index, if at least one of the following conditions is met:

- The given transmission format coincides with the canonical transmission format of the CQI index, or
- The canonical packet size of the CQI index is strictly less than the value of the ShortPacketsEnabledThresh attribute.

A Multi-User transmission format associated with a CQI index is defined to be compatible with the CQI index, if the value of the MultiUserPacketsEnabled attribute is 0x01.

The access terminal shall obey the following rules when transmitting the CQI Channel:

- Access terminal shall use CQIPeriod number of 20-ms reverse link frames to send a single CQI value. The CQI value is defined to take effect after CQIDelay number of frames from the frame boundary that the access terminal sends this new CQI value at , and stay in effect for CQIPeriod frames (see [7]).
- For an access terminal, the CQI value it transmits shall not change in slots other than T such that:

  $(T_{AT}$- FrameOffset – CQIDelay in slots) mod (CQIPeriod * 12 slots/frame) = 0,

  where T_{AT} is the CDMA system time in slots observed at the access terminal.

  The forward link serving data rate to this access terminal shall not change in slots other than T such that

  (T - FrameOffset) mod (CQIPeriod * 12 slots/frame) = 0

  where T the local CDMA system time observed either at access network or access terminal.
- When transmitting the CQI Channel, the access terminal shall set the CQI value according to the following rule:
  - The access terminal shall set the CQI value to a CQI index that corresponds to a sustainable forward link data rate to the terminal.

An access terminal is defined to be a potential target of a Single User MAC Layer packet if the packet is addressed to the access terminal, and is received using a transmission format, transmitting sector, and the start time that could be used to receive a Single-User packet to the access terminal. An access terminal is defined to be a potential target of a Multi-User MAC Layer packet if the packet is received using a transmission format, transmitting sector, and the start time that could be used to receive a Multi-User packet.

A slot t is defined to be a continuation of an earlier slot s, if the following conditions are met:

- The access terminal is a potential target of a packet for which the reception began in slot s.
- The slot t is in the same forward link interlace as the slot s; i.e., (t – s) mod 4 = 0.
- $s < t < s + 4 \times \min(N_1, N_2, \text{MinimumContinuationSpan})$, where N_1 denotes the Transmit Duration of the packet whose reception began in slot s and N_2 denotes the Span of the CQI index corresponding to the CQI value that is in effect during slot s (according to Table 1.6.6.1-2).

If the access terminal is a potential target of a packet transmitted by a sector starting in slot s, the access network shall not transmit a new packet from the same Forward Link Data Source to the access terminal in any slot t that is a continuation of slot s.

1.6.6.1.6 Command Processing

1.6.6.1.6.1 Activate

If this protocol receives an *Activate* command in the Inactive State, the access terminal and the access network shall transition to the Variable Rate State.

If this protocol receives the command in any other state it shall be ignored.

1.6.6.1.6.2 Deactivate

If the protocol receives a *Deactivate* command in the Variable Rate State State,

- The access terminal shall cease monitoring the Forward Traffic Channel, shall cease transmitting the CQI Channel, and shall transition to the Inactive State.
- The access network should cease transmitting the Forward Traffic Channel to this access terminal, should cease receiving the CQI channel- from this access terminal, and should transition to the Inactive State.

If this command is received in the Inactive State it shall be ignored.

1.6.6.1.7 Inactive State

When the protocol is in the Inactive State, the access terminal and the access network wait for an *Activate* command.

1.6.6.1.8 Variable Rate State

In the Variable Rate State, the access network transmits the Forward Traffic Channel using transmission format determined by the CQI Channel transmitted by the access terminal.

The access terminal shall perform the supervision procedures described in 1.6.6.1.9.1 in the Variable Rate State.

1.6.6.1.8.1 Packet Transmission and CQI Requirements

1.6.6.1.8.1.1 Access Terminal Requirements

In the Variable Rate State, a slot t is defined to be open at the access terminal, if slot t is not the continuation of any previous slot. In any open slot T, the access terminal shall attempt to receive a MAC Layer packet from the serving sector, whose transmission begins in slot T and whose packet type and transmission format are compatible with the CQI value in effect at slot T.

1.6.6.1.8.1.2 Access Network Requirements

The access network shall obey the following rule when processing the CQI and sending a packet to the access terminal:

- If the access network transmits a MAC Layer packet to the access terminal starting in slot T, it shall use a packet type and transmission format compatible with the CQI value in effect at slot T.

1.6.6.1.9 Supervision Procedures

1.6.6.1.9.1 CQI Supervision

The access terminal shall perform supervision on the CQI as follows:

- The access terminal shall set the CQI supervision timer for(CQISupervisionTimer × 10) + 240 ms when its CQI is a null rate CQI.
- The access terminal shall disable the timer if the CQI supervision timer is active and any of the following conditions is true:
  - the access terminal's CQI indicates a non-null rate
  - the access terminal successfully receives a Forward Traffic Channel packet or a Control Channel packet
- If the CQI supervision timer expires, the access terminal shall disable the Reverse Traffic Channel transmitter and set the Reverse Traffic Channel Restart timer for time $T_{FTCMPRestartTx}$.
- If the access terminal generates consecutive CQI values that correspond to non-null rates for more than $N_{FTCMPRestartTx}$ slots or the access terminal successfully receives a Forward Traffic Channel packet or a Control Channel packet, the access terminal shall disable the Reverse Traffic Channel Restart timer and shall enable the Reverse Traffic Channel transmitter.
- If the Reverse Traffic Channel Restart timer expires, the access terminal shall return a *SupervisionFailed* indication and transition to the Inactive State.

1.6.6.1.9.2 ForwardTrafficValid Monitoring

The access terminal shall monitor the bit associated with its MACIndex in the ForwardTrafficValid63To0 or ForwardTrafficValid127To64 field made available by the Overhead Messages protocol. If the Overhead Messages Protocol does not provide a ForwardTrafficValid63To0 or ForwardTrafficValid127To64 field associated with the access terminal, then the access terminal shall behave as if the field were set to '0'. If this bit is set to 0, the access terminal shall return a *SupervisionFailed* indication and transition to the Inactive State.

1.6.6.2 Message Formats

1.6.6.2.1 AttributeUpdateRequest

The sender sends an AttributeUpdateRequest message to offer an attribute-value for a given attribute.

Field	Length (bits)
MessageID	8
TransactionID	8
One or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x52.

TransactionID The sender shall increment this value for each new AttributeUpdateRequest message sent.

AttributeRecord The format of this record is specified in [1].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.6.6.2.2 AttributeUpdateAccept

The sender sends an AttributeUpdateAccept message in response to an AttributeUpdateRequest message to accept the offered attribute values.

Field	Length (bits)
MessageID	8
TransactionID	8

MessageID The sender shall set this field to 0x53.

TransactionID The sender shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.6.6.2.3 AttributeUpdateReject

The access network sends an AttributeUpdateReject message in response to an AttributeUpdateRequest message to reject the offered attribute values.

Field	Length (bits)
MessageID	8
TransactionID	8

MessageID The access network shall set this field to 0x54.

TransactionID The sender shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.6.6.3 Interface to Other Protocols

1.6.6.3.1 Commands Sent

This protocol does not issue any commands.

1.6.6.3.2 Indications

This protocol does not register to receive any indications.

1.6.7 Configuration Attributes

Unless specified otherwise, the access terminal and the access network shall not use the Generic Attribute Update Protocol to update configurable attributes belonging to the Forward Traffic Channel MAC Protocol. The access terminal and the access network shall support the use of the Generic Attribute Update Protocol to update values of the following attributes belonging to the Forward Traffic Channel MAC Protocol:

- MultiUserPacketsEnabled
- ShortPacketsEnabledThresh
- CQISupervisionTimer

1.6.7.1 Simple Attributes

The negotiable simple attributes for this protocol are listed in Table 1.6.7.1-1. The access terminal shall use as defaults the values in Table 1.6.7.1-1 that are typed in ***bold italics***.

Table 1.6.7.1-1. Configurable Values

Attribute ID	Attribute	Values	Meaning
0xfd	MultiUserPacketsEnabled	***0x00***	Use of Multi-User MAC packets is disabled
		0x01	Use of Multi-User MAC packets is enabled
		All other values	Reserved
0xfa	ShortPacketsEnabledThresh	***0x01***	ShortPacketsEnabledThresh is 2048 bits.
		0x00	ShortPacketsEnabledThresh is 1024 bits.
		0x02	ShortPacketsEnabledThresh is 3072 bits.
		0x03	ShortPacketsEnabledThresh is 4096 bits.
		All other values	Reserved
0xf8	CQISupervisionTimer	***0x00***	CQI Supervision Timer is 0
		0x01-0xff	Value of CQI Supervision Timer
0xf7	MinimumContinuationSpan	***0x04***	Minimum continuation span is 4 sub-packets
		0x01-0x03 and 0x05-0x10	Value of Minimum continuation span in sub-packets
		All other values	Reserved

1.6.8 Protocol Numeric Constants

Constant	Meaning	Value
$N_{FTCMPType}$	Type field for this protocol	[5]
$N_{FTCMPxHRPDS1}$	Subtype field for this protocol	0x0001
$N_{FTCMPRestartTx}$	Number of consecutive slots of non-null rate CQIs to re-enable the Reverse Traffic Channel transmitter once it is disabled due to CQI supervision failure.	16
$T_{FTCMPRestartTx}$	Reverse Channel Restart Timer	12 Control Channel cycles

1.6.9 Session State Information

The Session State Information record (see [1]) consists of parameter records.

The parameter records for this protocol consist of only the configuration attributes of this protocol.

1.7 xHRPD Subtype 0 Reverse Traffic Channel MAC Protocol

1.7.1 Overview

The xHRPD Subtype 0 Reverse Traffic Channel MAC Protocol provides the procedures and messages required for an access terminal to transmit, and for an access network to receive the Reverse Traffic Channel. Specifically, this protocol addresses Reverse Traffic Channel transmission rules and rate control. This protocol operates with xHRPD Subtype 0 Physical Layer Protocol. It supports intra-access terminal Quality of Service (QoS) for multiple concurrent active MAC flows at the access terminal. Maximum of 8 MAC flows are supported. QoS is achieved through priority mechanism. As part of session negotiation, the access network assigns a priority value (simple attribute) to each MAC flow. The access terminal determines physical layer packet size based on reverse link power and data rate control and applies absolute priority scheme to fill the packet from various flows (data from the highest priority flow is filled first).

This specification assumes that the access network has one instance of this protocol for every access terminal.

This protocol operates in one of three states:

- Inactive State: In this state, the access terminal is not assigned a Reverse Traffic Channel. When the protocol is in this state, it waits for an *Activate* command.
- Setup State: In this state, the access terminal obeys the power control commands that it receives from the access network. Data transmission on the Reverse Traffic Channel is not allowed in this state.

- Open State: In this state, the access terminal obeys the power control commands that it receives from the access network. In this state, the access terminal may negotiate different xHRPD Subtype 0 Reverse Traffic Channel MAC Protocol parameters and attributes per MAC flow and transmit data on the Reverse Traffic Channel.

The protocol states and the indications and events causing the transition between the states are shown in Figure 1.7.1-1.

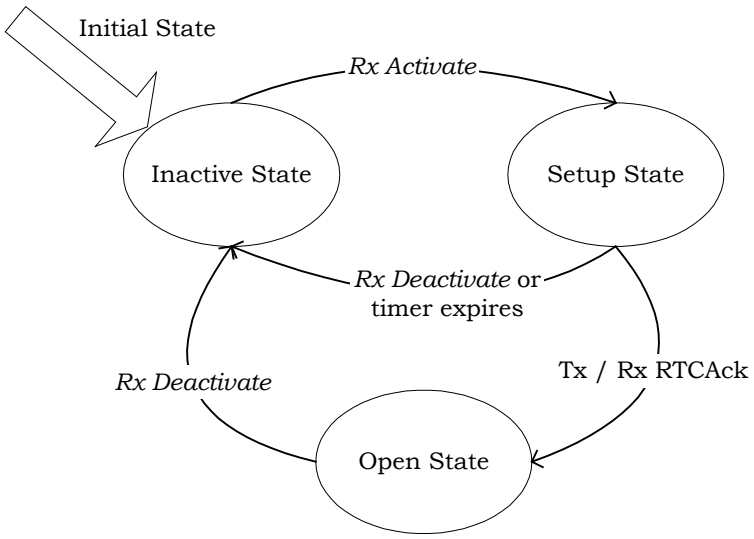

Figure 1.7.1-1. xHRPD Subtype 0 Reverse Traffic Channel MAC Protocol State Diagram

The xHRPD Subtype 0 Reverse Traffic Channel MAC protocol allows updating Reverse Traffic Channel MAC attributes (access terminal specific and MAC flow specific) using the Generic Attribute Update Protocol.

1.7.2 Primitives and Public Data

1.7.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*

1.7.2.2 Return Indications

This protocol returns the following indications:

- *LinkAcquired*
- *SupervisionFailed*

1.7.2.3 Public Data

This protocol shall make the following data public:

- Subtype for this protocol
- RPCStep

1.7.3 Protocol Data Unit

The transmission unit of this protocol is a Reverse Traffic Channel MAC Layer packet. Each Reverse Traffic Channel MAC Layer packet contains one Security Layer packet.

1.7.4 Protocol Initialization

1.7.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.
- The value of the public data for the InConfiguration protocol instance shall be set to the value of the public data for the InUse protocol instance.

1.7.5 Procedures and Messages for the InConfiguration Instance of the Protocol

1.7.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [1]) to define the processing of the configuration messages.

The access network shall not initiate negotiation of the MaxMACFlows attribute.

1.7.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.
- The value of the following public data of the InUse protocol shall be set to the corresponding attribute value of the InConfiguration protocol instance:
  - RPCStep
- If the InUse instance of this protocol has the same subtype as this protocol instance, then

- The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol.
- The access terminal and the access network shall purge the InConfiguration instance of the protocol.

- If the InUse instance of this protocol does not have the same subtype as this protocol instance, then the access network and the access terminal shall perform the following in the order specified:
  - The access terminal and the access network shall set the initial state for the InConfiguration instance of this protocol to the Inactive State.
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Reverse Traffic Channel MAC Protocol.
- All the public data not defined by this protocol shall be removed from the public data of the InUse protocol.

1.7.5.3 Message Formats

1.7.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x50.

TransactionID — The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord — The format of this record is specified in [1].

Channels	FTC RTC	**SLP**	Reliable
Addressing	Unicast	**Priority**	40

1.7.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x51.

TransactionID — The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord — An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [1]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC
Addressing	Unicast

SLP	Reliable
Priority	40

1.7.6 Procedures and Messages for the InUse Instance of the Protocol

1.7.6.1 Procedures

The protocol constructs a xHRPD Subtype 0 Reverse Traffic Channel MAC Layer packet out of a Security Layer packet and passes the packet for transmission to the Physical Layer Protocol.

The xHRPD Subtype 0 Reverse Traffic Channel MAC Protocol supports multiple MAC Flows. The FlowPriority attibute is used for defining priority for each MAC flow. The flow priority value is used by the QoS algorithm for prioritization and resource management. MAC flow *NN* is defined to be active if its FlowPriority has non-zero value. The number of active MAC Flows shall not exceed the value of the MaxNumActiveMACFlows parameter of the MaxMACFlows attribute.

1.7.6.1.1 MAC Layer Packet

The MAC Layer packet is the basic unit of data provided by the Reverse Traffic Channel MAC protocol to the Physical Layer Protocol. The structure of a MAC Layer packet is shown in Figure 1.7.6.1.1-1 and Figure 1.7.6.1.1-2. The MAC Layer packet consists of a Security Layer packet followed by the MAC Layer trailer for the data packet flow and only the Security Layer packet for the voice packet flow.

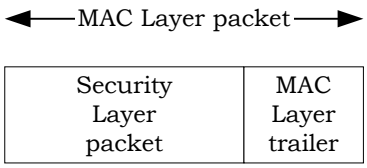

Figure 1.7.6.1.1-1.Reverse Traffic Channel MAC Layer Packet Structure

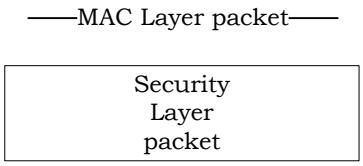

Figure 1.7.6.1.1-2.Reverse Traffic Channel MAC Layer Packet Structure For Voice Flow

The maximum size payload this protocol can support (i.e., the maximum size Security Layer packet that can be carried) is a function of the traffic type (voice or data), reverse transmit format (see [7]) and transmission rate used on the Reverse Traffic Channel and can be obtained from Table 1.3.1.3.1.1-1 in [7].

1.7.6.1.2 Command Processing

1.7.6.1.2.1 Activate

If the protocol receives an *Activate* command in the Inactive State, the access terminal and the access network shall perform the following:

- Set ATI_{LCM} to TransmitATI.ATI
- Transition to the Setup State

If the protocol receives this command in any other state it shall be ignored.

1.7.6.1.2.2 Deactivate

If the protocol receives a *Deactivate* command in the Setup State or the Open State,

- Access terminal shall cease transmitting the Reverse Traffic Channel and shall transition to the Inactive State.
- Access network shall cease monitoring the Reverse Traffic Channel from this access terminal and shall transition to the Inactive State.

If the protocol receives a *Deactivate* command in the Inactive State, it shall be ignored.

1.7.6.1.3 Reverse Traffic Channel Long Code Mask

The access terminal shall set the long code masks for the reverse traffic channel (MI_{RTCMAC} and MQ_{RTCMAC}) as follows. The 42-bit mask MI_{RTCMAC} shall be specified as shown in Table 1.7.6.1.3-1.

Table 1.7.6.1.3-1.Reverse Traffic Channel Long Code Masks

BIT	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
MI_{RTCMAC}	1	1	1	1	1	1	1	1	1	1	Permuted (ATI_{LCM})																															

Permuted (ATI_{LCM}) is defined as follows:

$ATI_{LCM} = (A_{31}, A_{30}, A_{29}, \ldots, A_0)$

Permuted (ATI_{LCM}) =
(A_0, A_{31}, A_{22}, A_{13}, A_4, A_{26}, A_{17}, A_8, A_{30}, A_{21}, A_{12}, A_3, A_{25}, A_{16}, A_7, A_{29}, A_{20}, A_{11}, A_2, A_{24}, A_{15}, A_6, A_{28}, A_{19}, A_{10}, A_1, A_{23}, A_{14}, A_5, A_{27}, A_{18}, A_9).

The 42-bit mask MQ_{RTCMAC} shall be derived from the mask MI_{RTCMAC} as follows:

$$MQ_{RTCMAC}[k] = MI_{RTCMAC}[k-1], \quad \text{for } k = 1,\ldots,41$$

$$MQ_{RTCMAC}[0] = MI_{RTCMAC}[0] \oplus MI_{RTCMAC}[1] \oplus MI_{RTCMAC}[2] \oplus MI_{RTCMAC}[4] \oplus MI_{RTCMAC}[5] \oplus MI_{RTCMAC}[6] \oplus MI_{RTCMAC}[9] \oplus MI_{RTCMAC}[15] \oplus MI_{RTCMAC}[16] \oplus MI_{RTCMAC}[17] \oplus MI_{RTCMAC}[18] \oplus MI_{RTCMAC}[20] \oplus MI_{RTCMAC}[21] \oplus MI_{RTCMAC}[24] \oplus MI_{RTCMAC}[25] \oplus MI_{RTCMAC}[26] \oplus MI_{RTCMAC}[30] \oplus MI_{RTCMAC}[32] \oplus MI_{RTCMAC}[34] \oplus MI_{RTCMAC}[41]$$

where the $\oplus$ denotes the Exclusive OR operation, and $MQ_{RTCMAC}[i]$ and $MI_{RTCMAC}[i]$ denote the i^{th} least significant bit of MQ_{RTCMAC} and MI_{RTCMAC}, respectively.

1.7.6.1.4 Inactive State

When the protocol is in the Inactive State the access terminal and the access network wait for an *Activate* command.

1.7.6.1.5 Setup State

1.7.6.1.5.1 Access Terminal Requirements

The access terminal shall set a timer for $T_{RTCMPATSetup}$ seconds when it enters this state. If the protocol is still in the Setup State when the timer expires, the access terminal shall return a *SupervisionFailed* indication.

The access terminal shall start transmitting 40-bit packets consisting of arbitrary 40-bit sequence at 2.4 kbps on the Reverse Traffic Channel upon entering this state, and shall obey the Reverse Power Control Channel. The access terminal shall set the CQI value as specified by the Forward Traffic Channel MAC Protocol (see 1.5).

The access terminal shall not transmit any data on the Reverse Traffic Data Channel while in this state.

If the access terminal receives an RTCAck message it shall return a *LinkAcquired* indication and transition to the Open State.

1.7.6.1.5.2 Access Network Requirements

The access network shall set a timer for $T_{RTCMPANSetup}$ seconds when it enters this state. If the protocol is still in the Setup State when the timer expires, the access network shall return a *SupervisionFailed* indication.

The access network shall attempt to acquire the Reverse Traffic Channel in this state. If the access network acquires the Reverse Traffic Channel, it shall send an RTCAck message to the access terminal, return a *LinkAcquired* indication, and shall transition to the Open State.

1.7.6.1.6 Open State

1.7.6.1.6.1 Access Terminal Requirements

In this state, the access terminal may negotiate different xHRPD Subtype 0 Reverse Traffic Channel MAC Protocol parameters and attributes per MAC flow and transmit data on the Reverse Traffic Channel.

1.7.6.2 Trailer and Message Formats

1.7.6.2.1 MAC Layer Trailer

The access terminal shall set the MAC Layer trailer as follows:

Field	Length (bits)
ConnectionLayerFormat	1
TransmissionMode	1

ConnectionLayerFormat

If the Security Layer packet contains a Format B Connection Layer packet, then the access terminal shall set this field to '1'. Otherwise, the access terminal shall set this field to '0'.

TransmissionMode

If the MAC flow is associated to link flow 2, then the access terminal shall set this field to '1'. Otherwise, the access terminal shall set this field to '0'.

1.7.6.2.2 RTCAck

The access network sends the RTCAck message to notify the access terminal that it has acquired the Reverse Traffic Channel. The access network shall send this message using the access terminal's current ATI.

Field	Length (bits)
MessageID	8

MessageID The access network shall set this field to 0x00.

Channels	FTC	SLP	Reliable
Addressing	Unicast	Priority	10

1.7.6.2.3 AttributeUpdateRequest

The sender sends an AttributeUpdateRequest message to offer an attribute-value for a given attribute.

Field	Length (bits)
MessageID	8
TransactionID	8
One or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x52.

TransactionID The sender shall increment this value for each new AttributeUpdateRequest message sent.

AttributeRecord The format of this record is specified in [1].

Channels	FTC RTC	SLP	Reliable
Addressing	unicast	Priority	40

1.7.6.2.4 AttributeUpdateAccept

The sender sends an AttributeUpdateAccept message in response to an AttributeUpdateRequest message to accept the offered attribute values.

Field	Length (bits)
MessageID	8
TransactionID	8

MessageID The sender shall set this field to 0x53.

TransactionID The sender shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.7.6.2.5 AttributeUpdateReject

The access network sends an AttributeUpdateReject message in response to an AttributeUpdateRequest message to reject the offered attribute values.

Field	Length (bits)
MessageID	8
TransactionID	8

MessageID The access network shall set this field to 0x54.

TransactionID The access network shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

1.7.6.3 Interface to Other Protocols

1.7.6.3.1 Commands Sent

This protocol does not issue any commands.

1.7.6.3.2 Indications

This protocol does not register to receive any indications.

1.7.7 Configuration Attributes

The following attributes and default values are defined (see [1] for attribute record definition).

1.7.7.1 Simple Attributes

The negotiable simple attribute for this protocol is listed in Table 1.7.7.1-1. The access network and the access terminal shall use the default value that is typed in ***bold italics***.

Table 1.7.7.1-1.Configurable Simple Attributes

Attribute ID	Attribute	Values	Meaning
0xffNN	FlowPriority	0x00-0x07	Priority of MAC flow 0x00: MAC Flow is not active 0x01 – 0x07: Lower the number, higher the priority
		0x08	Priority of MAC flow 0x08 – Lowest priority
		All other values	Reserved

1.7.7.2 Complex Attributes

The following configurable complex attributes are defined:

1.7.7.2.1 AssociatedFlows*NN* Attribute

This attribute is used for associating MAC flow with application and RLP flows. *NN* is the two-digit hexadecimal number that identifies the MAC Flows in the range 0x01 through MaxNumMACFlows –1, inclusive.

Field	Length(bits)	Default for *NN* between 0x02 and (MaxNumMACFlows –1), inclusive	Default for *NN* = 0x01
Length	8	N/A	N/A
AttributeID	8	N/A	N/A
One or more occurrences of the following attribute value record:			
{			
ValueID	8	N/A	N/A
FlowCount	8	0	1
FlowCount occurrences of the following two fields:			
{			
Stream	9	N/A	511
SubStream	8	N/A	0
}			
Reserved	0 – 7 (as	N/A	N/A

	needed)		

}

Length — Length of the complex attribute in octets. The sender shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The sender shall set this field to 0x01*NN*, where *NN* is the two-digit hexadecimal number that identifies the MAC Flow in the range 0x01 through MaxNumMACFlows –1, inclusive.

ValueID — The sender shall set this field to an identifier assigned to this complex value.

FlowCount — The sender shall set this field to the number of higher layer flows associated with this MAC Flow.

Stream — If this flow is generated by an application bound to a stream, then the sender shall set this field to the stream number. If this flow is generated by an application bound to a virtual stream, then the sender shall set this field to 3 more than the virtual stream number. If this MAC flow is to be associated with all higher layer flow not associated with a MAC flow, then the sender shall set this field to '11111111'.

SubStream — If the application bound generating this flow defines sub-streams, then the sender shall set this field to the number of the sub-stream associated with this MAC flow[8]. Otherwise, the sender shall set this field to '00000000'. If Stream is '11111111', then the sender shall set this field to '00000000'.

Reserved — The sender shall add reserved bits to make the length of each attribute value record an integer number of octets. The receiver shall ignore this field.

1.7.7.2.2 MaxMACFlows Attribute

[8] For example, in case of the Multi-flow Packet Application, this field is set to the RLP flow number corresponding to the RLP flow associated with this MAC flow.

Field	Length (bits)	Default
Length	8	N/A
AttributeID	16	N/A

One or more occurrences of the following record:

ValueID	8	N/A
MaxNumMACFlows	8	***0x08***
MaxNumActiveMACFlows	8	***0x08***

Length Length of the complex attribute in octets. The sender shall set this field to the length of the complex attribute excluding the Length field.

AttributeID The sender shall set this field to 0x02.

ValueID The sender shall set this field to an identifier assigned to this complex value.

MaxNumMACFlows The sender shall set this field to indicate the maximum total number of activated and deactivated MAC flows supported. The value shall be in the range of 0x04 to 0x10, inclusive

MaxNumActiveMACFlows
The sender shall set this field to indicate the maximum number of active MAC flows supported. The value shall be in the range of 0x04 to MaxNumMACFlows, inclusive.

1.7.8 Protocol Numeric Constants

Constant	Meaning	Value
$N_{RTCMPType}$	Type field for this protocol	[5]
$N_{xHRPDS0RTCMP}$	Subtype field for this protocol	0x0000
$T_{RTCMPATSetup}$	Maximum time for the access terminal to transmit the Reverse Traffic Channel in the Setup State	2.5 sec
$T_{RTCMPANSetup}$	Maximum time for the access network to acquire the Reverse Traffic Channel and send a notification to the access terminal.	2 sec

1.7.9 Session State Information

The Session State Information record (see [1]) consists of parameter records.

This protocol defines the following parameter record in addition to the configuration attributes for this protocol.

1.7.9.1 LongCodeMask Parameter

The following parameter shall be included in the Session State Information record only if the Session State Information is being transferred while the connection is open.

Table 1.7.9.1-1.The Format of the Parameter Record for the LongCodeMask Parameter

Field	Length (bits)
ParameterType	8
Length	8
MIRTCMAC	42
MQRTCMAC	42
Reserved	4

ParameterType — This field shall be set to 0x01 for this parameter record.

Length — This field shall be set to the length of this parameter record in units of octets excluding the Length field.

MIRTCMAC — This field shall be set to the value of the reverse traffic channel in-phase long code mask associated with the access terminal's session.

MQRTCMAC — This field shall be set to the value of the reverse traffic channel quadrature-phase long code mask associated with the access terminal's session.

Reserved — This field shall be set to zero.

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2 SECURITY LAYER

Same as defined in [4].

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3 CONNECTION LAYER

3.1 Introduction

3.1.1 General Overview

The Connection Layer controls the state of the air-link, and it prioritizes the traffic that is sent over it.

This section presents the default protocols for the Connection Layer. With the exception of the Overhead Messages Protocol, each of these protocols can be independently negotiated at the beginning of the session.

The access terminal and the access network maintain a connection whose state dictates the form in which communications between these entities can take place. The connection can be either closed or open:

- Closed Connection: When a connection is closed, the access terminal is not assigned any dedicated air-link resources. Communications between the access terminal and the access network are conducted over the Access Channel and the Control Channel.
- Open Connection: When a connection is open, the access terminal can be assigned the Forward Traffic Channel, and is assigned a Reverse Power Control Channel, Reverse Frequency Control Channel and a Reverse Traffic Channel. Communications between the access terminal and the access network are conducted over these assigned channels, as well as over the Control Channel.

The Connection Layer provides the following connection-related functions:

- Manages initial acquisition of the network.
- Manages opening and closing of connections.
- Manages communications when connection is closed and when a connection is open.
- Maintains approximate access terminal's location in either connection states.
- Manages radio link between the access terminal and the access network when a connection is open.
- Performs supervision both when the connection is open and when it is closed.
- Prioritizes and encapsulates transmitted data received from the Session Layer and forwards it to the Security Layer.
- De-capsulates data received from the Security Layer and forwards it to the Session Layer.

The Connection Layer performs these functions through the following protocols:

- Air Link Management Protocol: This protocol maintains the overall connection state in the access terminal and the access network. The protocol can be in one of three states, corresponding to whether the access terminal has yet to acquire the network (Initialization State), has acquired the network but the connection is closed (Idle State), or has an open connection with the access network (Connected State). This protocol activates one of the following three protocols as a function of its current state.
- Initialization State Protocol: This protocol performs the actions associated with acquiring an access network.
- Idle State Protocol: This protocol performs the actions associated with an access terminal that has acquired the network, but does not have an open connection. Mainly, these are keeping track of the access terminal's approximate location in support of efficient Paging (using the Route Update Protocol), the procedures leading to the opening of a connection, and support of access terminal power conservation.
- Connected State Protocol: This protocol performs the actions associated with an access terminal that has an open connection. Mainly, these are managing the radio link between the access terminal and the access network (handoffs, handled via the Route Update Protocol), and the procedures leading to the close of the connection.

In addition to the above protocols, which deal with the state of the connection, the Connection Layer also contains the following protocols:

- Route Update Protocol: This protocol performs the actions associated with keeping track of an access terminal's location and maintaining the radio link between the access terminal and the access network. This protocol performs supervision on the pilots.
- Overhead Messages Protocol: This protocol broadcasts essential parameters over the Control Channel. These parameters are shared by protocols in the Connection Layer as well as protocols in other layers. This protocol also performs supervision on the messages necessary to keep the Connection Layer functioning.
- Packet Consolidation Protocol: This protocol consolidates and prioritizes packets for transmission as a function of their assigned priority and the target transmission channel.

Figure 3.1.1-1 illustrates the relationship between all the Connection Layer protocols. An arrow between two protocols implies that the source sends commands to the target.

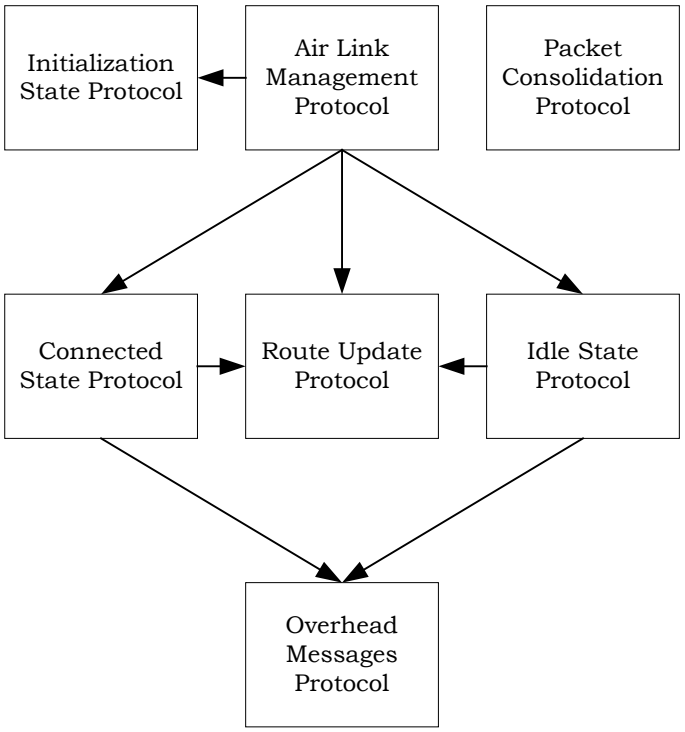

Figure 3.1.1-1. Connection Layer Protocols

The Air Link Management Protocol, its descendants and the Overhead Messages Protocol are control protocols. The Packet Consolidation Protocol operates on transmitted and received data.

3.1.2 Data Encapsulation for the InUse Protocol Instance

In the transmit direction, the Connection Layer receives Session Layer packets, adds Connection Layer header(s), concatenates them in the order to be processed on the receive side, adds padding, where applicable, and forwards the resulting packet for transmission to the Security Layer.

In the receive direction, the Connection Layer receives Security Layer packets from the Security Layer, and forwards the Session Layer packets to the Session Layer in the order received after removing the Connection Layer headers and padding.

Figure 3.1.2-1 and Figure 3.1.2-2 illustrate the relationship between Session Layer packets, Connection Layer packets and Security Layer payloads for Format A (maximum size) and Format B Connection Layer packets.

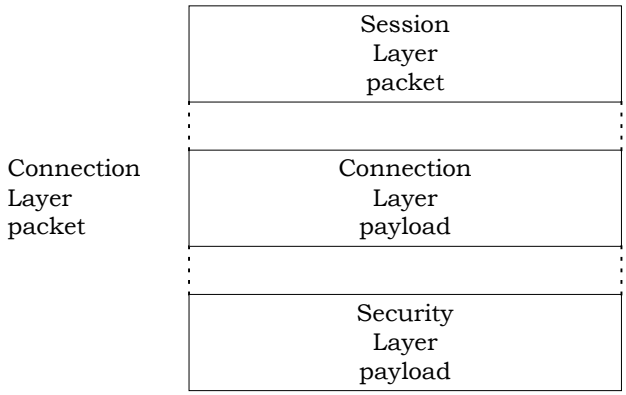

Figure 3.1.2-1. Connection Layer Encapsulation (Format A)

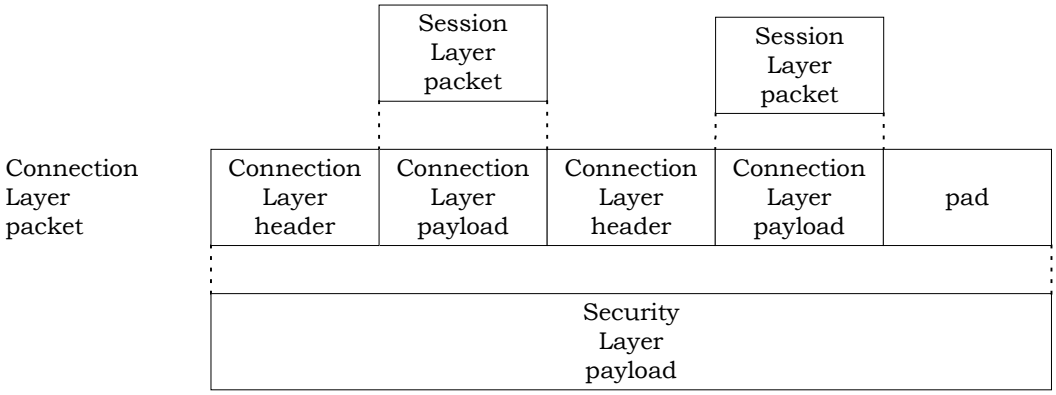

Figure 3.1.2-2. Connection Layer Encapsulation (Format B)

3.2 Default Air-Link Management Protocol

The Default Air-Link Management Protocol is same as defined in [4].

3.3 Default Initialization State Protocol

The Default Initialization State Protocol is same as defined in [4].

3.4 xHRPD Subtype 0 Idle State Protocol

3.4.1 Overview

The xHRPD Subtype 0 Idle State Protocol provides the procedures and messages used by the access terminal and the access network when the access terminal has acquired a network and a connection is not open.

This protocol operates in one of the following four states:

- Inactive State: In this state the protocol waits for an *Activate* command.

- Sleep State: In this state the access terminal may shut down part of its subsystems to conserve power. The access terminal does not monitor the Forward Channel, and the access network is not allowed to transmit unicast packets to it.
- Monitor State: In this state the access terminal monitors the Control Channel, listens for Page messages and if necessary, updates the parameters received from the Overhead Messages Protocol. The access network may transmit unicast packets to the access terminal in this state.
- Connection Setup State: In this state the access terminal and the access network set-up a connection.

Protocol states and events causing the transition between the states are shown in Figure 3.4.1-1 and Figure 3.4.1-2.

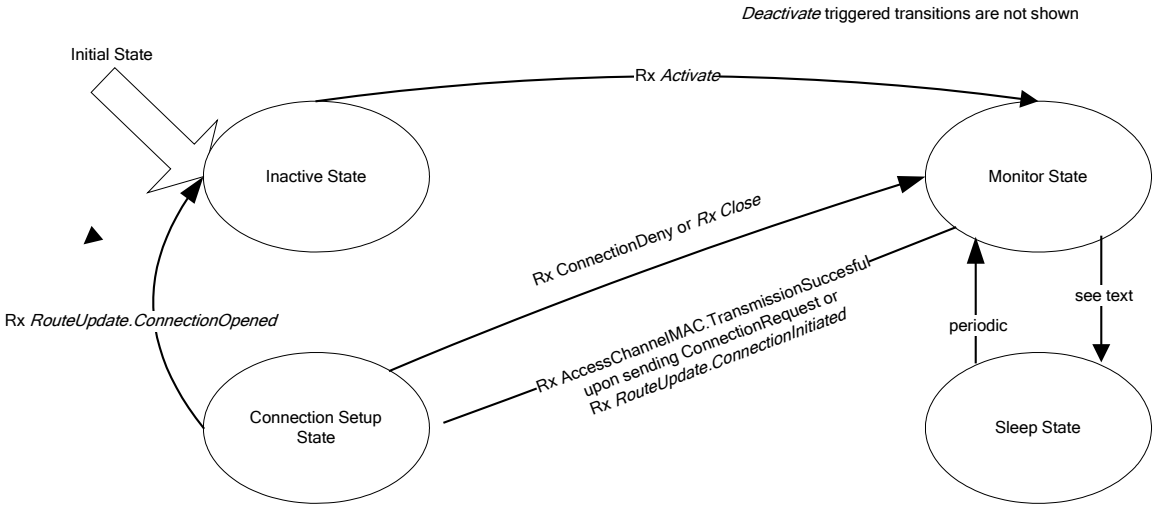

Figure 3.4.1-1. xHRPD Subtype 0 Idle State Protocol State Diagram (Access Terminal)

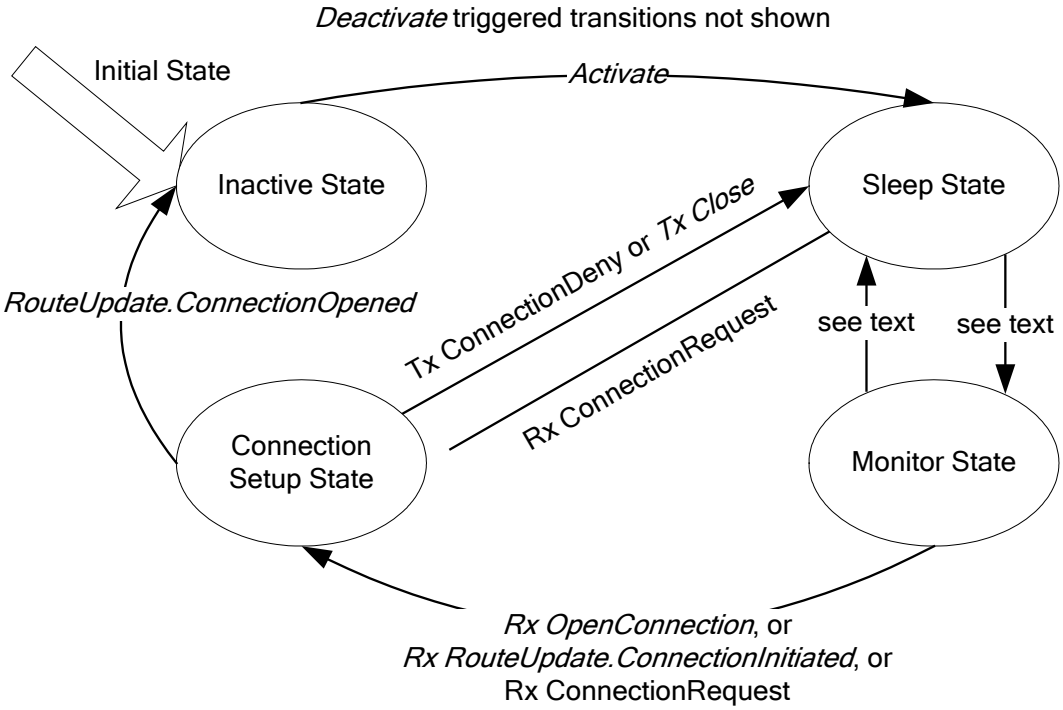

Figure 3.4.1-2. xHRPD Subtype 0 Idle State Protocol State Diagram (Access Network)

This protocol supports periodic network monitoring by the access terminal, allowing for significant power savings. The following access terminal operation modes are supported:

- Continuous operation, in which the access terminal continuously monitors the Control Channel.
- Suspended mode operation, in which the access terminal monitors the Control Channel continuously for a period of time and then proceeds to operate in the slotted mode. Suspended mode follows operation in the Air-Link Management Protocol Connected State and allows for quick network-initiated reconnection.
- Slotted mode operation, in which the access terminal monitors only selected slots.

This protocol supports two types of connection set-ups:

- Normal setup: this procedure is always performed at the initiative of the access terminal.[9] It consists of the access terminal sending a ConnectionRequest message which in turn causes the lower layers to open the connection. The Connection Setup State contains the requirements for normal setup.

[9] The access network may transmit a Page message to the access terminal directing it to initiate the procedure.

- Fast Connect: this procedure is always performed at the initiative of the access network and consists of the access network opening the connection directly via a *RouteUpdate.Open* command.[10] Fast Connect eliminates the need for the Page / ConnectionRequest exchange when the access network has pending data to transmit to an access terminal, and is especially useful when the access terminal is in suspended mode. Support for Fast Connect at the access network is optional. Support for Fast Connect at the access terminal is mandatory. The Monitor State contains the requirements for Fast Connect.

3.4.2 Primitives and Public Data

3.4.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*
- *OpenConnection*
- *Close*

3.4.2.2 Return Indications

This protocol returns the following indications:

- *ConnectionOpened*
- *ConnectionFailed*

3.4.2.3 Public Data

This protocol shall make the following data public:

- Subtype for this protocol

3.4.3 Protocol Data Unit

The transmission unit of this protocol is a message. This is a control protocol; and, therefore, it does not carry payload on behalf of other layers or protocols.

This protocol uses the Signaling Application to transmit and receive messages.

3.4.4 Protocol Initialization

3.4.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

---

[10] This command triggers a transmission of a TrafficChannelAssignment message based on the last RouteUpdate message received from the access terminal.

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.

3.4.4.2 Protocol Initialization for the InUse Protocol Instance

Upon creation, the InUse instance of this protocol in the access terminal and access network shall perform the following:

- The value of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- The protocol shall enter the Inactive State.

3.4.5 Procedures and Messages for the InConfiguration Instance of the Protocol

3.4.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [6]) to define the processing of the configuration messages.

3.4.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.
- If the InUse instance of any of the Connection Layer protocols does not have the same subtype as the corresponding InConfiguration protocol instance, then
  - the access terminal shall set the initial state of the InConfiguration and InUse protocol instances of the Idle State protocol to the Inactive State.
  - the access network shall set the initial state of the InConfiguration and InUse protocol instances of the Idle State protocol to the Sleep State.
- If the InUse instance of this protocol has the same subtype as this protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol, and

- The access terminal and the access network shall purge the InConfiguration instance of the protocol.

- If the InUse instance of this protocol does not have the same subtype as this protocol instance, then the access terminal and the access network shall perform the following:
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Idle State Protocol at the access terminal and the access network.
- All the public data not defined by this protocol shall be removed from the public data of the InUse protocol.

3.4.5.3 Message Formats

3.4.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x50.

TransactionID — The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord — The format of this record is specified in [6].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.4.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x51.

TransactionID The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [6]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC
Addressing	unicast

SLP	Reliable
Priority	40

3.4.6 Procedures and Messages for the InUse Instance of the Protocol

3.4.6.1 Procedures

3.4.6.1.1 Command Processing

3.4.6.1.1.1 Activate

When the protocol receives an *Activate* command in the Inactive State:

- The access terminal shall transition to the Monitor State.
- The access network shall transition to the Sleep State.[11]

If the protocol receives this command in any other state it shall be ignored.

3.4.6.1.1.2 Deactivate

When the protocol receives a *Deactivate* command in the Inactive State it shall be ignored.

When the protocol receives this command in any other state:

- The access terminal shall transition to the Inactive State.

[11] Since the transitions happen asynchronously, this requirement guarantees that the access network will not transmit unicast packets to the access terminal over the Control Channel when the access terminal is not monitoring the channel.

- The access network shall transition to the Inactive State.

3.4.6.1.1.3 OpenConnection

When the protocol receives an *OpenConnection* command in the Inactive State or the Connection Setup State, the command shall be ignored.

When the protocol receives this command in the Sleep State:

- The access terminal shall transition to the Monitor state and perform the procedures in 3.4.6.1.2 for sending a ConnectionRequest message.
- The access network shall queue the command and execute it when it is in the Monitor State.

When the protocol receives this command in the Monitor State:

- The access terminal shall perform the procedures in 3.4.6.1.2 for sending a ConnectionRequest message.
- The access network shall send a Page message to the access terminal and transition to the Connection Setup State.

3.4.6.1.1.4 Close

When the protocol receives a *Close* command in the Inactive State it shall be ignored.

When the protocol receives a *Close* command in any other state:

- The access terminal shall transition to the Monitor State.
- The access network shall transition to the Sleep State.

3.4.6.1.2 Access Terminal Procedures for Sending a ConnectionRequest Message

When procedures in this section are invoked, the access terminal shall perform the following:

- Send a ConnectionRequest message,
- If an *AccessChannelMAC.TransmissionSuccessful* indication is received, it shall transition to the Connection Setup State,
- If an *AccessChannelMAC.TransmissionFailed* indication is received, it shall return a *ConnectionFailed* indication.

3.4.6.1.3 Inactive State

When the protocol is in the Inactive State it waits for an *Activate* command.

If the access terminal receives an *OverheadMessages.Updated* indication in this state, then the access terminal shall queue the latest *OverheadMessages.Updated* indication for processing in the Monitor state.

3.4.6.1.4 Sleep State

When the access terminal is in the Sleep State it may stop monitoring the Control Channel by issuing the following commands:

- *OverheadMessages.Deactivate*
- *ControlChannelMAC.Deactivate*

The access terminal may shut down processing resources to reduce power consumption.

In order to transmit on the Access Channel in this state, the access terminal shall first transition from the Sleep State to the Monitor State. If the access terminal requires opening a connection, it shall transition to the Monitor state and perform the procedures in 3.4.6.1.2 for sending a ConnectionRequest message. When the access network is in the Sleep State, it is prohibited from sending unicast packets to the access terminal.

If the access network receives a ConnectionRequest message, it shall transition to the Connection Setup State.

If the access terminal advertised a suspend period that is current, the access network may transition to the Monitor State.

The access network and the access terminal shall transition from the Sleep State to the Monitor State in time to send and receive, respectively, the synchronous capsule sent in each Control Channel cycle *C* satisfying

$$(C + R) \bmod N_{IDPSleep} = 0$$

where *C* is the number of Control Channel cycles since the beginning of CDMA System Time and *R* is obtained as follows:

- If PreferredControlChannelCycleEnabled is equal to '0', then *R* is the result of applying the hash function (see [6]) using the following parameters:
  - Key = SessionSeed
  - Decorrelate = 6 × SessionSeed[11:0]
  - $N = N_{IDPSleep}$
  - where SessionSeed is given as public data of the Address Management Protocol.
- If PreferredControlChannelCycleEnabled is equal to '1', then *R* is set to PreferredControlChannelCycle.

3.4.6.1.5 Monitor State

When the access terminal is in the Monitor State, it continuously monitors the Control Channel.

When the access network is in the Monitor State, it may send unicast packets to the access terminal.

3.4.6.1.5.1 Access Terminal Requirements

Upon entering the Monitor State, the access terminal shall issue the following commands:

- *OverheadMessages.Activate*
- *ControlChannelMAC.Activate*

The access terminal shall comply with the following requirements when in the Monitor State:

- If the access terminal has queued an *OverheadMessages.Updated* indication or upon receiving an *OverheadMessages.Updated* indication, the access terminal shall tune to the CDMA Channel selected as specified in 3.4.6.1.5.1.1.
- The access terminal shall monitor the overhead messages as specified in the Overhead Messages Protocol (see 3.9).
- If the access terminal receives a Page message, it shall perform the procedures in 3.4.6.1.2 for sending a ConnectionRequest message.
- If the access terminal requires opening a connection, it shall perform the procedures in 3.4.6.1.2 for sending a ConnectionRequest message.
- If the access terminal receives a *RouteUpdate.ConnectionInitiated* indication it shall transition to the Connection Setup State.[12]
- Access terminal may transition to the Sleep State if the requirements specified in 3.4.6.1.5.1.2 are satisfied.

3.4.6.1.5.1.1 CDMA Channel Selection

The access terminal shall select a CDMA Channel from the list of channels in the SectorParameters message. If no channels are listed, the access terminal shall use the channel it is currently monitoring. If one or more channels are available, the access terminal shall use the hash function (see [6]) to compute an index into the channel list provided in the message. The access terminal shall use the following hash function parameters to obtain this index:

- Key = SessionSeed
- Decorrelate = 0
- N = ChannelCount field of the SectorParameters message

Where SessionSeed is provided as public data by the Address Management Protocol.

3.4.6.1.5.1.2 Transition to Sleep State

The access terminal may transition to the Sleep State if all of the following requirements are met:

[12] This requirement provides Fast Connect on the access terminal side.

- Access terminal has received a Control Channel synchronous Sleep State capsule in the current Control Channel Cycle and has determined that the SectorParameters message is up to date. The current Control Channel Cycle is defined to be the Control Channel Cycle that started at slot $\lfloor T/256 \rfloor$, where T is the current CDMA System Time in slots.
- Access terminal received an *AccessChannelMAC.TxEnded* indication for every *AccessChannelMAC.TxStarted* indication it received since entering the Monitor State.[13]
- Access terminal has not advertised a suspend period that is current (see 3.6). The suspend period is current if the time advertised in the associated ConnectionClose message is greater than the current CDMA System Time.[14]

3.4.6.1.5.2 Access Network Requirements

3.4.6.1.5.2.1 General Requirements

- Access network shall select the CDMA Channel following the same specifications as the access terminal, see 3.4.6.1.5.1.1.
- If the access network receives a ConnectionRequest message, it shall transition to the Connection Setup State.
- If the access network requires opening a connection with the access terminal and does not use an accelerated procedure to set-up a connection, the access network shall send a Page message to the access terminal over the Control Channel.
- The access network may use an accelerated procedure to set-up a connection with the access terminal by bypassing the paging process. The access network should only use this procedure if it has a reasonable estimate of the access terminal's current location. To set-up a connection in an accelerated fashion (Fast Connect) the access network shall:
  - Issue a *RouteUpdate.Open* command.
  - Transition to the Connection Setup State, when the protocol receives a *RouteUpdate.ConnectionInitiated* indication.
- The access network shall transition to the Sleep State if the access terminal did not advertise a suspend period that is current.

3.4.6.1.6 Connection Setup State

The access terminal and the access network use the Connection Setup State to perform a normal connection set-up.

---

[13] This pairing ensures that the access terminal does not have any outstanding messages waiting for an answer.

[14] The access terminal monitors the Control Channel continuously during a suspend period thus avoiding the delay in opening access network initiated connections due to the sleep period.

Figure 3.4.6.1.6-1 illustrates the process of opening a connection between the access terminal and the access network when this protocol is used along with the default Route Update and the default Reverse Traffic Channel MAC protocols.[15]

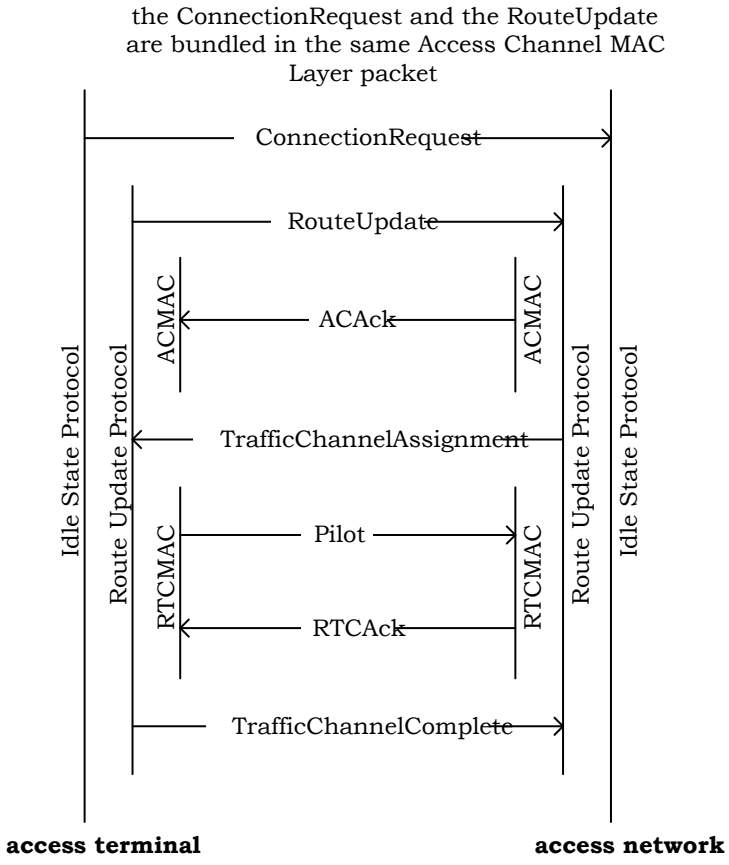

Figure 3.4.6.1.6-1. Connection Setup Exchange

3.4.6.1.6.1 Access Terminal Requirements

Upon entering the Connection Setup State the access terminal shall:

- Issue an *OverheadMessages.Activate* command,
- Issue a *ControlChannelMAC.Activate* command,
- Set a state timer for $T_{IDPATSetup}$ seconds,

If the access terminal receives a ConnectionDeny message, the access terminal shall return a *ConnectionFailed* indication,

If the state timer expires, the access terminal shall return a *ConnectionFailed* indication,

[15] The Fast Connect message exchange is identical except for not having the Idle State Protocol ConnectionRequest message and the Route Update Protocol RouteUpdate message.

If the access terminal receives a *RouteUpdate.ConnectionOpened* indication, it shall return a *ConnectionOpened* indication and transition to the Inactive State.

3.4.6.1.6.2 Access Network Requirements

If the access network entered this state due to receiving a *RouteUpdate.ConnectionInitiated* indication, it shall perform the following:

- Set state timer for $T_{IDPANSetup}$ seconds.
- If the protocol receives a *RouteUpdate.ConnectionOpened* indication, the access network shall return a *ConnectionOpened* indication and transition to the Inactive State.
- If the state timer expires, the access network shall return a *ConnectionFailed* indication and shall transition to the Sleep State.

Otherwise, the access network shall perform the following:

Upon reception of a ConnectionRequest message while in this state or if the access network entered this state due to reception of a ConnectionRequest message, the access network shall perform the following:

- If the access network denies the connection request, it should send the access terminal a ConnectionDeny message, shall return a *ConnectionFailed* indication, and shall transition to the Sleep State.
- Otherwise, the access network shall perform the following:
  - Set state timer for $T_{IDPANSetup}$ seconds.
  - Issue a *RouteUpdate.Open* command.
  - If the protocol receives a *RouteUpdate.ConnectionOpened* indication, the access network shall return a *ConnectionOpened* indication and transition to the Inactive State.
  - If the state timer expires, the access network shall return a *ConnectionFailed* indication and shall transition to the Sleep State.
- If the access network did not enter this state as a result of receiving a ConnectionRequest message, and if the access network does not receive a ConnectionRequest message within an implementation dependent time interval, then the access network shall return a *ConnectionFailed* indication, and shall transition to the Sleep State.

3.4.6.2 Message Formats

3.4.6.2.1 Page

The access network sends the Page message to direct the access terminal to request a connection.

Field	Length (bits)
MessageID	8

MessageID The access network shall set this field to 0x00.

Channels	CCsynSS	SLP	Best Effort
Addressing	unicast	Priority	20

3.4.6.2.2 ConnectionRequest

The access terminal sends the ConnectionRequest message to request a connection.

Field	Length (bits)
MessageID	8
TransactionID	8
RequestReason	4
PreferredChannelCount	5
PreferredChannelCount occurrences of the following field:	
{	
PreferredChannel	24
}	
PreferTwoRevNBChannel	1
LowRateType	2
Reserved	0-7 (as needed)

MessageID The access terminal shall set this field to 0x01.

TransactionID The access terminal shall increment this value for each new ConnectionRequest message sent.

RequestReason The access terminal shall set this field to one of the request reasons as shown in Table 3.4.6.2-1.

Table 3.4.6.2-1. Encoding of the RequestReason Field

Field value	Description
0x0	Access Terminal Initiated
0x1	Access Network Initiated
All other values are invalid	

PreferredChannelCount

The access terminal shall set this field to the number of occurrences of the forward link PreferredChannel field in this message.

PreferredChannel The access terminal shall set this field to the Channel record specification for the forward link CDMA channel on which the access terminal prefers to be assigned a Traffic Channel (see [6]).

PreferTwoRevNBChannel

The access terminal shall set this field to '0' to request one (6.4 kHz) reverse link narrowband channel and to '1' to request two (12.8 kHz) reverse link narrowband channels.

LowRateType The access terminal shall set this field to one of the low data rates (640 bps or 1.28 kbps) for a low-rate terminal: '1' for 640 bps; '2' for 1.28 kbps. Access network shall ignore this field, if it is set to '0'.

Reserved The access terminal shall add reserved bits to make the length of the entire message an integer number of octets. The access terminal shall set these bits to '0'. The access network shall ignore this field.

Channels	AC
Addressing	unicast

SLP	Best Effort
Priority	40

3.4.6.2.3 ConnectionDeny

The access network sends the ConnectionDeny message to deny a connection.

Field	Length (bits)
MessageID	8
TransactionID	8
DenyReason	4
Reserved	4

MessageID The access network shall set this field to 0x02.

TransactionID — The access network shall set this value to the TransactionID field of the corresponding ConnectionRequest message.

DenyReason — The access network shall set this field to indicate the reason it is denying the connection, as shown in Table 3.4.6.2-2.

Table 3.4.6.2-2. Encoding of the DenyReason Field

Field value	Description
0x0	General
0x1	Network Busy
0x2	Authentication or billing failure
All other values are reserved	

Reserved — The access network shall set this field to zero. The access terminal shall ignore this field.

Channels	CC	**SLP**	Best Effort
Addressing	unicast	**Priority**	40

3.4.6.3 Interface to Other Protocols

3.4.6.3.1 Commands Sent

This protocol issues the following commands:

- *RouteUpdate.Open* (access network only)
- *OverheadMessages.Activate*
- *OverheadMessages.Deactivate*
- *ControlChannelMAC.Activate*
- *ControlChannelMAC.Deactivate*

3.4.6.3.2 Indications

This protocol registers to receive the following indications:

- *RouteUpdate.ConnectionOpened*
- *RouteUpdate.ConnectionInitiated*
- *AccessChannelMAC.TxStarted*
- *AccessChannelMAC.TxEnded*
- *AccessChannelMAC.TransmissionSuccessful*
- *AccessChannelMAC.TransmissionFailed*
- *OverheadMessages.Updated*

3.4.7 Configuration Attributes

The following complex attribute and default values are defined (see [6] for attribute record definition).

3.4.7.1 PreferredControlChannelCycle Attribute

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A

One or more of the following attribute value record:

{

ValueID	8	N/A
PreferredControlChannelCycleEnabled	1	'0'
PreferredControlChannelCycle	0 or 15	N/A
Reserved	7 or 0	N/A

}

Length — Length of the complex attribute in octets. The sender shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The sender shall set this field to 0x00.

ValueID — The sender shall set this field to an identifier assigned to this complex value.

PreferredControlChannelCycleEnabled — The sender shall set this field to '1' if PreferredControlChannelCycle field is included in this attribute; otherwise, the sender shall set this field to '0'.

PreferredControlChannelCycle — If PreferredControlChannelCycleEnabled is set to '1', the sender shall include this field and set it to specify the Control Channel Cycle in which the access terminal transitions out of the Sleep State (see 0) in order to monitor the Control Channel. The sender shall omit this field if PreferredControlChannelCycleEnabled is set to '0'.

Reserved — The length of this field shall be such that the attribute value record is octet-aligned. The sender shall set this field to zero. The receiver shall ignore this field.

3.4.8 Protocol Numeric Constants

Constant	Meaning	Value	Comments
$N_{IDPType}$	Type field for this protocol	See [5]	
$N_{IDPxHRPDS0}$	Subtype field for this protocol	0x0000	
$N_{IDPSleep}$	Number of control channel cycles constituting a sleep period	0x0c	5.12 seconds
$T_{IDPATSetup}$	Maximum access terminal time in the Connection Setup State	2.5 seconds	
$T_{IDPANSetup}$	Maximum access network time in the Connection Setup State	1 second	

3.4.9 Session State Information

The Session State Information record (see [6]) consists of parameter records.

The parameter records for this protocol consist of only the configuration attributes of this protocol.

3.5 xHRPD Subtype 1 Idle State Protocol

3.5.1 Overview

The xHRPD Subtype 1 Idle State Protocol provides the procedures and messages used by the access terminal and the access network when the access terminal has acquired a network and a connection is not open.

This protocol operates in one of the following four states:

- Inactive State: In this state the protocol waits for an *Activate* command.
- Sleep State: In this state the access terminal may shut down part of its subsystems to conserve power. The access terminal does not monitor the Forward Channel, and the access network is not allowed to transmit unicast packets to it.
- Monitor State: In this state the access terminal monitors the Control Channel, listens for Page and if necessary, updates the parameters received from the Overhead Messages Protocol. The access network may transmit unicast packets to the access terminal in this state.
- Connection Setup State: In this state the access terminal and the access network set-up a connection.

Protocol states and events causing the transition between the states are shown in Figure 3.5.1-1 and

Figure 3.5.1-2.

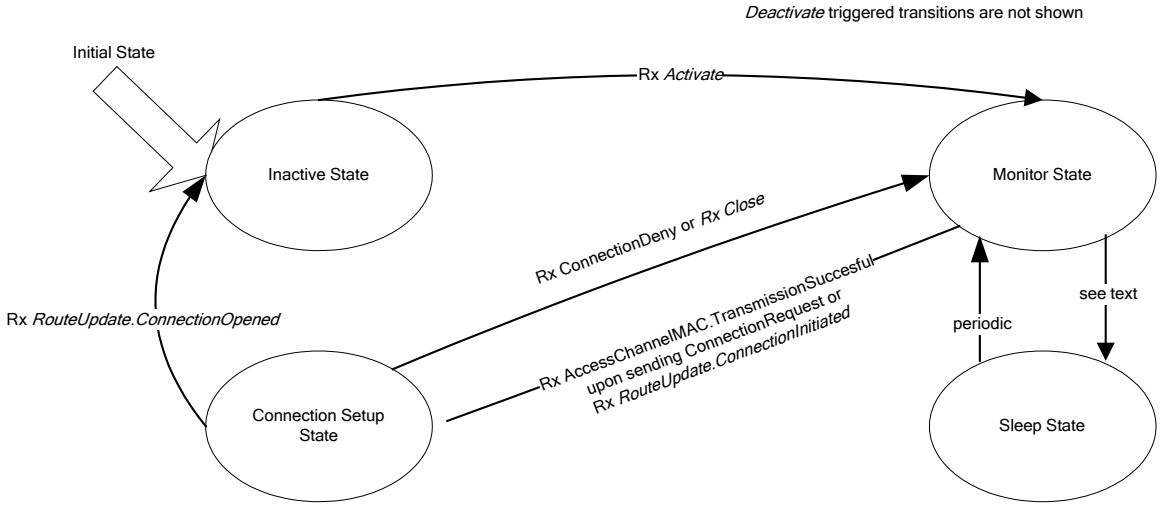

Figure 3.5.1-1. xHRPD Subtype 1 Idle State Protocol State Diagram (Access Terminal)

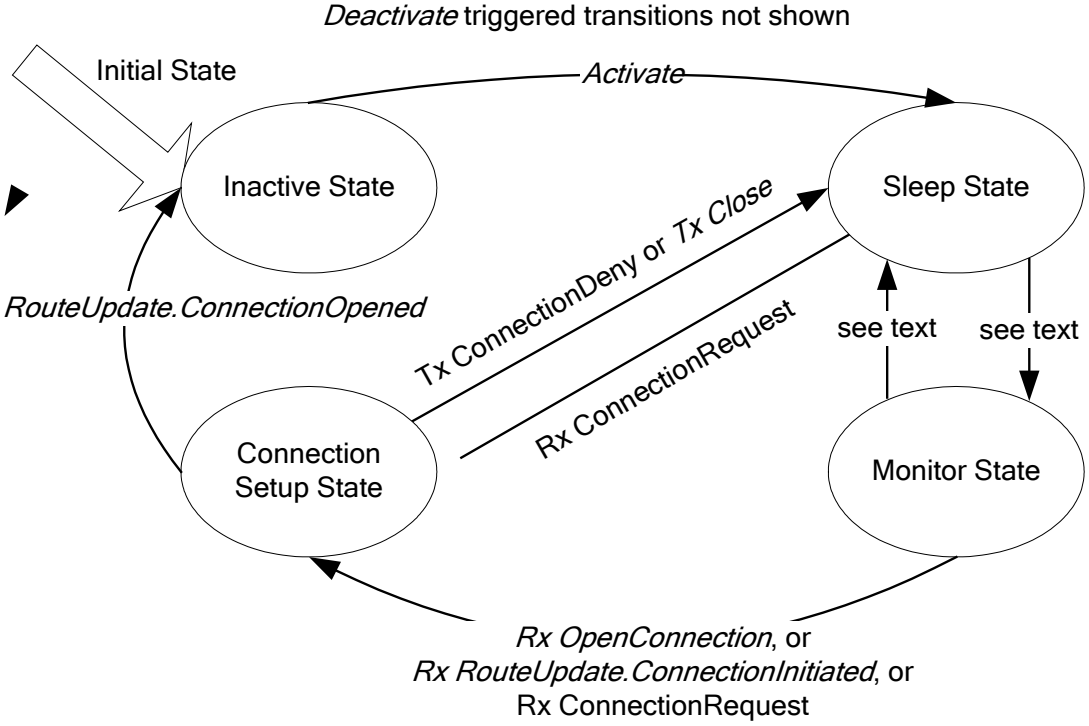

Figure 3.5.1-2. xHRPD Subtype 1 Idle State Protocol State Diagram (Access Network)

This protocol supports periodic network monitoring by the access terminal, allowing for significant power savings. The following access terminal operation modes are supported:

- Continuous operation, in which the access terminal continuously monitors the Control Channel.

- Suspended mode operation, in which the access terminal monitors the Control Channel continuously for a period of time and then proceeds to operate in the slotted mode. Suspended mode follows operation in the Air-Link Management Protocol Connected State and allows for quick network-initiated reconnection.
- Slotted mode operation, in which the access terminal monitors only selected slots.

This protocol supports two types of connection set-ups:

- Normal setup: this procedure is always performed at the initiative of the access terminal.[16] It consists of the access terminal sending a ConnectionRequest message which in turn causes the lower layers to open the connection. The Connection Setup State contains the requirements for normal setup.
- Fast Connect: this procedure is always performed at the initiative of the access network and consists of the access network opening the connection directly via a *RouteUpdate.Open* command.[17] Fast Connect eliminates the need for the Page / ConnectionRequest exchange when the access network has pending data to transmit to an access terminal, and is especially useful when the access terminal is in suspended mode. Support for Fast Connect at the access network is optional. Support for Fast Connect at the access terminal is mandatory. The Monitor State contains the requirements for Fast Connect.

3.5.2 Primitives and Public Data

3.5.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*
- *OpenConnection*
- *Close*

3.5.2.2 Return Indications

This protocol returns the following indications:

- *ConnectionOpened*
- *ConnectionFailed*

3.5.2.3 Public Data

This protocol shall make the following data public:

---

[16] The access network may transmit a Page message to the access terminal directing it to initiate the procedure.

[17] This command triggers a transmission of a TrafficChannelAssignment message based on the last RouteUpdate message received from the access terminal.

- Subtype for this protocol
- PageResponseAPersistence

3.5.3 Protocol Data Unit

The transmission unit of this protocol is a message. This is a control protocol; and, therefore, it does not carry payload on behalf of other layers or protocols.

This protocol uses the Signaling Application to transmit and receive messages.

3.5.4 Protocol Initialization

3.5.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.

3.5.4.2 Protocol Initialization for the InUse Protocol Instance

Upon creation, the InUse instance of this protocol in the access terminal and access network shall perform the following:

- The value of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- The protocol shall enter the Inactive State.

3.5.5 Procedures and Messages for the InConfiguration Instance of the Protocol

3.5.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [1]) to define the processing of the configuration messages.

3.5.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.

- If the InUse instance of any of the Connection Layer protocols does not have the same subtype as the corresponding InConfiguration protocol instance, then
  - the access terminal shall set the initial state of the InConfiguration and InUse protocol instances of the Idle State protocol to the Inactive State.
  - the access network shall set the initial state of the InConfiguration and InUse protocol instances of the Idle State protocol to the Sleep State.
- If the InUse instance of this protocol has the same subtype as this protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol, and
  - The access terminal and the access network shall purge the InConfiguration instance of the protocol.
- If the InUse instance of this protocol does not have the same subtype as this protocol instance, then the access terminal and the access network shall perform the following:
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Idle State Protocol at the access terminal and the access network.
- All the public data not defined by this protocol shall be removed from the public data of the InUse protocol.

3.5.5.3 Message Formats

3.5.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x50.

TransactionID — The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord — The format of this record is specified in [1].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.5.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x51.

TransactionID The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [6]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.5.6 Procedures and Messages for the InUse Instance of the Protocol

3.5.6.1 Procedures

3.5.6.1.1 Command Processing

3.5.6.1.1.1 Activate

When the protocol receives an *Activate* command in the Inactive State:

- The access terminal shall transition to the Monitor State.
- The access network shall transition to the Sleep State.[18]

[18] Since the transitions happen asynchronously, this requirement guarantees that the access network will not transmit unicast packets to the access terminal over the Control Channel when the access terminal is not monitoring the channel.

If the protocol receives this command in any other state it shall be ignored.

3.5.6.1.1.2 Deactivate

When the protocol receives a *Deactivate* command in the Inactive State it shall be ignored.

When the protocol receives this command in any other state:

- The access terminal shall transition to the Inactive State.
- The access network shall transition to the Inactive State.

3.5.6.1.1.3 OpenConnection

When the protocol receives an *OpenConnection* command in the Inactive State or the Connection Setup State, the command shall be ignored.

When the protocol receives this command in the Sleep State:

- The access terminal shall transition to the Monitor state and perform the procedures in 3.5.6.1.2 for sending a ConnectionRequest message.
- The access network shall queue the command and execute it when it is in the Monitor State.

When the protocol receives this command in the Monitor State:

- The access terminal shall perform the procedures in 3.5.6.1.2 for sending a ConnectionRequest message.
- The access network shall send a Page using Page message to the access terminal and transition to the Connection Setup State.

3.5.6.1.1.4 Close

When the protocol receives a *Close* command in the Inactive State it shall be ignored.

When the protocol receives a *Close* command in any other state:

- The access terminal shall transition to the Monitor State.
- The access network shall transition to the Sleep State.

3.5.6.1.2 Access Terminal Procedures for Sending a ConnectionRequest Message

When procedures in this section are invoked, the access terminal shall perform the following:

- If the access terminal received a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', then the access terminal shall not send the ConnectionRequest message on the sector where the access terminal received the ConnectionDeny message until the number of control channel cycles since receiving the ConnectionDeny message is greater than or equal to the value specified by the TCAPendingDuration.

- If the access terminal invokes these procedures in response to an access terminal-initiated event and the ConnectionDenyBackoff attribute is set to a value in the range 0x00 to 0x78, then the access terminal should perform the following:
  - If the access terminal determines that the number of control channel cycles that have passed since receiving a ConnectionDeny message with DenyReason set to *0x01* is less than the value of the ConnectionDenyBackoff attribute, then the access terminal shall postpone sending the ConnectionRequest message until the number of control channel cycles since receiving the ConnectionDeny message is greater than or equal to the value specified by the ConnectionDenyBackoff attribute.
- Send a ConnectionRequest message,
- If an *AccessChannelMAC.TransmissionSuccessful* indication is received, it shall transition to the Connection Setup State,
- If an *AccessChannelMAC.TransmissionFailed* indication is received, it shall return a *ConnectionFailed* indication.

3.5.6.1.3 T_{12} and T_{23} Computation

The access terminal shall compute T_{12} and T_{23} when an *AccessChannelMAC.TransmissionSuccessful* indication or a *ConnectedState.ConnectionClosed* indication is received. The access network shall compute T_{12} and T_{23} when an *AccessChannelMAC.MACLayerCapsuleReceived* indication, a *ConnectedState.ConnectionClosed*, or a *RouteUpdate.ConnectionLost indication* is received. The access terminal and the access network shall compute T_{12} and T_{23} as follows:

$$T_{12} = T_c + PagePeriod1 - \left[\left(T_c + 256 \times R\right) \bmod PagePeriod1\right] + PagePeriod1 \times \left[WCU \times \left(WakeCount1 + 1\right) - 1\right]$$

$$T_{23} = T_{12} + PagePeriod2 - \left[\left(T_{12} + 256 \times R\right) \bmod PagePeriod2\right] + PagePeriod2 \times \left[WCU \times \left(WakeCount2 + 1\right) - 1\right]$$

'

where Period1 and Period2 are specified in units of slots, T_c is the current CDMA system time, WCU is value of the WakeCountUnits attribute.

3.5.6.1.4 Inactive State

When the protocol is in the Inactive State it waits for an *Activate* command.

If at the access terminal receives an *OverheadMessages.Updated* indication in this state, then the access terminal shall queue the latest *OverheadMessages.Updated* indication for processing in the Monitor state.

3.5.6.1.5 Sleep State

When the access terminal is in the Sleep State it may stop monitoring the Control Channel by issuing the following commands:

- *OverheadMessages.Deactivate*
- *ControlChannelMAC.Deactivate*

The access terminal may shut down processing resources to reduce power consumption.

In order to transmit on the Access Channel in this state, the access terminal shall first transition from the Sleep State to the Monitor State. If the access terminal requires opening a connection, it shall transition to the Monitor state and perform the procedures in 3.5.6.1.2 for sending a ConnectionRequest message.

When the access network is in the Sleep State, it is prohibited from sending unicast packets to the access terminal.

If the access network receives a ConnectionRequest message, it shall transition to the Connection Setup State.

If the access terminal advertised a suspend period that is current, the access network may transition to the Monitor State.

The access network and the access terminal shall transition from the Sleep State to the Monitor State in time to send and receive, respectively, the sub-synchronous capsule or the synchronous capsule sent at time T satisfying the following condition:

$$[T+256\times R] \bmod \text{Period} = \text{Offset},$$

where T is the CDMA System Time in slots, and Offset is public data of the Control Channel MAC protocol.

R shall be obtained as follows:

- If PreferredControlChannelCycleEnabled is equal to '0', then *R* is the result of applying the hash function (see [6]) using the following parameters:
  - Key = SessionSeed
  - Decorrelate = 6 × SessionSeed[11:0]
  - N = Max(Period3/256, 1)
  - where SessionSeed is given as public data of the Address Management Protocol.
- If PreferredControlChannelCycleEnabled is equal to '1', then *R* is set to PreferredControlChannelCycle.

Period shall be computed as follows:

$$\text{Period} = \begin{cases} \text{Period1}, & \text{CDMA System Time in slots} < T_{12} \\ \text{Period2}, & T_{12} \le \text{CDMA System Time in slots} < T_{23}. \\ \text{Period3}, & \text{Otherwise} \end{cases}$$

The access network and the access terminal shall compute Period*i* according to Table 3.5.6.1.5-1.

Table 3.5.6.1.5-1. Computation of Period*i* from SlotCycle*i*

SlotCycle*i*	Period*i*
0x00 to 0x06	$2^{\text{SlotCycle}i} \times 4$ slots
0x07 to 0x1c	$2^{(\text{SlotCycle}i - 0x7)} \times 768$ slots

3.5.6.1.6 Monitor State

A paging mask is defined as a periodic interval with period and duty cycle defined by three associated fields PreMaskDuration, MaskDuration, and PostMaskDuration in the PagingMask attribute (see 3.5.7.3).

When the access terminal is in the Monitor State, it shall continuously monitor the Control Channel if MaskCount is equal to 0x00 or one of the following conditions is true for all MaskCount paging masks specified by the PagingMask attribute:

$$T \bmod [(\text{PreMaskDuration} + \text{MaskDuration} + \text{PostMaskDuration}) \times 4] < \text{PreMaskDuration} \times 4, \text{ or}$$

$$T \bmod [(\text{PreMaskDuration} + \text{MaskDuration} + \text{PostMaskDuration}) \times 4] \geq (\text{PreMaskDuration} + \text{MaskDuration}) \times 4,$$

where T is the CDMA System Time in slots, and PreMaskDuration, MaskDuration, and PostMaskDuration are parameters of the PagingMask complex attribute.

When the access network is in the Monitor State, it may send unicast packets to the access terminal. When the access network is in the Monitor State, it should not send unicast packets to the access terminal unless one of the following conditions is true for all MaskCount paging masks specified by the PagingMask attribute:

$$T \bmod [(\text{PreMaskDuration} + \text{MaskDuration} + \text{PostMaskDuration}) \times 4] < \text{PreMaskDuration} \times 4, \text{ or}$$

$$T \bmod [(\text{PreMaskDuration} + \text{MaskDuration} + \text{PostMaskDuration}) \times 4] \geq (\text{PreMaskDuration} + \text{MaskDuration}) \times 4.$$

where T is the CDMA System Time in slots, and PreMaskDuration, MaskDuration, and PostMaskDuration are parameters of the PagingMask complex attribute.

3.5.6.1.6.1 Access Terminal Requirements

Upon entering the Monitor State, the access terminal shall issue the following commands:

- *OverheadMessages.Activate*
- *ControlChannelMAC.Activate*

The access terminal shall comply with the following requirements when in the Monitor State:

- If the access terminal has queued an *OverheadMessages.Updated* indication or upon receiving an *OverheadMessages.Updated* indication, the access terminal shall tune to the CDMA Channel selected as specified in ☐

- If the access terminal entered Monitor State to receive the synchronous capsule, it shall monitor the overhead messages as specified in the Overhead Messages.
- If the access terminal receives a Page message, it shall perform the procedures in 3.5.6.1.2 for sending a ConnectionRequest message.
- If the access terminal requires opening a connection, it shall perform the procedures in 3.5.6.1.2 for sending a ConnectionRequest message.
- If the access terminal receives a *RouteUpdate.ConnectionInitiated* indication it shall:
  - If the access terminal had previously received a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', then the access terminal shall reset TCAPendingDuration to zero, and
  - transition to the Connection Setup State.[19]
- Access terminal may transition to the Sleep State if the requirements specified in 3.5.6.1.6.1.2 are satisfied.
- If the access terminal had previously received a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', and if the number of control channel cycles since receiving the ConnectionDeny message is greater than or equal to the value specified by the TCAPendingDuration, then the access terminal shall return a *ConnectionFailed* indication.

3.5.6.1.6.1.1 CDMA Channel Selection

The access terminal shall select a CDMA Channel from the list of channels or extended channels in the SectorParameters message. If no channels or extended channels are listed, the access terminal shall use the channel it is currently monitoring. If one or more channels are available, the access terminal shall use a hash function (see [6]) to compute an index into the subset of a subset of advertised CDMA Channels according to the following procedures.

The access terminal shall create a combined channel list as follows:

- If the extended channel list is included in the SectorParameters message, the access terminal shall create a combined channel list by appending each CDMA Channel in the extended channel list (in order) to the set of CDMA Channels in the channel list (in order). Otherwise, the access terminal shall set the combined channel list to the set of CDMA Channels in the channel list.
- If the SupportedCDMAChannels public data of the Route Update Protocol lists any channels, then the access terminal shall remove from the combined channel list the following CDMA Channels:
  - All forward CDMA Channels that are not supported by the access terminal as indicated by the SupportedCDMAChannels public data of the Route Update Protocol.

[19] This requirement provides Fast Connect on the access terminal side.

– All the forward CDMA Channels whose associated reverse CDMA Channel is not supported by the access terminal as indicated by the SupportedCDMAChannels public data of the Route Update Protocol.

The set, *S*, of CDMA Channels is determined as follows:

- If the AccessHashingChannelMaskIncluded field in the SectorParameters message is not included or is included and set to '0', the access terminal shall set *S* to the subset of CDMA Channels in the combined channel list.
- If the AccessHashingChannelMaskIncluded field in the SectorParameters message is included and is set to '1', the access terminal shall set *S* to the subset of CDMA Channels in the combined channel list for which:
  - Ni is equal to Nmax, where i is the index of the CDMA Channel in the combined channel list,

    where N_j = bitcount(AccessHashingClassMask [AccessHashingMaskLength:0] $\otimes$ M_j), where M_j is the AccessHashingChannelMask field in the SectorParameters message corresponding to the j^{th} CDMA Channel in the combined channel list;

    N_{max} is the maximum value of N_k for all k, where k is the index of the CDMA Channel in the combined channel list; and

    bitcount(x) is the number of '1' bits in the binary representation of *x*.

The CDMA Channels supported by the access terminal are public data of the Route Update Protocol. The access terminal shall use the following hash function parameters to obtain the index into set *S*:

- Key = SessionSeed
- Decorrelate = 0
- N = Number of CDMA Channels in set *S*

where SessionSeed is provided as public data by the Address Management Protocol.

3.5.6.1.6.1.2 Transition to Sleep State

The access terminal may transition to the Sleep State if all of the following requirements are met:

- One of the following requirements is met:
  - The access terminal entered the Monitor State to receive the synchronous capsule and has received a Control Channel synchronous Sleep State capsule in the current Control Channel Cycle and has determined that the SectorParameters message is up to date. The current Control Channel Cycle is defined to be the Control Channel Cycle that started at slot $\lfloor T/256 \rfloor$, where T is the current CDMA System Time in slots.

  - The access terminal entered the Monitor State to receive a sub-synchronous capsule, and has received the sub-synchronous capsule, or did not receive the sub-synchronous capsule in the expected slots.
  - The access terminal entered the Monitor State as a result of receiving a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', and the number of control channel cycles since receiving the ConnectionDeny message is greater than or equal to the value specified by the TCAPendingDuration.

- Access terminal received an *AccessChannelMAC.TxEnded* indication for every *AccessChannelMAC.TxStarted* indication it received since entering the Monitor State.[20]
- Access terminal has not advertised a suspend period that is current (see 3.6). The suspend period is current if the time advertised in the associated ConnectionClose message is greater than the current CDMA System Time.[21]

3.5.6.1.6.2 Access Network Requirements

3.5.6.1.6.2.1 General Requirements

- Access network shall select the CDMA Channel following the same specifications as the access terminal, see 3.5.6.1.6.1.1.
- If the access network receives a ConnectionRequest message, it shall transition to the Connection Setup State.
- If the access network requires opening a connection with the access terminal and does not use an accelerated procedure to set-up a connection, the access network shall send a Page message to the access terminal over the Control Channel.
- Access network may use an accelerated procedure to set-up a connection with the access terminal by bypassing the paging process. The access network should only use this procedure if it has a reasonable estimate of the access terminal's current location. To set-up a connection in an accelerated fashion (Fast Connect) the access network shall:
  - If the access network had previously sent a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', and the number of control channel cycles since sending the ConnectionDeny message is less the value specified by the TCAPendingDuration, then the access network shall reset TCAPendingDuration to zero.
  - Issue a *RouteUpdate.Open* command.

---

[20] This pairing ensures that the access terminal does not have any outstanding messages waiting for an answer.

[21] The access terminal monitors the Control Channel continuously during a suspend period thus avoiding the delay in opening access network initiated connections due to the sleep period.

- Transition to the Connection Setup State, when the protocol receives a *RouteUpdate.ConnectionInitiated* indication.

- Access network shall transition to the Sleep State if all of the following conditions are met:
  - the access terminal did not advertise a suspend period that is current.
  - The access network entered the Monitor State as a result of sending a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', and the number of control channel cycles since sending the ConnectionDeny message is greater than or equal to the value specified by the TCAPendingDuration.
- If the access network had previously sent a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', and the number of control channel cycles since sending the ConnectionDeny message is greater than or equal to the value specified by the TCAPendingDuration, then the access network shall return a *ConnectionFailed* indication.

3.5.6.1.7 Connection Setup State

The access terminal and the access network use the Connection Setup State to perform a normal connection set-up.

Figure 3.5.6.1.7-1 illustrates the process of opening a connection between the access terminal and the access network when this protocol is used along with the default Route Update and the default Reverse Traffic Channel MAC protocols.[22]

[22] The Fast Connect message exchange is identical except for not having the Idle State Protocol ConnectionRequest message and the Route Update Protocol RouteUpdate message.

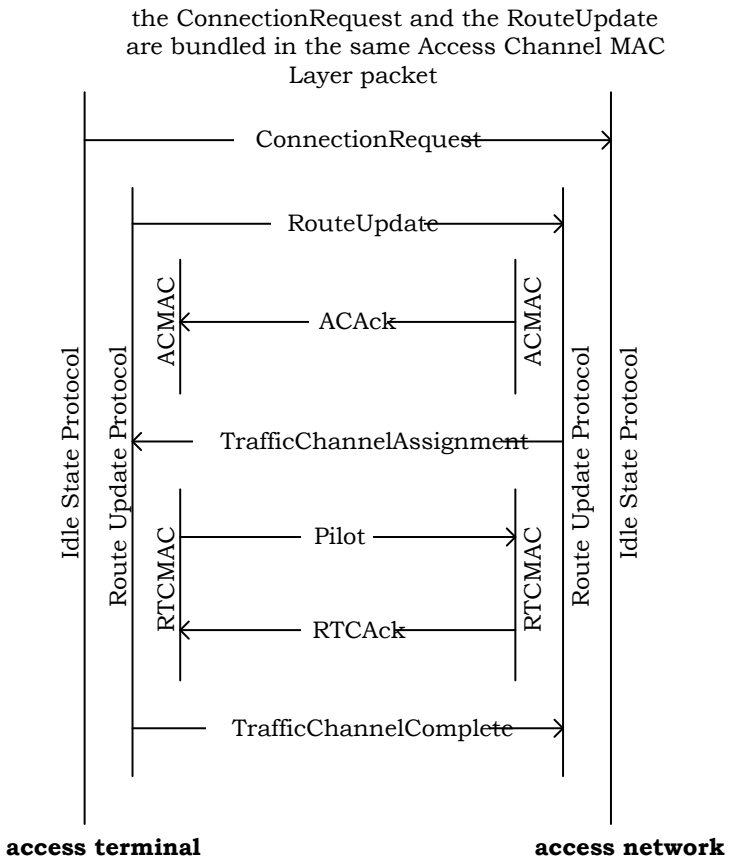

Figure 3.5.6.1.7-1. Connection Setup Exchange

3.5.6.1.7.1 Access Terminal Requirements

The access terminal shall comply with the following requirements.

- Upon entering the Connection Setup State the access terminal shall:
  - Issue an *OverheadMessages.Activate* command,
  - Issue a *ControlChannelMAC.Activate* command,
  - Set a state timer for $T_{IDPATSetup}$ seconds,
- If the access terminal receives a ConnectionDeny message with the DenyReason not included, or included and is not set to 'Traffic Channel Assignment Pending', the access terminal shall return a *ConnectionFailed* indication,
- If the access terminal receives a ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending', then the access terminal shall transition to the Monitor state,
- If the state timer expires, the access terminal shall return a *ConnectionFailed* indication,

- If the access terminal receives a *RouteUpdate.ConnectionOpened* indication, it shall return a *ConnectionOpened* indication and transition to the Inactive State.

3.5.6.1.7.2 Access Network Requirements

If the ConnectionRequest message contains one or more preferred CDMA channels, then the access network should assign a Traffic Channel on one of the preferred CDMA channels.

If all of the following conditions are met:

- The traffic channel resource is not available,
- The ConnectionQueuingSupported attribute is set to '0x01', and
- One of the following conditions is met:
  - The received ConnectionRequest message has the ConnectionQueuingReq field set to '1', or
  - The access network determines that queuing should be applied[23],

then the access network should:

- Send ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending',
- Queue the ConnectionRequest for TCAPendingDuration in units of number of control channel cycles after sending the ConnectionDeny message, and
- Transition to the Monitor state

The access network shall not send ConnectionDeny message with the DenyReason set to 'Traffic Channel Assignment Pending' if the ConnectionQueuingSupported attribute is set to '0x00'.

The access network should deny the connection request if all of the following conditions are true:

- the ConnectionRequest message from the access terminal contains one or more preferred CDMA channels, and
- none of the preferred CDMA channels in the ConnectionRequest message can be used to assign a Traffic Channel.

If the access network entered this state due to receiving a *RouteUpdate.ConnectionInitiated* indication, it shall perform the following:

- Set state timer for $T_{IDPANSetup}$ seconds.

[23] The ConnectionRequest Queuing function is enabled when the priority treatment is required by the application service such as the priority service

- If the protocol receives a *RouteUpdate.ConnectionOpened* indication, the access network shall return a *ConnectionOpened* indication and transition to the Inactive State.
- If the state timer expires, the access network shall return a *ConnectionFailed* indication and shall transition to the Sleep State.

Otherwise, the access network shall perform the following:

Upon reception of a ConnectionRequest message while in this state or if the access network entered this state due to reception of a ConnectionRequest message, the access network shall perform the following:

- If the access network denies the connection request, it should send the access terminal a ConnectionDeny message, shall return a *ConnectionFailed* indication, and shall transition to the Sleep State.
- Otherwise, the access network shall perform the following:
  - Set state timer for $T_{IDPANSetup}$ seconds.
  - Issue a *RouteUpdate.Open* command.
  - If the protocol receives a *RouteUpdate.ConnectionOpened* indication, the access network shall return a *ConnectionOpened* indication and transition to the Inactive State.
  - If the state timer expires, the access network shall return a *ConnectionFailed* indication and shall transition to the Sleep State.
- If the access network did not enter this state as a result of receiving a ConnectionRequest message, and if the access network does not receive a ConnectionRequest message within an implementation dependent time interval, then the access network shall return a *ConnectionFailed* indication, and shall transition to the Sleep State.

3.5.6.2 Message Formats

3.5.6.2.1 Page

The access network sends the Page message to direct the access terminal to request a connection.

Field	Length (bits)
MessageID	8
PageResponseAPersistenceIncluded	0 or 1
PageResponseAPersistence	0 or 6
Reserved	0 – 7 (as needed)

MessageID The access network shall set this field to 0x00.

PageResponseAPersistenceIncluded

The access network shall include this field if any of the non-reserved fields that follow this field are included in the message. If included, the access network shall set this field as follows:

The access network shall set this field to '0' if the PageResponseAPersistenceSupported attribute is set to 0x00. Otherwise, the access network shall set this field as follows:

The access network shall set this field to '1' if the PageResponseAPersistence field is included in this message. Otherwise, the access network shall set this field to '0'.

PageResponseAPersistence

The access network shall omit this field if the PageResponseAPersistenceIncluded is not included, or if the PageResponseAPersistenceIncluded field is included and set to '0'. Otherwise, the access network shall include this field and set it as follows:

The access network shall set this field *n* such that $2^{-n/4}$ is the access persistence probability that the access terminal is to use when responding to this Page message. The access network shall not set this field to 0x3f.

Reserved The access network shall include Reserved bits to make the length of the entire message equal to an integer number of octets. The access network shall set these bits to '0'.

Channels	CCsynSS CCsubsyn	**SLP**	Best Effort
Addressing	unicast	**Priority**	20

3.5.6.2.2 ConnectionRequest

The access terminal sends the ConnectionRequest message to request a connection.

Field	Length (bits)
MessageID	8
TransactionID	8
RequestReason	4
PreferredChannelCount	5
PreferredChannelCount occurrences of the following field:	
{	
PreferredChannel	24
}	
PreferTwoRevNBChannel	1
LowRateType	2
Reserved	0-7 (as needed)

MessageID The access terminal shall set this field to 0x01.

TransactionID The access terminal shall increment this value for each new ConnectionRequest message sent.

RequestReason The access terminal shall set this field to one of the request reasons as shown in Table 3.5.6.2-1.

Table 3.5.6.2-1. Encoding of the RequestReason Field

Field value	Description
0x0	Access Terminal Initiated
0x1	Access Network Initiated
All other values are invalid	

PreferredChannelCount

The access terminal shall set this field to the number of occurrences of the forward link PreferredChannel field in this message.

PreferredChannel The access terminal shall set this field to the Channel record specification for the forward link CDMA channel on which the access terminal prefers to be assigned a Traffic Channel (see [6]).

PreferTwoRevNBChannel

The access terminal shall set this field to '0' to request one (6.4 kHz) reverse link narrowband channel and to '1' to request two (12.8 kHz) reverse link narrowband channels.

LowRateType — The access terminal shall set this field to one of the low data rates (640 bps or 1.28 kbps) for a low-rate terminal: '1' for 640 bps; '2' for 1.28 kbps. Access network shall ignore this field, if it is set to '0'.

Reserved — The access terminal shall add reserved bits to make the length of the entire message an integer number of octets. The access terminal shall set these bits to '0'. The access network shall ignore this field.

Channels	AC	**SLP**	Best Effort
Addressing	unicast	**Priority**	40

3.5.6.2.3 ConnectionDeny

The access network sends the ConnectionDeny message to deny a connection.

Field	Length (bits)
MessageID	8
TransactionID	8
DenyReason	4
TCAPendingDuration	0 or 6
Reserved	0-7 (as needed)

MessageID — The access network shall set this field to 0x02.

TransactionID — The access network shall set this value to the TransactionID field of the corresponding ConnectionRequest message.

DenyReason — The access network shall set this field to indicate the reason it is denying the connection, as shown in Table 3.5.6.2-2.

Table 3.5.6.2-2. Encoding of the DenyReason Field

Field value	Description
0x0	General
0x1	Network Busy
0x2	Authentication or billing failure
0x3	Preferred channel not available
0x4	Traffic Channel Assignment Pending
All other values are reserved	

TCAPendingDuration

The access network shall include this field if DenyReason field is

included and is set to 0x04 (Traffic Channel Assignment Pending). If this field is included, the access network shall set this field to the pending duration in units of control channel cycles.

Reserved — The access network shall add reserved bits to make the length of the entire message an integer number of octets. The access network shall set these bits to '0'. The access terminal shall ignore this field.

Channels	CC	**SLP**	Best Effort
Addressing	unicast	**Priority**	40

3.5.6.2.4 AttributeUpdateRequest

The sender sends an AttributeUpdateRequest message to offer a set of attribute values for a given attribute.

Field	Length (bits)
MessageID	Protocol dependent
TransactionID	8
One or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x52.

TransactionID — The sender shall increment this value for each new AttributeUpdateRequest message sent.

AttributeRecord — The format of this record is specified in [6].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.5.6.2.5 AttributeUpdateAccept

The sender sends an AttributeUpdateAccept message in response to an AttributeUpdateRequest message to accept the offered attribute values.

Field	Length (bits)
MessageID	Protocol dependent
TransactionID	8

MessageID — The sender shall set this field to 0x53.

TransactionID The sender shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.5.6.2.6 AttributeUpdateReject

The access network sends an AttributeUpdateReject message in response to an AttributeUpdateRequest message to reject the offered attribute values.

Field	Length (bits)
MessageID	Protocol dependent
TransactionID	8

MessageID The access network shall set this field to 0x54.

TransactionID The access network shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.5.6.3 Interface to Other Protocols

3.5.6.3.1 Commands Sent

This protocol issues the following commands:

- *RouteUpdate.Open* (access network only)
- *OverheadMessages.Activate*
- *OverheadMessages.Deactivate*
- *ControlChannelMAC.Activate*
- *ControlChannelMAC.Deactivate*

3.5.6.3.2 Indications

This protocol registers to receive the following indications:

- *RouteUpdate.ConnectionOpened*
- *RouteUpdate.ConnectionInitiated*
- *AccessChannelMAC.TxStarted*
- *AccessChannelMAC.TxEnded*

- *AccessChannelMAC.TransmissionSuccessful*
- *AccessChannelMAC.MACLayerCapsuleReceived*
- *AccessChannelMAC.TransmissionFailed*
- *OverheadMessages.Updated*
- *ConnectedState.ConnectionClosed*
- *RouteUpdate.ConnectionLost*

3.5.7 Configuration Attributes

Unless specified otherwise, the access terminal and the access network shall not use the Generic Attribute Update Protocol to update configurable attributes belonging to the Enhanced Idle State Protocol. The access terminal and the access network shall support the use of the Generic Attribute Update Protocol to update values of the following attributes belonging to the Enhanced Idle State Protocol:

- PreferredControlChannelCycle
- SlottedMode
- PagingMask
- AccessHashingClassMask
- WakeCountUnitsSupported
- WakeCountUnits
- ConnectionQueuingSupported

The access terminal shall not include the AccessHashingClassMask in an AttributeUpdateRequest message.

The access network shall not send an AttributeUpdateRequest message containing the PreferredControlChannelCycle, the PagingMask, WakeCountUnitsSupported, or the ConnectionQueuingSupported attribute.

If the SmallSlotCycleAllowed attribute is set to 0x00, then the access network and the access terminal shall not send an AttributeUpdateRequest message proposing a value of the SlotCycle1 field of the SlottedMode attribute that is less than 0x06.

If the WakeCountUnitsSupported attribute is set to 0x00, then the access network and the access terminal shall not send an AttributeUpdateRequest message containing the WakeCountUnits attribute.

3.5.7.1 Simple Attributes

The simple configurable attributes are listed in Table 3.5.7.1-1. The access network and the access terminal shall use the default values that are typed in ***bold italics.***

1 **Table 3.5.7.1-1Configurable Simple Attributes**

Attribute ID	Attribute	Values	Meaning
0xff	SmallSlotCycleAllowed	0x00	Access terminal and access network will not propose a value of SlotCycle1 that is less than 0x06.
		0x01	Access terminal and access network can propose a value of SlotCycle1 that is less than 0x06.
		0x02 to 0xff	Reserved
0xfe	AccessHashingClassMask	***0x0000***	Access terminal and access network will hash to channels with any access hashing class.
		0x0001 to 0xffff	Access terminal and access network will hash to channels with designated access hashing classes (see 3.5.6.1.6.1.1).
0xfd	ConnectionDenyBackoff	0x00-0x78	Access terminal is to observe a back off period specified by this attribute (in units of control channel cycles) after receiving a ConnectionDeny message with DenyReason field set to 0x01 before sending an access terminal-initiated ConnectionRequest message
		0x79-0xfe	Reserved
		0xff	Access terminal is to observe an implementation-specific back off period after receiving a ConnectionDeny message with DenyReason field set to 0x01 before sending an access terminal-initiated ConnectionRequest message
0xfc	PageResponseAPersistenceSupported	***0x00***	Access terminal does not support PageResponseAPersistence.
		0x01	Access terminal supports PageResponseAPersistence.
		All other values	Reserved
0xfa	WakeCountUnitsSupported	***0x00***	Access terminal does not support negotiation of WakeCountUnits attribute
		0x01	Access terminal supports negotiation of WakeCountUnits attribute
		All other values	Reserved

Attribute ID	Attribute	Values	Meaning
0xf9	WakeCountUnits	***0x18***	Units of WakeCount1 and WakeCount2 fields in SlottedMode attribute.
		0x01-0x17	Units of WakeCount1 and WakeCount2 fields in SlottedMode attribute.
		All other values	Reserved
0xf3	ConnectionQueuingSupported	***0x00***	Access terminal does not support ConnectionRequest queuing.
		0x01	Access terminal supports ConnectionRequest queuing.
		All other values	Reserved

3.5.7.2 Complex Attributes

3.5.7.2.1 PreferredControlChannelCycle Attribute

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A

One or more of the following attribute value record:

{

ValueID	8	N/A
PreferredControlChannelCycleEnabled	1	'0'
PreferredControlChannelCycle	0 or 15	N/A
Reserved	7 or 0	N/A

}

Length — Length of the complex attribute in octets. The sender shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The sender shall set this field to 0x00.

ValueID — The sender shall set this field to an identifier assigned to this complex value.

PreferredControlChannelCycleEnabled — The sender shall set this field to '1' if PreferredControlChannelCycle field is included in this attribute; otherwise, the sender shall set this field to '0'.

PreferredControlChannelCycle

If PreferredControlChannelCycleEnabled is set to '1', the sender shall include this field and set it to specify the Control Channel Cycle in which the access terminal transitions out of the Sleep State (see 0) in order to monitor the Control Channel. The sender shall omit this field if PreferredControlChannelCycleEnabled is set to '0'.

Reserved — The length of this field shall be such that the attribute value record is octet-aligned. The sender shall set this field to zero. The receiver shall ignore this field.

3.5.7.2.2 SlottedMode Attribute

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A

One or more of the following attribute value record:

{

ValueID	8	N/A
SlotCycle1	5	0x9
SlotCycle2	5	0x9
SlotCycle3	5	0x9
WakeCount1	4	0x0
WakeCount2	4	0x0
Reserved	1	N/A

}

Length — Length of the complex attribute in octets. The sender shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The sender shall set this field to 0x01.

ValueID — The sender shall set this field to an identifier assigned to this complex value.

SlotCycle1 — The sender shall set this field to SlotCycle1. The sender shall not set this field to more than 0x1c.

SlotCycle2 — The sender shall set this field to SlotCycle2. SlotCycle2 shall be greater than or equal to SlotCycle1. The sender shall not set this field to more than 0x1c.

SlotCycle3 The sender shall set this field to SlotCycle3. SlotCycle3 shall be greater than or equal to SlotCycle2. The sender shall not set this field to more than 0x1c.

WakeCount1 The sender shall set this field to WakeCount1.

WakeCount2 The sender shall set this field to WakeCount2. WakeCount2 shall be greater or equal to than WakeCount1.

Reserved The sender shall set this field to '0'. The receiver shall ignore this field.

3.5.7.3 PagingMask Attribute

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A
One or more of the following record:		
ValueID	8	N/A
MaskCount	8	0x00
MaskCount occurrences of the following four fields:		
MaskPurpose	8	N/A
PreMaskDuration	16	N/A
MaskDuration	16	N/A
PostMaskDuration	16	N/A

Length Length of the complex attribute in octets. The sender shall set this field to the length of the complex attribute excluding the Length field.

AttributeID The sender shall set this field to 0x02.

ValueID The sender shall set this field to an identifier assigned to this complex value.

MaskCount The sender shall set this field to the number of paging masks specified in this complex attribute.

MaskPurpose The sender shall set this field to indicate the purpose of the mask according to Table 3.5.7.3-1.

Table 3.5.7.3-1. Definition of MaskPurpose Field of a Paging Mask

MaskPurpose Value	Meaning
0x00	Unspecified purpose.
0x01	The paging mask is associated with monitoring the cdma2000 1x system (see [11]).
0x02-0xff	Specified by [18].

PreMaskDuration The sender shall set this field to the length of the pre-mask duration in units of four slots.

MaskDuration The sender shall set this field to the length of the masked duration in units of four slots.

PostMaskDuration The sender shall set this field to the length of the post-mask duration in units of four slots.

3.5.8 Protocol Numeric Constants

Constant	Meaning	Value	Comments
$N_{IDPType}$	Type field for this protocol	See [5]	
$N_{IDPxHRPDS1}$	Subtype field for this protocol	0x0001	
$T_{IDPATSetup}$	Maximum access terminal time in the Connection Setup State	2.5 seconds	
$T_{IDPANSetup}$	Maximum access network time in the Connection Setup State	1 second	

3.5.9 Session State Information

The Session State Information record (see [6]) consists of parameter records.

The parameter records for this protocol consist of only the configuration attributes of this protocol.

3.6 Default Connected State Protocol

The Default Connected State Protocol is same as defined in [4].

3.7 xHRPD Subtype 0 Route Update Protocol

3.7.1 Overview

The xHRPD Subtype 0 Route Update Protocol provides the procedures and messages used by the access terminal and the access network to keep track of the access terminal's approximate location.

This protocol can be in one of three states:

- Inactive State: In this state the protocol waits for an *Activate* command.

- Idle State: This state corresponds to the Air-Link Management Protocol Idle State. In this state, the access terminal autonomously maintains the Active Set. Route update messages from the access terminal to the access network are based on the distance between the access terminal's current serving sector and the serving sector at the time the access terminal last sent an update.
- Connected State: In this state the access network dictates the access terminal's Active Set. Route update messages from the access terminal to the access network are based on changing radio link conditions.

Transitions between states are driven by commands received from Connection Layer protocols and the transmission and reception of the TrafficChannelAssignment message.

The protocol states, messages and commands causing the transition between the states are shown in Figure 3.7.1-1.

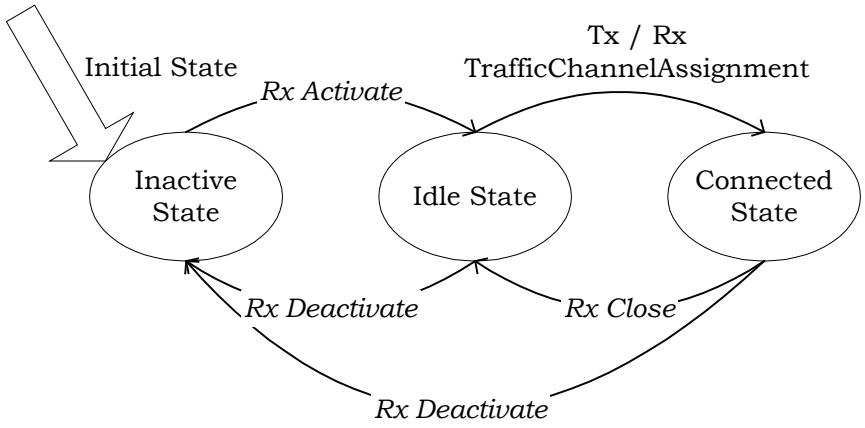

Figure 3.7.1-1. xHRPD Subtype 0 Route Update Protocol State Diagram

This protocol uses parameters that are provided, as public data by the Overhead Messages Protocol, configured attributes, or protocol constants.

Table 3.7.1-1 lists all of the protocol parameters obtained from the public data of the Overhead Messages Protocol.

Table 3.7.1-1. Route Update Protocol Parameters that are Public Data of the Overhead Messages Protocol

RU Parameter	Comment
Latitude	Latitude of sector in units of 0.25 second
Longitude	Longitude of sector in units of 0.25 second
RouteUpdateRadiusOverhead	Distance (unless modified by the RouteUpdateRadiusMultiply and/or RouteUpdateRadiusAdd attributes) between the serving sector and the sector in which location was last reported which triggers a new report. If this field is set to zero, then distance triggered reporting is disabled
NumNeighbors	Number of neighbors specified in the message
NeighborPN	PN Offset of each neighbor in units of 64 PN chips
NeighborChannelIncluded	Set to '1' if a Channel Record is included for the neighbor
NeighborChannel	Neighbor Channel Record specifying network type and frequency

3.7.2 Primitives and Public Data

3.7.2.1 Commands

This protocol defines the following commands:

- *Activate*
- *Deactivate*
- *Open*
- *Close*
- *SendRouteUpdate*

3.7.2.2 Return Indications

This protocol returns the following indications:

- *ConnectionLost* (access network only)
- *NetworkLost*
- *IdleHO*
- *ActiveSetUpdated*
- *AssignmentRejected*
- *ConnectionInitiated*
- *ConnectionOpened*

3.7.2.3 Public Data

This protocol shall make the following data public:

- Subtype for this protocol
- Active Set
- Pilot PN for every pilot in the Active Set
- MACIndex for every pilot in the Active Set
- Channel record specified in the TrafficChannelAssignment message
- FrameOffset specified in the TrafficChannelAssignment message
- Current RouteUpdate message
- Information listed in SupportedCDMAChannels attribute
- Pilot strength of all pilots in the Active Set

3.7.3 Protocol Data Unit

The transmission unit of this protocol is a message. This is a control protocol and, therefore, it does not carry payload on behalf of other layers or protocols.

This protocol uses the Signaling Application to transmit and receive messages.

3.7.4 Protocol Initialization

3.7.4.1 Protocol Initialization for the InConfiguration Protocol Instance

Upon creation, the InConfiguration instance of this protocol in the access terminal and the access network shall perform the following in the order specified:

- The fall-back values of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- If the InUse instance of this protocol has the same protocol subtype as this InConfiguration protocol instance, then the fall-back values of the attributes defined by the InConfiguration protocol instance shall be set to the values of the corresponding attributes associated with the InUse protocol instance.
- The value for each attribute for this protocol instance shall be set to the fall-back value for that attribute.

3.7.4.2 Protocol Initialization for the InUse Protocol Instance

Upon creation, the InUse instance of this protocol in the access terminal and the access network shall perform the following:

- The value of the attributes for this protocol instance shall be set to the default values specified for each attribute.
- The protocol shall enter the Inactive State.

3.7.5 Procedures and Messages for the InConfiguration Instance of the Protocol

3.7.5.1 Procedures

This protocol uses the Generic Configuration Protocol (see [6]) to define the processing of the configuration messages. The access terminal should send a ConfigurationRequest message containing the SupportedCDMAChannels attribute. If the access terminal sends a ConfigurationRequest message containing the SupportedCDMAChannels attribute, then the access terminal shall include in the attribute all Band Classes and Band Sub-classes supported by the access terminal.

3.7.5.2 Commit Procedures

The access terminal and the access network shall perform the procedures specified in this section, in the order specified, when directed by the InUse instance of the Session Configuration Protocol to execute the Commit procedures:

- All the public data that are defined by this protocol, but are not defined by the InUse protocol instance shall be added to the public data of the InUse protocol.
- The value of the following public data of the InUse instance of the protocol shall be set to the corresponding attribute value of the InConfiguration protocol instance:
  - SupportedCDMAChannels
- If the InUse instance of the Route Update Protocol has the same subtype as this protocol instance, but the InUse instance of any other protocol in the Connection Layer does not have the same subtype as the corresponding InConfiguration protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol, and
  - The access terminal shall set the initial state of the InConfiguration and InUse protocol instances of the Route Update protocol to the Inactive State.
  - The access network shall set the initial state of the InConfiguration and InUse protocol instances of the Route Update protocol to the Idle State.
  - The access terminal and the access network shall purge the InConfiguration instance of the protocol.
- If the InUse instance of all protocols in the Connection Layer have the same subtype as the corresponding InConfiguration protocol instance, then
  - The access terminal and the access network shall set the attribute values associated with the InUse instance of this protocol to the attribute values associated with the InConfiguration instance of this protocol, and
  - The InUse protocol instance at the access terminal shall perform the procedures specified in 3.7.6.1.2.1.

- The access terminal and the access network shall purge the InConfiguration instance of the protocol.

- If the InUse instance of the Route Update Protocol does not have the same subtype as this protocol instance, then the access terminal and the access network shall perform the following:
  - The access terminal shall set the initial state of the InConfiguration and InUse protocol instances of the Route Update protocol to the Inactive State.
  - The access network shall set the initial state of the InConfiguration and InUse protocol instances of the Route Update protocol to the Idle State.
  - The InConfiguration protocol instance shall become the InUse protocol instance for the Route Update Protocol at the access terminal and the access network.
- All the public data that are not defined by this protocol shall be removed from the list of public data for the InUse protocol instance.

3.7.5.3 Message Formats

3.7.5.3.1 ConfigurationRequest

The ConfigurationRequest message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x50.

TransactionID — The sender shall increment this value for each new ConfigurationRequest message sent.

AttributeRecord — The format of this record is specified in [6].

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.5.3.2 ConfigurationResponse

The ConfigurationResponse message format is as follows:

Field	Length (bits)
MessageID	8
TransactionID	8
Zero or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID The sender shall set this field to 0x51.

TransactionID The sender shall set this value to the TransactionID field of the corresponding ConfigurationRequest message.

AttributeRecord An attribute record containing a single attribute value. If this message selects a complex attribute, only the ValueID field of the complex attribute shall be included in the message. The format of the AttributeRecord is given in [6]. The sender shall not include more than one attribute record with the same attribute identifier.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.6 Procedures and Messages for the InUse Instance of the Protocol

3.7.6.1 Procedures

3.7.6.1.1 Command Processing

3.7.6.1.1.1 Activate

If the protocol receives an *Activate* command in the Inactive State, the access terminal and the access network shall perform the following:

- Issue an *AccessChannelMAC.Activate* command,
- Transition to the Idle State.

If this command is received in any other state, it shall be ignored.

3.7.6.1.1.2 Deactivate

If the protocol receives a *Deactivate* command in the Inactive State, it shall be ignored.

If the protocol receives this command in any other state, the access terminal and the access network shall:

- Issue a *ReverseTrafficChannelMAC.Deactivate* command,
- Issue a *ForwardTrafficChannelMAC.Deactivate* command,
- Issue an *AccessChannelMAC.Deactivate* command,

- Transition to the Inactive State.

3.7.6.1.1.3 Open

If the protocol receives an *Open* command in the Idle State,

- The access terminal shall ignore it.
- The access network shall:
  - Transmit a TrafficChannelAssignment message as follows:
    + The access network should base the TrafficChannelAssignment message on the last RouteUpdate message it received from the access terminal.
    + If the SupportedCDMAChannels attribute contains one or more band classes, then the access network shall assign a Traffic Channel on a CDMA Channel supported by the access terminal as indicated by the value of the SupportedCDMAChannels attribute.
  - Return a *ConnectionInitiated* indication,
  - Issue a *ReverseTrafficChannelMAC.Activate* command,
  - Issue a *ForwardTrafficChannelMAC.Activate* command,
  - Issue an *AccessChannelMAC.Deactivate* command,
  - Transition to the Connected State.

If this command is received in any other state it shall be ignored.

3.7.6.1.1.4 Close

If the protocol receives a *Close* command in the Connected State the access terminal and the access network shall:

- Issue a *ReverseTrafficChannelMAC.Deactivate* command,
- Issue a *ForwardTrafficChannelMAC.Deactivate* command,
- Issue an *AccessChannelMAC.Activate* command,
- Transition to the Idle State.

If this command is received in any other state it shall be ignored.

3.7.6.1.2 Pilots and Pilot Sets

The access terminal estimates the strength of the Forward Channel transmitted by each sector in its neighborhood. This estimate is based on measuring the strength of the Forward Pilot Channel (specified by the pilot's PN offset and the pilot's CDMA Channel), henceforth referred to as the pilot.

When this protocol is in the Connected State, the access terminal may use pilot strengths to decide when to generate RouteUpdate messages.When this protocol is in the Idle State, the access terminal uses pilot strengths to decide which sector's Control Channel it monitors.

The following pilot sets are defined to support the Route Update process:[24]

- Active Set: The set of pilots (specified by the pilot's PN offset and the pilot's CDMA Channel) associated with the sectors currently serving the access terminal. When a connection is open, a sector is considered to be serving an access terminal when there is a Forward Traffic Channel, Reverse Traffic Channel and Reverse Power Control Channel assigned to the access terminal. When a connection is not open, a sector is considered to be serving the access terminal when the access terminal is monitoring that sector's control channel.
- Candidate Set: The pilots (specified by the pilot's PN offset and the pilot's CDMA Channel) that are not in the Active Set, but are received by the access terminal with sufficient strength to indicate that the sectors transmitting them are good candidates for inclusion in the Active Set.
- Neighbor Set: The set of pilots (specified by the pilot's PN offset and the pilot's CDMA Channel) that are not in either one of the two previous sets, but are likely candidates for inclusion in the Active Set.
- Remaining Set: The set of all possible pilots (specified by the pilot's PN offset and the pilot's CDMA Channel) on the current channel assignment, excluding the pilots that are in any of the three previous sets.

At any given instant a pilot in the current CDMA Channel is a member of exactly one set.

The access terminal maintains all four sets. The access network maintains only the Active Set.

The access terminal complies with the following rules when searching for pilots, estimating the strength of a given pilot, and moving pilots between sets.

3.7.6.1.2.1 Neighbor Set Search Window Parameters Update

The access terminal shall maintain RouteUpdateNeighborList which is a list of structures of type Neighbor (defined below). For each pilot (specified by the pilot's PN offset and the pilot's CDMA Channel) in the Neighbor Set, the access terminal shall maintain a structure in the RouteUpdateNeighborList.

A Neighbor structure consists of four fields: PilotPN, Channel, SearchWindowSize, and SearchWindowOffset.

The RouteUpdateNeighborList is used by the access terminal to perform pilot search on a pilot in the Neighbor Set.

When this set of procedures is invoked, the access terminal shall perform the following steps in the order specified:

- For each pilot (specified by its pilot PN and its channel) in the Neighbor Set, the access terminal shall first initialize the corresponding Neighbor structure in RouteUpdateNeighborList as follows:

[24] In this context, a pilot identifies a sector.

- Set the structure's PilotPN field to the neighbor pilot's PN.
- Set the structure's Channel field to the neighbor pilot's channel record.
- Set the structure's SearchWindowSize field to the configurable attribute SearchWindowNeighbor.
- Set the structure's SearchWindowOffset to zero.

- For each pilot (specified by the pilot's PN offset and the pilot's CDMA Channel) listed in the OverheadMessagesNeighborList, the access terminal shall set the non-NULL fields of the corresponding Neighbor structure in the RouteUpdateNeighborList to the fields of the Neighbor structure in the OverheadMessagesNeighborList for this pilot.
- For each pilot (specified by the pilot's PN offset and the pilot's CDMA Channel) listed in the NeighborListMessageNeighborList, the access terminal shall set the non-NULL fields of the corresponding Neighbor structure in the RouteUpdateNeighborList to the fields of the Neighbor structure in the NeighborListMessageNeighborList for this pilot.

3.7.6.1.2.2 Pilot Search

The access terminal shall continually search for pilots in the Connected State and whenever it is monitoring the Control Channel in the Idle State. The access terminal shall search for pilots in all pilot sets. This search shall be governed by the following rules:

Search Priority: The access terminal should use the same search priority for pilots in the Active Set and Candidate Set. In descending order of search rate, the access terminal shall search, most often, the pilots in the Active Set and Candidate Set, then shall search the pilots in the Neighbor Set, and lastly shall search the pilots in the Remaining Set.

Search Window Size: The access terminal shall use the search window size specified by the configurable attribute SearchWindowActive for pilots in the Active Set and Candidate Set. For each pilot in the Neighbor Set, the access terminal shall use the search window size specified by Table 3.7.6.2.8-1Table and SearchWindowSize field of the corresponding Neighbor structure in the RouteUpdateNeighborList. The access terminal shall use search window size specified by configurable attribute SearchWindowRemaining for pilots in the Remaining Set.

Search Window Center: The access terminal should center the search window around the earliest usable multipath component for pilots in the Active Set. The access terminal should center the search window for each pilot in the Neighbor Set around the pilot's PN sequence offset plus the search window offset specified by Table 3.7.6.2.8-2Table and SearchWindowOffset field of the corresponding Neighbor structure in the RouteUpdateNeighborList using timing defined by the access terminal's time reference (see [2]). The access terminal should center the search window around the pilot's PN sequence offset using timing defined by the access terminal's time reference (see [2]) for the Remaining Set.

3.7.6.1.2.3 Pilot Strength Measurement

The access terminal shall measure the strength of every pilot it searches. The strength estimate formed by the access terminal shall be computed as the sum of the ratios of received pilot energy per chip, E_c, to total received spectral density, I_0 (signal and noise) for at most *k* multipath components, where *k* is the maximum number of multipath components that can be demodulated simultaneously by the access terminal.

3.7.6.1.2.4 Pilot Drop Timer Maintenance

For each pilot, the access terminal shall maintain a pilot drop timer.

If DynamicThresholds is equal to '0', the access terminal shall perform the following:

- The access terminal shall start a pilot drop timer for each pilot in the Candidate Set or the Active Set whenever the strength becomes less than the value specified by PilotDrop. The access terminal shall consider the timer to be expired after the time specified by PilotDropTimer.
- The access terminal shall reset and disable the timer whenever the strength of the pilot becomes greater than the value specified by PilotDrop.

If DynamicThresholds is equal to '1', the access terminal shall perform the following:

- The access terminal shall start a pilot drop timer for each pilot in the Candidate Set whenever the strength of the pilot becomes less than the value specified by PilotDrop. The access terminal shall consider the timer value to be expired after the time specified by PilotDropTimer. The access terminal shall reset and disable the timer if the strength of the pilot becomes greater than the value specified by PilotDrop.
- For each pilot in the Active Set, the access terminal shall sort pilots in the Active Set in order of increasing strengths, i.e., $PS_1 < PS_2 < PS_3 < ... < PS_{N_A}$, where N_A is the number of the pilots in the Active Set. The access terminal shall start the Pilot drop timer for each pilot PS_i in the Active Set whenever the strength PS_i satisfies the following inequality:

$$10 \times \log_{10} PS_i < \max\left(\frac{SoftSlope}{8} \times 10 \times \log_{10} \sum_{j>i} PS_j + \frac{DropIntercept}{2}, -\frac{PilotDrop}{2} \right)$$

$$i = 1, 2, ..., N_A - 1$$

  The access terminal shall reset and disable the timer whenever the above inequality is not satisfied for the corresponding pilot.

Sections 3.7.6.1.2.6 and 3.7.6.1.6.5 specify the actions the access terminal takes when the pilot drop timer expires.

3.7.6.1.2.5 Active Set Management

The access terminal shall support a maximum Active Set size of $N_{RUPActive}$ pilots.

Rules for maintaining the Active Set are specific to each protocol state (see 3.7.6.1.5.1 and 3.7.6.1.6.1).

3.7.6.1.2.6 Candidate Set Management

The access terminal shall support a maximum Candidate Set size of $N_{RUPCandidate}$ pilots.

The access terminal shall add a pilot to the Candidate Set if one of the following conditions is met:

- Pilot is not already in the Active Set or Candidate Set and the strength of the pilot exceeds the value specified by PilotAdd.
- Pilot is deleted from the Active Set, its pilot drop timer has expired, DynamicThresholds is equal to '1', and the pilot strength is above the threshold specified by PilotDrop.
- Pilot is deleted from the Active Set but its pilot drop timer has not expired.

The access terminal shall delete a pilot from the Candidate Set if one of the following conditions is met:

- Pilot is added to the Active Set.
- Pilot's drop timer has expired.
- Pilot is added to the Candidate Set; and, as a consequence, the size of the Candidate Set exceeds $N_{RUPCandidate}$. In this case, the access terminal shall delete the weakest pilot in the set. Pilot A is considered weaker than pilot B:
  - If pilot A has an active drop timer but pilot B does not,
  - If both pilots have an active drop timer and pilot A's drop timer is closer to expiration than pilot B's, or
  - If neither of the pilots has an active drop timer and pilot A's strength is less than pilot B's.

3.7.6.1.2.7 Neighbor Set Management

The access terminal shall support a minimum Neighbor Set size of $N_{RUPNeighbor}$ pilots.

- The access terminal shall maintain a counter, AGE, for each pilot in the Neighbor Set as follows.

The access terminal shall perform the following in the order specified:

- If a pilot is added to the Active Set or Candidate Set, it shall be deleted from the Neighbor Set.
- If a pilot is deleted from the Active Set, but not added to the Candidate Set, then it shall be added to the Neighbor Set with the AGE of 0.
- If a pilot is deleted from the Candidate Set, but not added to the Active Set, then it shall be added to the Neighbor Set with the AGE of 0.

- If the size of the Neighbor Set is greater than the maximum Neighbor Set supported by the access terminal, the access terminal shall delete enough pilots from the Neighbor Set such that the size of the Neighbor Set is the maximum size supported by the access terminal and pilots with higher AGE are deleted first[25].
- If the access terminal receives an *OverheadMessages.Updated* indication, then:
  - The access terminal shall increment the AGE for every pilot in the Neighbor Set.
  - For each pilot in the neighbor list given as public data by the Overhead Messages Protocol that is a member of the Neighbor Set, the access terminal shall perform the following:
    + The access terminal shall set the AGE of this neighbor list pilot to the minimum of its current AGE and NeighborMaxAge.
  - For each pilot in the neighbor list given as public data by the Overhead Messages Protocol (in the order specified in the neighbor list) that is a member of the Remaining Set, the access terminal shall perform the following:
    + If the addition of this neighbor list pilot to the Neighbor Set would not cause the size of the Neighbor Set size to increase beyond the maximum Neighbor Set size supported by the access terminal, then the access terminal shall add this neighbor list pilot to the Neighbor Set with its AGE set to NeighborMaxAge.
    + If the addition of this neighbor list pilot would cause the size of the Neighbor Set to increase beyond the maximum Neighbor Set size supported by the access terminal and the Neighbor Set contains at least one pilot with AGE greater than NeighborMaxAge associated with the pilot's channel, then the access terminal shall delete the pilot in the Neighbor Set for which the difference between its AGE and the NeighborMaxAge associated with that pilot's channel (i.e., AGE - NeighborMaxAge) is the greatest and shall add this neighbor list pilot to the Neighbor Set with its AGE set to NeighborMaxAge associated with the pilot's channel.
    + If the addition of this neighbor list pilot would cause the size of the Neighbor Set to increase beyond the maximum Neighbor Set size supported by the access terminal and the Neighbor Set does not contain a pilot with AGE greater than NeighborMaxAge associated with the pilot's channel, the access terminal shall not add this neighbor list pilot to the Neighbor Set.
- If the access terminal receives a NeighborList message, then:
  - The access terminal shall increment the AGE for every pilot in the Neighbor Set.
  - For each pilot in the neighbor list given in the NeighborList message that is a member of the Neighbor Set, the access terminal shall perform the following:

[25] The order in which pilots of the same AGE are deleted does not matter in this case.

+ The access terminal shall set the AGE of this neighbor list pilot to the minimum of its current AGE and NeighborMaxAge.

– For each pilot in the neighbor list given in the NeighborList message (in the order specified in the message) that is a member of the Remaining Set, the access terminal shall perform the following:

+ If the addition of this neighbor list pilot to the Neighbor Set would not cause the size of the Neighbor Set size to increase beyond the maximum Neighbor Set size supported by the access terminal, then the access terminal shall add this neighbor list pilot to the Neighbor Set with its AGE set to NeighborMaxAge.

+ If the addition of this neighbor list pilot would cause the size of the Neighbor Set to increase beyond the maximum Neighbor Set size supported by the access terminal and the Neighbor Set contains at least one pilot with AGE greater than NeighborMaxAge associated with the pilot's channel, then the access terminal shall delete the pilot in the Neighbor Set for which the difference between its AGE and the NeighborMaxAge associated with that pilot's channel (i.e., AGE - NeighborMaxAge) is the greatest and shall add this neighbor list pilot to the Neighbor Set with its AGE set to NeighborMaxAge associated with the pilot's channel.

+ If the addition of this neighbor list pilot would cause the size of the Neighbor Set to increase beyond the maximum Neighbor Set size supported by the access terminal and the Neighbor Set does not contain a pilot with AGE greater than NeighborMaxAge associated with the pilot's channel, the access terminal shall not add this neighbor list pilot to the Neighbor Set.

The access terminal shall perform the procedures specified in 3.7.6.1.2.1 if a pilot (specified by the pilot's PN offset and the pilot's CDMA Channel) is added to or deleted from the Neighbor Set.

3.7.6.1.2.8 Remaining Set Management

The access terminal shall initialize the Remaining Set to contain all the pilots whose PN offset index is an integer multiple of PilotIncrement and are not already members of any other set.

The access terminal shall add a pilot to the Remaining Set if it deletes the pilot from the Neighbor Set and if the pilot was not added to the Active Set or Candidate Set.

The access terminal shall delete the pilot from the Remaining Set if it adds it to another set.

3.7.6.1.2.9 Pilot PN Phase Measurement

The access terminal shall measure the arrival time, PILOT_ARRIVAL, for each pilot reported to the access network. The pilot arrival time shall be the time of occurrence, as measured at the access terminal antenna connector, of the earliest arriving usable multipath component of the pilot. The arrival time shall be measured relative to the access terminal's time reference in units of PN chips. The access terminal shall compute the reported pilot PN phase, PILOT_PN_PHASE, as:

$$\text{PILOT\_PN\_PHASE} = (\text{PILOT\_ARRIVAL} + (64 \times \text{PILOT\_PN})) \bmod 2^{15},$$

where PILOT_PN is the PN sequence offset index of the pilot.

3.7.6.1.3 Message Sequence Numbers

The access network shall validate all received RouteUpdate messages as specified in 3.7.6.1.3.1.

The access terminal shall validate all received TrafficChannelAssignment messages as specified in 3.7.6.1.3.2.

The RouteUpdate message and the TrafficChannelAssignment message carry a MessageSequence field that serves to flag duplicate or stale messages.

The MessageSequence field of the RouteUpdate message is independent of the MessageSequence field of the TrafficChannelAssignment message.

3.7.6.1.3.1 RouteUpdate Message Validation

When the access terminal first sends a RouteUpdate message, it shall set the MessageSequence field of the message to zero. Subsequently, the access terminal shall increment this field each time it sends a RouteUpdate message.

The access network shall consider all RouteUpdate messages it receives in the Idle State as valid.

The access network shall initialize the receive pointer, *V(R)* to the MessageSequence field of the first RouteUpdate message it received in the Idle State, and the access network shall subsequently set it to the MessageSequence field of each received RouteUpdate message.

When the access network receives a RouteUpdate message in the Connected State, it shall validate the message using the procedure defined in [6]. The access network shall discard the message if it is invalid.

3.7.6.1.3.2 TrafficChannelAssignment Message Validation

The access network shall set the MessageSequence field of the TrafficChannelAssignment message it sends in the Idle State to zero. Subsequently, each time the access network sends a new TrafficChannelAssignment message in the Connected State, it shall increment this field. If the access network is sending the same message multiple times, it shall not change the value of this field between transmissions.[26]

The access terminal shall initialize the receive pointer, *V(R)*, to the MessageSequence field of the TrafficChannelAssignment message that it receives in the Idle State.

When the access terminal receives a TrafficChannelAssignment message in the Connected State, it shall validate the message using the procedure defined in [6]. The access terminal shall discard the message if it is invalid.

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[26] The access network may send a message multiple times to increase its delivery probability.

3.7.6.1.3.3 AttributeOverride Message Validation

The access network shall set the MessageSequence field of the first AttributeOverride message that it sends after the Route Update protocol enters the Connected State to zero. Subsequently, each time the access network sends a new AttributeOverride message in the Connected State, it shall increment this field. If the access network is sending the same message multiple times, it shall not change the value of this field between transmissions.[27]

The access terminal shall initialize the receive pointer, *V(R)*, to the MessageSequence field of the first AttributeOverride message that it receives in the Connected State.

When the access terminal receives a subsequent AttributeOverride message, it shall validate the message using the procedure defined in [6]. The access terminal shall discard the message if it is invalid.

3.7.6.1.4 Inactive State

Upon entering this state, the access terminal shall perform the following:

- The access terminal shall set the Active Set, the Candidate Set, and the Neighbor Set to NULL.
- The access terminal shall initialize the Remaining Set to contain all the pilots whose PN offset index is an integer multiple of PilotIncrement and are not already members of any other set.
- The access terminal shall perform the following in the order specified:
  - Remove all Neighbor structures from OverheadMessagesNeighborList.
  - Remove all Neighbor structures from NeighborListMessageNeighborList.
  - Perform the procedures specified in 3.7.6.1.2.1.
- The access terminal shall set (x_L, y_L), the longitude and latitude of the sector in whose coverage area the access terminal last sent a RouteUpdate message, to (NULL, NULL).

3.7.6.1.5 Idle State

In this state, RouteUpdate messages from the access terminal are based on the distance between the sector where the access terminal last sent a RouteUpdate message and the sector currently in its active set.

The access network sends the TrafficChannelAssignment message to open a connection in this state.

Upon entering this state, the access terminal shall perform the following:

- Remove all Neighbor structures from NeighborListMessageNeighborList and perform the procedures specified in 3.7.6.1.2.1.

[27] The access network may send a message multiple times to increase its delivery probability.

- Stop using the parameters specified in the AttributeOverride message in the set management procedures and start using values specified by the SetManagementSameChannelParameters and the SetManagementDifferentChannelParameters attributes whichever applicable, in the set management procedures.

3.7.6.1.5.1 Active Set Maintenance

The access network shall not initially maintain an Active Set for the access terminal in this state.

If the access network receives an *Open* command, prior to send a TrafficChannelAssignment message, the access network shall initialize the Active Set to the set of pilots in the TrafficChannelAssignment message that it sends in response to command (see 3.7.6.1.1.3).

The access terminal shall initially keep an Active Set of size one when it is in the Idle State. The Active Set pilot shall be the pilot associated with the Control Channel the access terminal is currently monitoring. The access terminal shall return an *IdleHO* indication when the Active Set changes in the Idle State.

The access terminal shall not change its Active Set pilot at a time that causes it to miss a synchronous Control Channel capsule. Other rules governing when to replace this Active Set pilot are beyond the scope of this specification.

If the access terminal receives a TrafficChannelAssignment message, it shall set its Active Set to the list of pilots specified in the message if the TrafficChannelAssignment message does not contain a Channel Record, or if the TrafficChannelAssignment message contains a Channel Record and the access terminal supports the CDMA Channel specified by the Channel Record.

3.7.6.1.5.2 Pilot Channel Supervision in the Idle State

The access terminal shall perform pilot channel supervision in the Idle State as follows:

- Access terminal shall monitor the pilot strength of the pilot in its active set, all the pilots in the candidate set and all the pilots in the neighbor set that are on the same frequency.
- If the strength of all the pilots that the access terminal is monitoring goes below the value specified by PilotDrop, the access terminal shall start a pilot supervision timer. The access terminal shall consider the timer to be expired after the time specified by PilotDropTimer.
- If the strength of at least one of the pilots goes above the value specified by PilotDrop while the pilot supervision timer is counting down, the access terminal shall reset and disable the timer.
- If the pilot supervision timer expires, the access terminal shall return a *NetworkLost* indication.

3.7.6.1.5.3 Processing the TrafficChannelAssignment Message in the Idle State

If the access terminal receives a TrafficChannelAssignment message in this state, it shall perform the following if the TrafficChannelAssignment message does not contain a Channel Record, or if the TrafficChannelAssignment message contains a Channel Record and the access terminal supports the CDMA Channel specified by the Channel Record:

- Update its Active Set as described in 3.7.6.1.5.1.
- If MACIndexMSB fields are included in the TrafficChannelAssignment message, then the access terminal shall determine the 7-bit MACIndex for each pilot in the Active Set by prepending the corresponding MACIndexMSB field of the TrafficChannelAssignment message to the corresponding MACIndexLSBs field of the TrafficChannelAssignment message. Otherwise the access terminal shall set the MACIndex to the corresponding MACIndexLSBs field.
- Return a *ConnectionInitiated* Indication.
- If the Channel Record is included in the message, then the access terminal shall tune to the CDMA Channel specified by the Channel Record.
- Issue the following commands:
  - *ReverseTrafficChannelMAC.Activate*
  - *ForwardTrafficChannelMAC.Activate*
  - *AccessChannelMAC.Deactivate*
- Transition to the Connected State.

3.7.6.1.5.4 Route Update Report Rules

The access terminal shall send RouteUpdate messages to update its location with the access network.

The access terminal shall not send a RouteUpdate message if the state timer of the Connection Setup State in the Idle State Protocol is active.

The access terminal shall comply with the following rules regarding RouteUpdate messages:

- The xHRPD Subtype 0 Route Update Protocol shall send a RouteUpdate message upon receiving a *SendRouteUpdate* command.
- If the value of the SupportRouteUpdateEnhancements attribute is not 0x00, then the access terminal shall send a RouteUpdate message whenever it receives a RouteUpdateRequest message.
- The access terminal shall send a RouteUpdate message with every access channel capsule transmitted by the access terminal.
- The access terminal shall include in the RouteUpdate message the pilot PN phase, pilot strength, and drop timer status for every pilot in the Active Set and Candidate Set.
- The access terminal shall send a RouteUpdate message if all of the following conditions are true:

- the RouteUpdateRadiusOverhead field of the SectorParameters message is not set to zero, and
- the value of the RouteUpdateRadiusMultiply attribute is not 0x00, and
- the computed value r is greater than max (0, rm × ro + ra), where ro is the value provided in the RouteUpdateRadiusOverhead field of the SectorParameters message transmitted by the sector in which the access terminal last sent a RouteUpdate message, rm is the value of the RouteUpdateRadiusMultiply attribute, and ra is the value of the RouteUpdateRadiusAdd attribute.

If (x_L,y_L) are the longitude and latitude of the sector to which the access terminal last sent a RouteUpdate, and (x_C,y_C) are the longitude and latitude of the sector currently providing coverage to the access terminal, then r is given by[28]

$$r = \left\lfloor \frac{\sqrt{\left[(x_C - x_L) \times \cos\left(\frac{\pi}{180} \times \frac{y_L}{14400} \right) \right]^2 + [y_C - y_L]^2}}{16} \right\rfloor \quad [29]$$

The access terminal shall compute r with an error of no more than ±5% of its true value when $|y_L/14400|$ is less than 60 and with an error of no more than ±7% of its true value when $|y_L/14400|$ is between 60 and 70.[30]

If the value of the SupportRouteUpdateEnhancements attribute is 0x00, then the access network shall not send a RouteUpdateRequest message. If the value of the SupportRouteUpdateEnhancements attribute is not 0x00, then the access network may send a RouteUpdateRequest message.

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[28] The *x's* denote longitude and the *y's* denote latitude.

[29] This equation applies if the access terminal does not cross longitude = 180. Modified equation that is applicable in all cases is:

$$r = \left\lfloor \frac{\sqrt{\left[D_{longitude} \times \cos\left(\frac{\pi}{180} \times \frac{y_L}{14400} \right) \right]^2 + [y_C - y_L]^2}}{16} \right\rfloor$$

$$D_{longitude} = x_C - x_L \text{ if } \left| \frac{x_C - x_L}{14400} \right| < 180$$

$$D_{longitude} = 360 \times 14400 - |x_C - x_L| \text{ if } \left| \frac{x_C - x_L}{14400} \right| \geq 180$$

[30] x_L and y_L are given in units of 1/4 seconds. $x_L/14400$ and $y_L/14400$ are in units of degrees.

3.7.6.1.6 Connected State

In this state, RouteUpdate messages from the access terminal are based on changes in the radio link between the access terminal and the access network, obtained through pilot strength measurements at the access terminal.

The access network determines the contents of the Active Set through TrafficChannelAssignment messages.

3.7.6.1.6.1 Access Terminal Requirements

In the Connected State, the access terminal shall perform the following:

- If the protocol receives a *ReverseTrafficChannelMAC.LinkAcquired* indication the access terminal shall:
  - Send a TrafficChannelComplete message with the MessageSequence field of the message set to the MessageSequence field of the TrafficChannelAssignment message,
  - Return a *ConnectionOpened* indication.

3.7.6.1.6.2 Access Network Requirements

In the Connected State, the access network shall perform the following:

- If the protocol receives a *ReverseTrafficChannelMAC.LinkAcquired* indication the access network shall return a *ConnectionOpened* indication.

3.7.6.1.6.3 Active Set Maintenance

3.7.6.1.6.3.1 Access Network

Whenever the access network sends a TrafficChannelAssignment message to the access terminal, it shall add to the Active Set any pilots listed in the message that are not currently in the Active Set.

The access network shall delete a pilot from the Active Set if the pilot was not listed in a TrafficChannelAssignment message and if the access network received the TrafficChannelComplete message, acknowledging that TrafficChannelAssignment message.

The access network should send a TrafficChannelAssignment message to the access terminal in response to changing radio link conditions, as reported in the access terminal's RouteUpdate messages.

The access network should only specify a pilot in the TrafficChannelAssignment message if it has allocated the required resources in the associated sector. This means that the sector specified by the pilot is ready to receive data from the access terminal and is ready to transmit queued data to the access terminal.

If the SupportedCDMAChannels attribute contains one or more band classes, then the access network shall assign a Traffic Channel on a CDMA Channel supported by the access terminal as indicated by the value of the SupportedCDMAChannels attribute.

If the access network adds or deletes a pilot in the Active Set, it shall send an *ActiveSetUpdated* indication.

If the access network adds a pilot specified in a RouteUpdate message to the Active Set, the access network may use the PilotPNPhase field provided in the message to obtain a round trip delay estimate from the access terminal to the sector associated with this pilot. The access network may use this estimate to accelerate the acquisition of the access terminal's Reverse Traffic Channel in that sector.

3.7.6.1.6.3.2 Access Terminal

If the access terminal receives a valid TrafficChannelAssignment message (see 3.7.6.1.3.2), it shall replace the contents of its current Active Set with the pilots specified in the message. The access terminal shall process the message as defined in 3.7.6.1.6.6.

3.7.6.1.6.4 ResetReport Message

The access network may send a ResetReport message to reset the conditions under which RouteUpdate messages are sent from the access terminal. Access terminal usage of the ResetReport message is specified in the following section.

3.7.6.1.6.5 Route Update Report Rules

The access terminal sends a RouteUpdate message to the access network in this state to request addition or deletion of pilots from its Active Set. If the access terminal is sending the RouteUpdate message in response to a RouteUpdateRequest message that contains a Channel record, the access terminal shall include in a RouteUpdate message the pilot PN phase, pilot strength, and drop status for pilots whose strength is above the value specified by PilotAdd and subject to the following conditions:

- If the RouteUpdateRequest message contains one or more SectorPilotPN fields, the access terminal shall include pilots in the CDMA channel indicated by the Channel record and that are indicated by the SectorPilotPN fields. Otherwise, the access terminal shall include pilots which are in the CDMA channel indicated by the Channel record.

If the access terminal is not sending the RouteUpdate message in response to a RouteUpdateRequest message that contains a Channel record, the access terminal shall determine which pilots to include in the RouteUpdate message as follows:

- If DynamicThresholds is equal to '0', the access terminal shall include in the RouteUpdate message the pilot PN phase, pilot strength, and drop timer status for every pilot in the Active Set and Candidate Set. If DynamicThresholds is equal to '1', then the access terminal shall include in the RouteUpdate message the pilot PN phase, pilot strength, and drop timer status for every pilot in the Active Set, for each pilot in the Candidate Set whose strength is above the values specified by PilotAdd, and for each pilot in the Candidate Set whose strength, PS, satisfies the following inequality:

$$10 \times \log_{10} PS > \frac{SoftSlope}{8} \times 10 \times \log_{10} \sum_{i \in A} PS_i + \frac{AddIntercept}{2},$$

where the summation is performed over all pilots currently in the Active Set.

It is optional for the access terminal to send RouteUpdate message. In case the access terminal chooses to do so, it shall send a RouteUpdate message if any one of the following occurs:

- The value of the SupportRouteUpdateEnhancements attribute is not 0x00 and the access terminal receives a RouteUpdateRequest message.
- The xHRPD Subtype 0 Route Update Protocol receives a *SendRouteUpdate* command.
- If DynamicThresholds is equal to '0' and the strength of a Neighbor Set or Remaining Set pilot is greater than the value specified by PilotAdd.
- If DynamicThresholds is equal to '1' and the strength of a Neighbor Set or Remaining Set pilot, PS, satisfies the following inequality:

$$10 \times \log_{10} PS > \max\left(\frac{SoftSlope}{8} \times 10 \times \log_{10} \sum_{i \in A} PS_i + \frac{AddIntercept}{2}, -\frac{PilotAdd}{2} \right)$$

  where the summation is performed over all pilots currently in the Active Set.

- If DynamicThresholds is equal to '0' and the strength of a Candidate Set pilot is greater than the value specified by PilotCompare above an Active Set pilot, and a RouteUpdate message carrying this information has not been sent since the last ResetReport message was received.
- If DynamicThresholds is equal to '0' and the strength of a Candidate Set pilot is above PilotAdd, and a RouteUpdate message carrying this information has not been sent since the last ResetReport message was received.
- If DynamicThresholds is equal to '1' and
  - the strength of a Candidate Set pilot, PS, satisfies the following inequality:

$$10 \times \log_{10} PS > \frac{SoftSlope}{8} \times 10 \times \log_{10} \sum_{i \in A} PS_i + \frac{AddIntercept}{2}$$

    where the summation is performed over all pilots currently in the Active Set, and
  - a RouteUpdate message carrying this information has not been sent since the last ResetReport message was received.
- If DynamicThresholds is equal to '1' and
  - the strength of a Candidate Set pilot is greater than the value specified by PilotCompare above an Active Set pilot, and
  - the strength of a Candidate Set pilot, PS, satisfies the following inequality:

$$10 \times \log_{10} PS > \frac{SoftSlope}{8} \times 10 \times \log_{10} \sum_{i \in A} PS_i + \frac{AddIntercept}{2}$$

    where the summation is performed over all pilots currently in the Active Set, and
  - a RouteUpdate message carrying this information has not been sent since the last ResetReport message was received.

- The pilot drop timer of an Active Set pilot has expired, and a RouteUpdate message carrying this information has not been sent since the last ResetReport message was received.

If the value of the SupportRouteUpdateEnhancements attribute is 0x00, then the access network shall not send a RouteUpdateRequest message. If the value of the SupportRouteUpdateEnhancements attribute is not 0x00, then the access network may send a RouteUpdateRequest message.

3.7.6.1.6.6 Processing the TrafficChannelAssignment Message in the Connected State

If valid TrafficChannelAssignment (see 3.7.6.1.3.2) message does not contain a Channel Record, or if a valid TrafficChannelAssignment message contains a Channel Record and the access terminal supports the CDMA Channel specified by the Channel Record, then the access terminal shall process the message as follows:

- If the TrafficChannelAssignment message contains a value for the FrameOffset that is different from the value of the FrameOffset received in the last TrafficChannelAssignment message that was received in the Idle state, then the access terminal shall return a *RouteUpdate.AssignmentRejected* indication and shall discard the message.
- The access terminal shall update its Active Set as defined in 3.7.6.1.6.3.2.
- The access terminal shall tune to the CDMA Channel defined by the Channel Record, if this record is included in the message.
- If MACIndexMSB fields are included in the TrafficChannelAssignment message, then the access terminal shall determine the 7-bit MACIndex for each pilot in the Active Set by prepending the corresponding MACIndexMSB field of the TrafficChannelAssignment message to the corresponding MACIndexLSBs field of the TrafficChannelAssignment message. Otherwise the access terminal shall set the MACIndex to the corresponding MACIndexLSBs field.
- The access terminal shall start monitoring and responding to the Power Control Channels defined by the MACIndex fields provided in the message.
- The access terminal shall send the access network a TrafficChannelComplete message specifying the MessageSequence value received in the TrafficChannelAssignment message.

3.7.6.1.6.7 Processing the TrafficChannelComplete Message

The access network should set a transaction timer when it sends a TrafficChannelAssignment message. If the access network sets a transaction timer, it shall reset the timer when it receives a TrafficChannelComplete message containing a MessageSequence field equal to the one sent in the TrafficChannelAssignment message.

If the timer expires, the access network should return a *ConnectionLost* indication.

3.7.6.1.6.8 Transmission and Processing of the NeighborList Message

The access network may send the NeighborList message to the access terminal when the protocol is in the Connected State to override the search window size and/or search window offset corresponding to a pilot in the Neighbor Set.

Upon receiving a NeighborList message, the access terminal shall perform the following in the order specified:

- The access terminal shall remove all Neighbor structures from NeighborListMessageNeighborList.
- For each pilot (specified by its pilot PN and its channel) listed in the received NeighborList message, the access terminal shall add a Neighbor structure to NeighborListMessageNeighborList and populate it as follows:
  - Set the structure's PilotPN field to the message's corresponding PilotPN field.
  - If the message's ChannelIncluded field is set to '1', set the structure's Channel field to the message's corresponding Channel field. Otherwise, set the structure's Channel field to the current channel.
  - If the message's SearchWindowSizeIncluded field is set to '1', then set the structure's SearchWindowSize field to the message's corresponding SearchWindowSize field. Otherwise, set the structure's SearchWindowSize field to NULL.
  - If the SearchWindowOffsetIncluded field is set to '1', then set the structure's SearchWindowOffset field to the message's corresponding SearchWindowOffset field. Otherwise, set the structure's SearchWindowOffset field to NULL.
- Perform the procedures specified in 3.7.6.1.2.1.

3.7.6.1.6.9 Transmission and Processing of the AttributeOverride Message

The access network may send the AttributeOverride message to the access terminal to override the parameters specified in the SetManagementSameChannelParameters and SetManagementDifferentChannelParameters configuration attributes.

If the value of the SetManagementOverrideAllowed attribute is 0x01, then upon receiving a valid (see 3.7.6.1.3.3) AttributeOverride message, the access terminal shall start using the values specified in the message.

The access terminal shall discard the values of the SetManagementSameChannelParameters and SetManagementDifferentChannelParameters in the AttributeOverride message if the SetManagementOverrideAllowed attribute is set to 0x00.

When the access terminal receives a valid (see 3.7.6.1.3.3) AttributeOverride message, it shall send the access network an AttributeOverrideResponse message specifying the MessageSequence value received in the AttributeOverride message.

3.7.6.1.6.10 Processing of OverheadMessages.Updated Indication

Upon receiving *OverheadMessages.Updated* indication, the access terminal shall perform the OverheadMessagesNeighborList Initialization procedures as specified in 3.7.6.1.6.11 and then perform the procedures specified in 3.7.6.1.2.1.

3.7.6.1.6.11 OverheadMessagesNeighborList Initialization

When the OverheadMessagesNeighborList initialization procedures are invoked by the access terminal, it shall perform the following:

- The access terminal shall remove all Neighbor structures from the OverheadMessagesNeighborList list.
- For each pilot (specified by its pilot PN and its channel) in the neighbor list given as public data of Overhead Messages Protocol, the access terminal shall add a Neighbor structure to the OverheadMessagesNeighborList list and populate it as follows:
  - Set the structure's PilotPN field to the corresponding NeighborPilotPN field given as public data of the Overhead Messages Protocol.
  - If the Overhead Messages Protocol's NeighborChannelIncluded field is set to '1', set the structure's Channel field to the Overhead Messages Protocol's corresponding NeighborChannel. Otherwise, set the structure's Channel field to the current channel.
  - If the Overhead Messages Protocol's SearchWindowSizeIncluded field is set to '1', then set the structure's SearchWindowSize field to the Overhead Messages Protocol's corresponding SearchWindowSize field. Otherwise, set the structure's SearchWindowSize field to NULL.
  - If the Overhead Messages Protocol's SearchWindowOffsetIncluded field is set to '1', then set the structure's SearchWindowOffset field to the Overhead Messages Protocol's corresponding SearchWindowOffset field. Otherwise, set the structure's SearchWindowOffset field to NULL.

3.7.6.2 Message Formats

3.7.6.2.1 RouteUpdate

The access terminal sends the RouteUpdate message to notify the access network of its current location and provide it with an estimate of its surrounding radio link conditions.

Field	Length (bits)
MessageID	8
MessageSequence	8
ReferencePilotPN	9
ReferencePilotStrength	6
ReferenceKeep	1
NumPilots	4

NumPilots occurrences of the following fields:

{

PilotPNPhase	15
ChannelIncluded	1
FwdChannel	0 or 24
PilotStrength	6
Keep	1

}

InitialCQI	4
CQIFormat	2
xHRPDLocationPresent	1
xHRPDLocation	0 or 7
Reserved	Variable

MessageID The access terminal shall set this field to 0x00.

MessageSequence The access terminal shall set this field to the sequence number of this message. The sequence number of this message is 1 more than the sequence number of the last RouteUpdate message (modulo 2^8) sent by this access terminal. If this is the first RouteUpdate message sent by the access terminal, it shall set this field to 0x00.

ReferencePilotPN The access terminal shall set this field to the access terminal's time reference (the reference pilot), relative to the zero offset pilot PN sequence in units of 64 PN chips.

ReferencePilotStrength
The access terminal shall set this field to $\lfloor -2 \times 10 \times \log_{10} PS \rfloor$, where PS is the strength of the reference pilot, measured as specified in 3.7.6.1.2.3. If this value is less than 0, the access terminal shall set this field to '000000'. If this value is greater than '111111', the access terminal shall set this field to '111111'.

ReferenceKeep — If the pilot drop timer corresponding to the reference pilot has expired, the access terminal shall set this field to '0'; otherwise, the access terminal shall set this field to '1'.

NumPilots — The access terminal shall set this field to the number of pilots that follow this field in the message.

PilotPNPhase — The PN offset in resolution of 1 chip of a pilot in the Active Set or Candidate Set of the access terminal that is not the reference pilot.

ChannelIncluded — The access terminal shall set this field to '1' if the channel for this pilot offset is not the same as the current channel. Otherwise, the access terminal shall set this field to '0'.

FwdChannel — The access terminal shall include this field if the ChannelIncluded field is set to '1'. The access terminal shall set this to the channel record corresponding to this pilot (see [1]). Otherwise, the access terminal shall omit this field for this pilot offset.

PilotStrength — The access terminal shall set this field to $\lfloor -2 \times 10 \times \log_{10} PS \rfloor$, where PS is the strength of the pilot in the above field, measured as specified in 3.7.6.1.2.3. If this value is less than 0, the access terminal shall set this field to '000000'. If this value is greater than '111111', the access terminal shall set this field to '111111'.

Keep — If the pilot drop timer corresponding to the pilot in the above field has expired, the access terminal shall set this field to '0'; otherwise, the access terminal shall set this field to '1'.

InitialCQI — The access terminal shall set this field to the initial CQI value corresponding to the initial forward link data rate being requested by the access terminal.

CQIFormat — The access terminal shall set this field to '00' if it supports 4-bit CQI format and to '01' if it supports 2-bit CQI format. Other values are reserved.

xHRPDLocationPresent

The access terminal shall set this field to '1' if it has GPS location. Otherwise, the access terminal shall set this field to '0'.

xHRPDLocation — If the xHRPDLocationPresent field is set to '0', then the access terminal shall omit this field. Otherwise, the access terminal shall set this field to '0000000' for USA and '0000001' for Canada. Rest of the values are reserved.

Reserved — The number of bits in this field is equal to the number needed to make the message length an integer number of octets. This field shall be set to all zeros.

Channels	AC	RTC
Addressing	unicast	

SLP	Reliable[31]	Best Effort
Priority	20	

3.7.6.2.2 TrafficChannelAssignment

The access network sends the TrafficChannelAssignment message for assigning traffic channel.

[31] This message is sent reliably when it is sent over the Reverse Traffic Channel.

Field	Length (bits)
MessageID	8
MessageSequence	8
ChannelIncluded	1
xHRPDFwdChannel	0 or 24
FrameOffset	4
CQIFormat	2
CQIPeriod	8
xHRPDReserved1	4
NumPilots	4

NumPilots occurrences of the following record:

{

PilotPN	9
xHRPDReserved2	1
MACIndexLSBs	6
xHRPDReserved3	3
xHRPDReserved4	2
xHRPDReserved5	3

}

xHRPDReserved6	1

NumPilots occurrences of the following field:

{

xHRPDReserved7	2

}

MACIndexMSBsIncluded	1

NumPilots occurrences of the following field:

{

MACIndexMSB	0 or 1

}

xHRPDReserved8	5

NumPilots occurrences of the following field:

{

xHRPDReserved9	3

}

xHRPDReserved10	1

xHRPDRevChannel	24
FrequencyPreCorrection	10
AccessSNR	6
Reserved	Variable

MessageID The access network shall set this field to 0x01.

MessageSequence The access network shall set this to 1 higher than the MessageSequence field of the last TrafficChannelAssignment message (modulo 2^S, S=8) sent to this access terminal.

ChannelIncluded The access network shall set this field to '1' if the Channel record is included for these pilots. Otherwise, the access network shall set this field to '0'.

xHRPDFwdChannel The access network shall include this field if the ChannelIncluded field is set to '1'. The access network shall set this to the forward channel record corresponding to this pilot (see [1]). Otherwise, the access network shall omit this field for this pilot offset. If Channel is included, the access network shall set the SystemType field of the Channel record to '0x03'.

FrameOffset The access network shall set this field to the frame offset the access terminal shall use when transmitting the Reverse Traffic Channel, in units of slots.

CQIFormat The access terminal shall set this field to '00' if it supports 4-bit CQI format and to '01' if it supports 2-bit CQI format. Other values are reserved.

CQIPeriod The access terminal shall set this field to a value that specifies the duration in 20 msec frames during which access terminal transmits a single CQI value.

xHRPDReserved1 This field shall be set to all zeros.

NumPilots The access network shall set this field to the number of pilots included in this message.

PilotPN The access network shall set this field to the PN Offset associated with the sector that will transmit a Power Control Channel to the access terminal, to whom the access terminal is allowed to connect, and whose Control Channel and Forward Traffic Channel the access terminal may monitor.

xHRPDReserved2 This field shall be set to zero.

MACIndexLSBs Least Significant Bits of the Medium Access Control Index. The access network shall set this field to the six least significant bits of the MACIndex assigned to the access terminal by this sector.

xHRPDReserved3 This field shall be set to all zeros.

xHRPDReserved4 This field shall be set to all zeros.

xHRPDReserved5 This field shall be set to all zeros.

xHRPDReserved6 This field shall be set to '1'.

xHRPDReserved7 This field shall be set to all zeros.

MACIndexMSBsIncluded

If MACIndexMSB fields are included in this message, then the access network shall set this field to '1'. Otherwise, the access network shall set this field to '0'.

MACIndexMSB Most significant bit of the Medium Access Control Index. If MACIndexMSBsIncluded field is not included in this message or if MACIndexMSBsIncluded field is equal to '0', then the access network shall omit this field. Otherwise, the access network shall set this field as follows:

The *i*th occurrence of this field corresponds to the *i*th occurrence of the PilotPN field in this message. The access network shall set the *i*th occurrence of this field to the most significant bit of the 7-bit MACIndex assigned to the access terminal by the *i*th PilotPN.

xHRPDReserved8 This field shall be set to all zeros.

xHRPDReserved9 This field shall be set to all zeros.

xHRPDReserved10 This field shall be set to zero.

xHRPDRevChannel The access network shall set this field to reverse channel record (see [6]).

FrequencyPreCorrection

The access network shall set field to the frequency offset of the received access probe as measured by the access network. This field is a 10-bit signed number and the value range of -512 to 511 corresponds to -1024 to 1022 Hz frequency offset.

AccessSNR The access network shall set field to the signal-to-noise ratio of the received access probe as measured by the access network. The value

range of -32 to 31 corresponds to SNR of -15 dB to 16 dB with 0.5 dB resolution.

Reserved — The number of bits in this field is equal to the number needed to make the message length an integer number of octets. This field shall be set to all zeros.

Channels	CC FTC
Addressing	unicast

SLP	Reliable Best Effort[32]
Priority	20

3.7.6.2.3 TrafficChannelComplete

The access terminal sends the TrafficChannelComplete message to provide an acknowledgment for the TrafficChannelAssignment message.

Field	Length (bits)
MessageID	8
MessageSequence	8

MessageID — The access terminal shall set this field to 0x02.

MessageSequence — The access terminal shall set this field to the MessageSequence field of the TrafficChannelAssignment message whose receipt this message is acknowledging.

Channels	RTC
Addressing	unicast

SLP	Reliable
Priority	40

3.7.6.2.4 ResetReport

The access network sends the ResetReport message to reset the RouteUpdate transmission rules at the access terminal.

Field	Length (bits)
MessageID	8

MessageID — The access network shall set this field to 0x03.

[32] The TrafficChannelAssignment message sent in response to the Open command is sent using best effort SLP. All subsequent TrafficChannelAssignment messages are sent using reliable delivery SLP.

Channels	FTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.6.2.5 NeighborList

The NeighborList message is used to convey information corresponding to the neighboring sectors to the access terminals when the access terminal is in the Connected State.

Field	Length (bits)
MessageID	8
Count	5
Count occurrences of the following field:	
{	
PilotPN	9
}	
Count occurrences of the following two fields:	
{	
ChannelIncluded	1
Channel	0 or 24
}	
SearchWindowSizeIncluded	1
Count occurrences of the following field:	
{	
SearchWindowSize	0 or 4
}	
SearchWindowOffsetIncluded	1
Count occurrences of the following field:	
{	
SearchWindowOffset	0 or 3
}	
FPDCHSupportedIncluded	0 or 1
m, 0 ≤ *m* ≤ Count. occurrences of the following field:	
{	
FPDCHSupported	0 or 1
}	
Reserved	Variable

MessageID The access network shall set this field to 0x04.

Count — The access network shall set this field to the number of records specifying neighboring sectors information included in this message.

PilotPN — The access network shall set this field to the PN Offset of a neighboring sector for which the access network is providing search window information in this message.

ChannelIncluded — The access network shall set this field to '1' if a Channel record is included for this neighbor, and to '0' otherwise. The access network may set this field to '0' if the channel associated with this pilot is the same as the channel that is used to carry this message. If this field is set to '0', the access terminal shall assume that the channel associated with this pilot is the same as the channel on which this message is received. The nth occurrence of this field corresponds to the n^{th} occurrence of PilotPN in the record that contains the PilotPN field above.

Channel — Channel record specification for the neighbor channel. See [1] for the Channel record format. The n^{th} occurrence of this field corresponds to the n^{th} occurrence of PilotPN in the record that contains the PilotPN field above.

SearchWindowSizeIncluded — The access network shall set this field to '1' if SearchWindowSize field for neighboring sectors is included in this message. Otherwise, the access network shall set this field to '0'.

SearchWindowSize — The access network shall omit this field if SearchWindowSizeIncluded is set to '0'. If SearchWindowSizeIncluded is set to '1', the access network shall set this field to the value shown in Table corresponding to the search window size to be used by the access terminal for the neighbor pilot. The n^{th} occurrence of this field corresponds to the n^{th} occurrence of PilotPN in the record that contains the PilotPN field above.

Table 3.7.6.2.5-1. Search Window Sizes

SearchWindowSize Value	Search Window Size (PN chips)
0	4
1	6
2	8
3	10
4	14
5	20
6	28
7	40
8	60
9	80
10	100
11	130
12	160
13	226
14	320
15	452

SearchWindowOffsetIncluded

The access network shall set this field to '1' if SearchWindowOffset field for neighboring sectors is included in this message. Otherwise, the access network shall set this field to '0'.

SearchWindowOffset

The access network shall omit this field if SearchWindowOffsetIncluded is set to '0'. If SearchWindowOffsetIncluded is set to '1', the access network shall set this field to the value shown in Table 3.7.6.2.5-2Table corresponding to the search window offset to be used by the access terminal for the neighbor pilot. The n^{th} occurrence of this field corresponds to the n^{th} occurrence of PilotPN in the record that contains the PilotPN field above.

Table 3.7.6.2.5-2. Search Window Offset

SearchWindowOffset	Offset (PN chips)
0	0
1	WindowSize[33] /2
2	WindowSize
3	3 × WindowSize /2
4	- WindowSize /2
5	- WindowSize
6	-3 × WindowSize /2
7	Reserved

FPDCHSupportedIncluded

If this field is included, the access network shall set this field as follows:

The access network shall set this field to '0' if the FPDCHSupported fields are omitted. Otherwise, the access network shall set this field to '1'.

FPDCHSupported

If FPDCHSupportedIncluded is not included or is included and is set to '0', the access network shall omit all occurrences of this field. Otherwise, the access network shall include *m* occurrences of this field, where *m* is the number of Channel records in this message that have SystemType equal to 0x01, and the access network shall set the occurrences of this field as follows:

The access network shall set the *i*th occurrence of this field as follows:

If the system on the CDMA Channel corresponding to the *i*th Channel record (see [6]) that has SystemType equal to 0x01 supports the Forward Packet Data Channel (see [11]), the access terminal shall set the *i*th occurrence of this field to '1'. Otherwise, the access network shall set the *i*th occurrence of this field to '0'.

Reserved

The number of bits in this field is equal to the number needed to make the message length an integer number of octets. The access network shall set this field to zero. The access terminal shall ignore this field.

[33] WindowSize is pilot's search window size in PN chips.

Channels	FTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.6.2.6 AttributeOverride

The access network may send this message in order to override the configured values for the attributes includes in this message.

Field	Length (bits)
MessageID	8
MessageSequence	8
One or more instances of the following record:	
AttributeRecord	variable

MessageID The access network shall set this field to 0x05.

MessageSequence The access network shall set this to 1 higher than the MessageSequence field of the last AttributeOverride message (modulo 2^S, S=8) sent to this access terminal.

The access network shall include one or more instances of the following record:

AttributeRecord The access network shall set this record to the attribute record that the access terminal is to use to override the values of the configured attribute specified by the AttributeID of this record. See [6] for the format of the attributes. The access network shall not include more than one AttributeRecord with the same AttributeID in this message. The access network shall include exactly one instance of attribute values per AttributeID. The access network shall set the ValueID associated with the complex attributes to zero. The valid attribute records that can be included in this message are SetManagementSameChannelParameters and SetManagementDifferentChannelParameters.

Channels	FTC	**SLP**	Best Effort
Addressing	unicast	**Priority**	40

3.7.6.2.7 AttributeOverrideResponse

The access terminal sends the AttributeOverrideResponse message to provide an acknowledgment for the AttributeOverride message.

Field	Length (bits)
MessageID	8
MessageSequence	8

MessageID The access network shall set this field to 0x06.

MessageSequence The access terminal shall set this field to the MessageSequence field of the AttributeOverride message whose receipt this message is acknowledging.

Channels	RTC	**SLP**	Best Effort
Addressing	unicast	**Priority**	40

3.7.6.2.8 RouteUpdateRequest

The access network sends a RouteUpdateRequest message to request the access terminal to send a RouteUpdate message.

Field	Length (bits)
MessageID	8
ChannelIncluded	1
Channel	0 or 24
SectorCount	0 or 4
SectorCount occurrences of the following field:	
{	
SectorPilotPN	9
}	
SectorSearchWindowSizeIncluded	0 or 1
SectorCount occurrences of the following field:	
{	
SectorSearchWindowSize	0 or 4
}	
SectorSearchWindowOffsetIncluded	0 or 1
SectorCount occurrences of the following field:	
{	
SectorSearchWindowOffset	0 or 3
}	
Reserved	0 – 7 (as needed)

MessageID The access network shall set this field to 0x07.

ChannelIncluded If SupportRouteUpdateEnhancements is less than 0x02 or if this message is being sent on the Control Channel, the access network shall set this field to '0'. Otherwise, the access network may set this field to '1' to indicate that the Channel field is included or to '0' to indicate that the Channel field is not included.

Channel If ChannelIncluded is set to '0', the access network shall omit this field. Otherwise, the access network shall set this field to a Channel record specification. See [1] for the Channel record format. The access network shall set the SystemType field of this record to 0x03 if SupportRouteUpdateEnhancements is equal to 0x02.

SectorCount If ChannelIncluded is set to '0', the access network shall omit this field. Otherwise, the access network shall set this field to the number of records specifying neighboring sectors information included in this message.

SectorPilotPN The access network shall set this field to the PN Offset of a neighboring sector for which the access terminal is to report pilot strength information.

SectorSearchWindowSizeIncluded
If ChannelIncluded is set to '0', the access network shall omit this field. Otherwise, the access network shall set this field to '1' if SectorSearchWindowSize field for neighboring sectors is included in this message. Otherwise, the access network shall set this field to '0'.

SectorSearchWindowSize
The access network shall omit this field if SectorSearchWindowSizeIncluded is set to '0'. If SectorSearchWindowSizeIncluded is set to '1', the access network shall set this field to the value shown in Table 3.7.6.2.8-1 corresponding to the search window size to be used by the access terminal for the neighbor pilot. The n^{th} occurrence of this field corresponds to the n^{th} occurrence of SectorPilotPN in the record that contains the SectorPilotPN field above.

Table 3.7.6.2.8-1. Search Window Sizes

SearchWindowSize Value	Search Window Size (PN chips)
0	4
1	6
2	8
3	10
4	14
5	20
6	28
7	40
8	60
9	80
10	100
11	130
12	160
13	226
14	320
15	452

SectorSearchWindowOffsetIncluded

If ChannelIncluded is set to '0', the access network shall omit this field. Otherwise, the access network shall set this field to '1' if SectorSearchWindowOffset field for neighboring sectors is included in this message. Otherwise, the access network shall set this field to '0'.

SectorSearchWindowOffset

The access network shall omit this field if SectorSearchWindowOffsetIncluded is set to '0'. If SectorSearchWindowOffsetIncluded is set to '1', the access network shall set this field to the value shown in Table 3.7.6.2.8-2 corresponding to the search window offset to be used by the access terminal for the neighbor pilot. The n^{th} occurrence of this field corresponds to the n^{th} occurrence of SectorPilotPN in the record that contains the SectorPilotPN field above.

Table 3.7.6.2.8-2. Search Window Offset

SearchWindowOffset	Offset (PN chips)
0	0
1	WindowSize[34] /2
2	WindowSize
3	3 × WindowSize /2
4	- WindowSize /2
5	- WindowSize
6	-3 × WindowSize /2
7	Reserved

Reserved — The access network shall add reserved bits to make the length of the entire message equal to an integer number of octets. The access network shall set this field to 0. The access terminal shall ignore this field.

Channels	FTC CC	**SLP**	Best Effort
Addressing	unicast	**Priority**	40

3.7.6.2.9 AttributeUpdateRequest

The sender sends an AttributeUpdateRequest message to offer an attribute value for a given attribute.

Field	Length (bits)
MessageID	8
TransactionID	8
One or more instances of the following record	
AttributeRecord	Attribute dependent

MessageID — The sender shall set this field to 0x52.

TransactionID — The sender shall increment this value for each new AttributeUpdateRequest message sent.

AttributeRecord — The format of this record is specified in [6].

[34] WindowSize is pilot's search window size in PN chips.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.6.2.10 AttributeUpdateAccept

The sender sends an AttributeUpdateAccept message in response to an AttributeUpdateRequest message to accept the offered attribute values.

Field	Length (bits)
MessageID	8
TransactionID	8

MessageID The sender shall set this field to 0x53.

TransactionID The sender shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC RTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.6.2.11 AttributeUpdateReject

The access network sends an AttributeUpdateReject message in response to an AttributeUpdateRequest message to reject the offered attribute values.

Field	Length (bits)
MessageID	8
TransactionID	8

MessageID The access network shall set this field to 0x54.

TransactionID The access network shall set this value to the TransactionID field of the corresponding AttributeUpdateRequest message.

Channels	FTC	**SLP**	Reliable
Addressing	unicast	**Priority**	40

3.7.6.3 Interface to Other Protocols

3.7.6.3.1 Commands Sent

This protocol sends the following commands:

- *ReverseTrafficChannelMAC.Activate*

- *ReverseTrafficChannelMAC.Deactivate*
- *ForwardTrafficChannelMAC.Activate*
- *ForwardTrafficChannelMAC.Deactivate*
- *AccessChannelMAC.Activate*
- *AccessChannelMAC.Deactivate*

3.7.6.3.2 Indications

This protocol registers to receive the following indications:

- *ReverseTrafficChannelMAC.LinkAcquired*
- *OverheadMessages.Updated*

3.7.7 Configuration Attributes

Unless specified otherwise, the access terminal and the access network shall not use the Generic Attribute Update Protocol to update configurable attributes belonging to the xHRPD Subtype 0 Route Update Protocol. If the value of the SupportRouteUpdateEnhancements attribute is not 0x00, then the access terminal and the access network shall support the use of the Generic Attribute Update Protocol to update values of the following attributes belonging to the xHRPD Subtype 0 Route Update Protocol:

- RouteUpdateRadiusMultiply
- RouteUpdateRadiusAdd

If the value of the SupportRouteUpdateEnhancements attribute is 0x00, then the access network shall not include the RouteUpdateRadiusMultiply and RouteUpdateRadiusAdd attributes in an AttributeUpdateRequest message.

3.7.7.1 Simple Attributes

The configurable simple attributes for this protocol are listed in Table 3.7.7.1-1. The access terminal shall not include these simple attributes in a ConfigurationRequest message or an AttributeUpdateRequest message.

The access terminal and access network shall use as defaults the values in Table 3.7.7.1-1 that are typed in ***bold italics***.

Table 3.7.7.1-1. Configurable Values

Attribute ID	Attribute	Values	Meaning
0x03	SetManagementOverrideAllowed	***0x00***	The SetManagementSameChannelParameters and SetManagementDifferentChannelParameters attributes in the AttributeOverride message are discarded.
		0x01	The SetManagementSameChannelParameters and SetManagementDifferentChannelParameters attributes in the AttributeOverride message are acted upon.
		0x02-0xff	Reserved
0xff	RouteUpdateRadiusMultiply	0x00	Distance-based registration is disabled.
		0x0a	Multiplier for the Route update radius is 1.
		0x01 to 0x64	Multiplier for the Route update radius in units of 0.1.
		All other values	Reserved
0xfe	RouteUpdateRadiusAdd	***0x0000***	Addition to the Route update radius is zero.
		0x0001 to 0x0fff	Addition to the Route update radius expressed as 2's complement value.
		All other values	Reserved
0xfd	SupportRouteUpdateEnhancements	***0x00***	Use of Generic Attribute Update Protocol to update RouteUpdateRadiusMultiply and RouteUpdateRadiusAdd and processing of RouteUpdateRequest message is not supported.

Attribute ID	Attribute	Values	Meaning
		0x01	Use of Generic Attribute Update Protocol to update RouteUpdateRadiusMultiply and RouteUpdateRadiusAdd and processing of RouteUpdateRequest message without Channel Record is supported.
		0x02	Use of Generic Attribute Update Protocol to update RouteUpdateRadiusMultiply and RouteUpdateRadiusAdd and processing of RouteUpdateRequest message with Channel Record whose SystemType is equal to 0x03 is supported.
		All other values	Reserved

3.7.7.2 Complex Attributes

The following complex attributes and default values are defined (see [6] for attribute record definition). The following complex attributes are to be used only by the access network in a ConfigurationRequest message:

- SearchParameters
- SetManagementSameChannelParameters
- SetManagementDifferentChannelParameters

The following complex attributes are to be used only by the access terminal in a ConfigurationRequest message:

- SupportedCDMAChannels

3.7.7.2.1 SearchParameters Attribute

Field	Length (bits)	Default Value
Length	8	N/A
AttributeID	8	N/A
One or more of the following record:		
ValueID	8	N/A
PilotIncrement	4	4
SearchWindowActive	4	8
SearchWindowNeighbor	4	10
SearchWindowRemaining	4	10

Length — Length of the complex attribute in octets. The access network shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The access network shall set this field to 0x00.

ValueID — This field identifies this particular set of values for the attribute. The access network shall increment this field for each complex attribute-value record for a particular attribute.

PilotIncrement — The access network shall set this field to the pilot PN sequence increment, in units of 64 PN chips, that access terminals are to use for searching the Remaining Set. The access network should set this field to the largest increment such that the pilot PN sequence offsets of all its neighbor access networks are integer multiples of that increment. The access terminal shall support all the valid values for this field.

SearchWindowActive

Search window size for the Active Set and Candidate Set. The access network shall set this field to the value shown in Table 3.7.6.2.8-1Table corresponding to the search window size to be used by the access terminal for the Active Set and Candidate Set. The access terminal shall support all the valid values specified by this field.

SearchWindowNeighbor

Search window size for the Neighbor Set. The access network shall set this field to the value shown in Table corresponding to the search window size to be used by the access terminal for the Neighbor Set. The access terminal shall support all the valid values specified by this field.

SearchWindowRemaining

Search window size for the Remaining Set. The access network shall set this field to the value shown in Table corresponding to the search window size to be used by the access terminal for the Remaining Set. The access terminal shall support all the valid values specified by this field.

3.7.7.2.2 SetManagementSameChannelParameters Attribute

The access terminal shall use these attributes if the pilot being compared is on the same channel as the active set pilots' channel.

Field	Length (bits)	Default Value
Length	8	N/A
AttributeID	8	N/A
One or more of the following attribute value record:		
{		
ValueID	8	N/A
PilotAdd	6	0x0e
PilotCompare	6	0x05
PilotDrop	6	0x12
PilotDropTimer	4	3
DynamicThresholds	1	0
SoftSlope	0 or 6	N/A
AddIntercept	0 or 6	N/A
DropIntercept	0 or 6	N/A
NeighborMaxAge	4	0
Reserved	variable	N/A
}		

Length — Length of the complex attribute in octets. The access network shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The access network shall set this field to 0x01.

ValueID — This field identifies this particular set of values for the attribute. The access network shall increment this field for each complex attribute-value record for a particular attribute.

PilotAdd — This value is used by the access terminal to trigger a RouteUpdate in the Connected State. The access network shall set this field to the

pilot detection threshold, expressed as an unsigned binary number equal to $\lfloor -2 \times 10 \times \log10\ Ec/I_0 \rfloor$. The value used by the access terminal is –0.5 dB times the value of this field. The access terminal shall support all the valid values specified by this field.

PilotDrop — This value is used by the access terminal to start a pilot drop timer for a pilot in the Active Set or the Candidate Set. The access network shall set this field to the pilot drop threshold, expressed as an unsigned binary number equal to $\lfloor -2 \times 10 \times \log10\ Ec/I_0 \rfloor$. The value used by the access terminal is –0.5 dB times the value of this field. The access terminal shall support all the valid values specified by this field.

PilotCompare — Active Set versus Candidate Set comparison threshold, expressed as a 2's complement number. The access terminal transmits a RouteUpdate message when the strength of a pilot in the Candidate Set exceeds that of a pilot in the Active Set by this margin. The access network shall set this field to the threshold Candidate Set pilot to Active Set pilot ratio, in units of 0.5 dB. The access terminal shall support all the valid values specified by this field.

PilotDropTimer — Timer value after which an action is taken by the access terminal for a pilot that is a member of the Active Set or Candidate Set, and whose strength has not become greater than the value specified by PilotDrop. If the pilot is a member of the Active Set, a RouteUpdate message is sent in the Connected State. If the pilot is a member of the Candidate Set, it will be moved to the Neighbor Set. The access network shall set this field to the drop timer value shown in Table 3.7.7.2.2-1 corresponding to the pilot drop timer value to be used by access terminals. The access terminal shall support all the valid values specified by this field.

Table 3.7.7.2.2-1. Pilot Drop Timer Values

PilotDropTimer	Timer Expiration (seconds)	PilotDropTimer	Timer Expiration (seconds)
0	< 0.1	8	27
1	1	9	39
2	2	10	55
3	4	11	79
4	6	12	112
5	9	13	159
6	13	14	225
7	19	15	319

DynamicThresholds — This field shall be set to '1' if the following three fields are included in this record. Otherwise, this field shall be set to '0'.

SoftSlope — This field shall be included only if DynamicThresholds is set to '1'. This field shall be set to an unsigned binary number, which is used by the access terminal in the inequality criterion for adding a pilot to the Active Set or dropping a pilot from the Active Set. The access terminal shall support all the valid values specified by this field.

AddIntercept — This field shall be included only if DynamicThresholds is set to '1'. This field shall be set to a 2's complement signed binary number in units of dB. The access terminal shall support all the valid values specified by this field.

DropIntercept — This field shall be included only if DynamicThresholds is set to '1'. This field shall be set to a 2's complement signed binary number in units of dB. The access terminal shall support all the valid values specified by this field.

NeighborMaxAge — The access network shall set this field to the maximum AGE value beyond which the access terminal is to drop members from the Neighbor Set. The access terminal shall support all the valid values specified by this field.

Reserved — The access network shall set this field to zero. The access terminal shall ignore this field. The length of this field shall be such that the attribute value record is octet-aligned.

3.7.7.2.3 SetManagementDifferentChannelParameters Attribute

The access terminal shall use these attributes if the pilot being compared is on a channel that is different from the active set pilots' channel.

Field	Length (bits)	Default Value
Length	8	N/A
AttributeID	8	N/A

One or more of the following attribute value record:

{

ValueID	8	N/A
PilotAdd	6	0x0e
PilotCompare	6	0x05
PilotDrop	6	0x12
PilotDropTimer	4	3
DynamicThresholds	1	0
SoftSlope	0 or 6	N/A
AddIntercept	0 or 6	N/A
DropIntercept	0 or 6	N/A
NeighborMaxAge	4	0
Reserved	variable	N/A

}

Length — Length of the complex attribute in octets. The access network shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The access network shall set this field to 0x02.

ValueID — This field identifies this particular set of values for the attribute. The access network shall increment this field for each complex attribute-value record for a particular attribute.

PilotAdd — This value is used by the access terminal to trigger a RouteUpdate in the Connected State. The access network shall set this field to the pilot detection threshold, expressed as an unsigned binary number equal to $\lfloor -2 \times 10 \times \log10\ Ec/I_0 \rfloor$. The value used by the access terminal is –0.5 dB times the value of this field. The access terminal shall support all the valid values specified by this field.

PilotDrop — This value is used by the access terminal to start a pilot drop timer for a pilot in the Active Set or the Candidate Set. The access network

shall set this field to the pilot drop threshold, expressed as an unsigned binary number equal to $\lfloor -2 \times 10 \times \log10\ Ec/I_0 \rfloor$. The value used by the access terminal is –0.5 dB times the value of this field. The access terminal shall support all the valid values specified by this field.

PilotCompare — Active Set versus Candidate Set comparison threshold, expressed as a 2's complement number. The access terminal transmits a RouteUpdate message when the strength of a pilot in the Candidate Set exceeds that of a pilot in the Active Set by this margin. The access network shall set this field to the threshold Candidate Set pilot to Active Set pilot ratio, in units of 0.5 dB. The access terminal shall support all the valid values specified by this field.

PilotDropTimer — Timer value after which an action is taken by the access terminal for a pilot that is a member of the Active Set or Candidate Set, and whose strength has not become greater than the value specified by PilotDrop. If the pilot is a member of the Active Set, a RouteUpdate message is sent in the Connected State. If the pilot is a member of the Candidate Set, it will be moved to the Neighbor Set. The access network shall set this field to the drop timer value shown in Table 3.7.7.2.2-1 corresponding to the pilot drop timer value to be used by access terminals. The access terminal shall support all the valid values specified by this field.

DynamicThresholds — This field shall be set to '1' if the following three fields are included in this record. Otherwise, this field shall be set to '0'.

SoftSlope — This field shall be included only if DynamicThresholds is set to '1'. This field shall be set to an unsigned binary number, which is used by the access terminal in the inequality criterion for adding a pilot to the Active Set or dropping a pilot from the Active Set. The access terminal shall support all the valid values specified by this field.

AddIntercept — This field shall be included only if DynamicThresholds is set to '1'. This field shall be set to a 2's complement signed binary number in units of dB. The access terminal shall support all the valid values specified by this field.

DropIntercept — This field shall be included only if DynamicThresholds is set to '1'. This field shall be set to a 2's complement signed binary number in units of dB. The access terminal shall support all the valid values specified by this field.

NeighborMaxAge — The access network shall set this field to the maximum AGE value beyond which the access terminal is to drop members from the

Neighbor Set. The access terminal shall support all the valid values specified by this field.

Reserved — The access network shall set this field to zero. The access terminal shall ignore this field. The length of this field shall be such that the attribute value record is octet-aligned.

3.7.7.2.4 SupportedCDMAChannels Attribute

The access terminal uses this attribute to convey to the access network the CDMA Channels supported by the access terminal.

Field	Length (bits)	Default Value
Length	8	N/A
AttributeID	8	N/A
One or more of the following attribute value record:		
{		
ValueID	8	N/A
BandClassCount	8	0
BandClassCount occurrences of the following record:		
{		
BandClass	5	N/A
BandSubClassCount	8	N/A
BandSubClassCount occurrences of the following field:		
BandSubClass	8	N/A
}		
Reserved	0 – 7 (as needed)	N/A
}		

Length — Length of the complex attribute in octets. The access terminal shall set this field to the length of the complex attribute excluding the Length field.

AttributeID — The access terminal shall set this field to 0x04.

ValueID — This field identifies this particular set of values for the attribute. The access terminal shall set this field to an identifier assigned to this complex value.

BandClassCount — The access terminal shall set this field to the number of occurrences of the BandClass field in this complex value.

BandClass The access terminal shall set this field to the band class supported by the access terminal.

BandSubClassCount The access terminal shall set this field to the number of band sub-classes supported by the access terminal in this band class.

BandSubClass The access terminal shall set this field to the band sub-class supported by the access terminal.

Reserved The access terminal shall add reserved bits to make the length of each attribute value record equal to an integer number of octets. The access terminal shall set this field to zero. The access network shall ignore this field.

3.7.8 Protocol Numeric Constants

Constant	Meaning	Value
$N_{RUPType}$	Type field for this protocol	See [5]
$N_{RUPxHRPDS0}$	Subtype field for this protocol	0x0000
$N_{RUPActive}$	Maximum size of the Active Set	6
$N_{RUPCandidate}$	Maximum size of the Candidate Set	6
$N_{RUPNeighbor}$	Minimum size of the Neighbor Set	20

3.7.9 Session State Information

The Session State Information record (see) consists of parameter records.

This protocol defines the following parameter record in addition to the configuration attributes for this protocol.

3.7.9.1 RouteUpdate Parameter

The following parameter shall be included in the Session State Information record only if the Session State Information is being transferred while the connection is open.

Table 3.7.9.1-1. The Format of the Parameter Record for the RouteUpdate Parameter

Field	Length (bits)
ParameterType	8
Length	8
TCAMessageSequence	8
RUPMessageSequence	8
ChannelIncluded	1
xHRPDFwdChannel	0 or 24
FrameOffset	4
CQIFormat	2
CQIPeriod	8
xHRPDReserved1	4
NumPilots	4

NumPilots occurrences of the following fields{

PilotPN	9
SectorID	128
xHRPDReserved2	1
MACIndexLSBs	6
xHRPDReserved3	3
xHRPDReserved4	2
xHRPDReserved5	3

}

xHRPDReserved6	1

NumPilots occurrences of the following field:

{

xHRPDReserved7	2

}

MACIndexMSBsIncluded	1

NumPilots occurrences of the following field:

{

MACIndexMSB	0 or 1

}

xHRPDReserved8	5

NumPilots occurrences of the following field:

{

xHRPDReserved9	3

}

xHRPDReserved10	1
xHRPDRevChannel	24
FrequencyPreCorrection	10
AccessSNR	6
Reserved	Variable

ParameterType This field shall be set to 0x01 for this parameter record.

Length This field shall be set to the length of this parameter record in units of octets excluding the Length field.

TCAMessageSequence
This field shall be set to the MessageSequence field of the last TrafficChannelAssignment message that was sent by the source access network.

RUPMessageSequence
This field shall be set to the MessageSequence field of the last RouteUpdate message that was received by the source access network.

ChannelIncluded This field shall be set to '1' if the Channel field is included. Otherwise, this field shall be set to '0'.

xHRPDFwdChannel This field shall be included only if the ChannelIncluded field is set to '1'. If included, this field shall be set to the last xHRPDFwdChannel field of the last TrafficChannelAssignment message that included the Channel field and was sent by the source access network, or the xHRPDFwdChannel field shall be set by another access network if the RouteUpdate parameter is from the other access network.

FrameOffset This field shall be set to the FrameOffset field in the last TrafficChannelAssignment message that was sent by the source access network, or the FrameOffset field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

CQIFormat This field shall be set to the CQIFormat field in the last TrafficChannelAssignment message that was sent by the source access network, or the CQIFormat field in the next

TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

CQIPeriod — This field shall be set to the CQIPeriod field in the last TrafficChannelAssignment message that was sent by the source access network, or the CQIPeriod field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

xHRPDReserved1 — This field shall be set to all zeros.

NumPilots — This field shall be set to the NumPilots field in the last TrafficChannelAssignment message that was sent by the source access network, or the NumPilots field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

PilotPN — This field shall be set to the corresponding PilotPN field in the last TrafficChannelAssignment message that was sent by the source access network, or the corresponding PilotPN field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

SectorID — This field shall be set to the SectorID corresponding to the sector associated with the PilotPN specified above.

xHRPDReserved2 — This field shall be set to zero.

MACIndexLSBs — This field shall be set to the corresponding MACIndexLSBs field in the last TrafficChannelAssignment message that was sent by the source access network, or the corresponding MACIndexLSBs field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

xHRPDReserved3 — This field shall be set to all zeros.

xHRPDReserved4 — This field shall be set to all zeros.

xHRPDReserved5 — This field shall be set to all zeros.

xHRPDReserved6 — This field shall be set to ’1’.

xHRPDReserved7 This field shall be set to all zeros.

MACIndexMSBsIncluded

If MACIndexMSB fields are included in this message, then the access network shall set this field to '1'. Otherwise, the access network shall set this field to '0'.

MACIndexMSB If MACIndexMSBsIncluded field is set to '1' then this field shall be set to the corresponding MACIndexMSB field in the last TrafficChannelAssignment message that was sent by the source access network, or the corresponding MACIndexMSB field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

xHRPDReserved8 This field shall be set to all zeros.

xHRPDReserved9 This field shall be set to all zeros.

xHRPDReserved10 This field shall be set to zero.

xHRPDRevChannel This field shall be set to the last xHRPDRevChannel field of the last TrafficChannelAssignment message that was sent by the source access network, or the corresponding xHRPDRevChannel field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

FrequencyPreCorrection

This field shall be set to the last FrequencyPreCorrection field of the last TrafficChannelAssignment message that was sent by the source access network, or the corresponding FrequencyPreCorrection field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

AccessSNR This field shall be set to the last AccessSNR field of the last TrafficChannelAssignment message that was sent by the source access network, or the corresponding AccessSNR field in the next TrafficChannelAssignment message to be sent by the source access network if the RouteUpdate parameter is from another access network.

Reserved The number of bits in this field is equal to the number needed to make the length of this parameter record length an integer number of octets. This field shall be set to all zeros.

3.7.9.2 AttributeOverrideMessageSequence Parameter

The following parameter shall be included in the Session State Information Record only if the Session State Information is being transferred while the Connection is open and SetManagementOverrideAllowed is set to 0x01.

Table 3.7.9.2-1. The Format of the Parameter Record for the AttributeOverrideMessageSequence Parameter

Field	Length (bits)
ParameterType	8
Length	8
AttributeOverrideMessageSequence	8

ParameterType This field shall be set to 0x03 for this parameter record.

Length This field shall be set to the length of this parameter record in units of octets excluding the Length field.

AttributeOverrideMessageSequence
This field shall be set to the MessageSequence field of the last AttributeOverride message that was sent by the source access network. If the access network has not sent the AttributeOverride message during this connection, then this field shall be set to 255.

3.8 Default Packet Consolidation Protocol

The Default Packet Consolidation Protocol is same as defined in [4].

3.9 Overhead Messages Protocol

The Overhead Messages Protocol is same as defined in [29].

4 SESSION LAYER

4.1 Introduction

4.1.1 General Overview

The Session Layer contains protocols used to negotiate a session between the access terminal and the access network.

A session is a shared state maintained between the access terminal and the access network, including information such as:

- A unicast address (UATI) assigned to the access terminal,
- the set of protocols used by the access terminal and the access network to communicate over the air-link,
- configuration settings for these protocols (e.g., authentication keys, parameters for Connection Layer and MAC Layer protocols, etc.), and
- an estimate of the current access terminal location.

During a single session the access terminal and the access network can open and close a connection multiple times; therefore, sessions will be closed rarely, and only on occasions such as the access terminal leaving the coverage area or such as prolonged periods in which the access terminal is unavailable.

The Session Layer contains the following protocols:

- Session Management Protocol: This protocol provides the means to control the activation of other Session Layer protocols. In addition, this protocol ensures the session is still valid and manages closing of the session.
- Address Management Protocol: This protocol specifies procedures for the initial UATI assignment and maintains the access terminal addresses.
- Session Configuration Protocol: This protocol provides the means to negotiate and provision the protocols used during the session, and negotiates the configuration parameters for these protocols. This protocol uses the procedures and attribute value formats defined by the Generic Configuration Protocol (see [6]) for protocol negotiation.
- Multimode Capability Discovery Protocol: This protocol allows the access network to discover the multimode capabilities of the access terminal.

The relationship between the Session Layer protocols is illustrated in Figure 4.1.1-1.

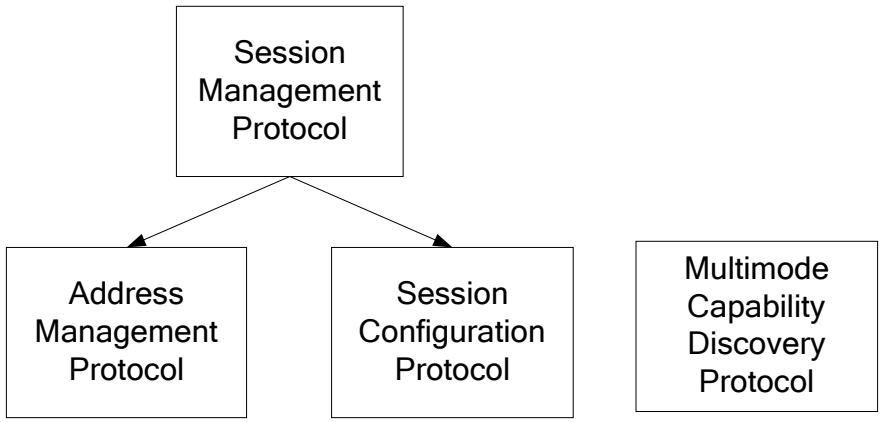

Figure 4.1.1-1. Session Layer Protocols

4.1.2 Data Encapsulation for the InUse Protocol Instance

The Session Layer does not modify transmitted or received packets.

Figure 4.1.2-1 illustrates the relationship between Stream Layer packets, Session Layer packets, and Connection Layer payload.

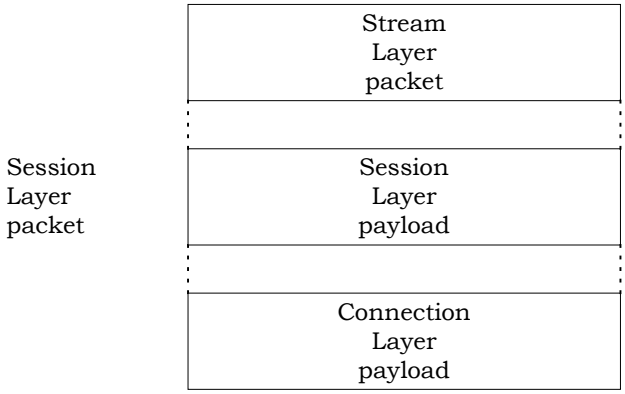

Figure 4.1.2-1. Session Layer Encapsulation

4.2 Default Session Management Protocol

The Default Session Management Protocol is same as defined in[5].

4.3 Default Address Management Protocol

The Default Address Management Protocol is same as defined in[5].

4.4 Default Session Configuration Protocol

The Default Session Configuration Protocol is same as defined in[5] except for the change in the simple configurable attribute 0x00NN as shown in Table 4.4-1.

Table 4.4-1. Simple Configurable Attributes

Attribute ID	Attribute	Values	Meaning
0x00NN	Protocol Type, where NN is the hexadecimal Protocol Type value excluding values 0x03, 0x0c, 0x14, 0x15, 0x16, and 0x17.[35]	***0x0000***	Default Protocol Subtype
		0xfffe	HardLink Protocol Subtype
		0x0001 – 0xfffd, 0xffff	Protocol Subtype
	NN is 0x03 or 0x0c	***0x0001***	xHRPD Protocol Subtype 1
		0xfffe	HardLink Protocol Subtype
		0x0000, 0x0002 – 0xfffd, 0xffff	Protocol Subtype

4.5 Generic Multimode Capability Discovery Protocol

The Generic Multimode Capability Discovery Protocol is same as defined in[5].

4.6 Session State Information

The Session State Information record (see [6]) consists of parameter records.

The parameter records for this protocol consist of only the configuration attributes for this protocol.

[35] Protocol subtypes for protocol types 0x14 – 0x17 are configured by the Stream Layer Protocol.

5 STREAM LAYER

5.1 Introduction

5.1.1 General Overview

The Stream Layer provides the following functions:

- Multiplexing of application streams for one access terminal. Stream 0 is always assigned to the Signaling Application. The other streams can be assigned to applications with different QoS (Quality of Service) requirements, or other applications.
- Provision of configuration messages that map applications to streams.

The Stream Layer uses the Stream Layer Protocol to provide these functions.

Application Subtypes are specified in [18]. Table 5.1-1 specifies the values of Application Subtype for Applications defined in this specification.

Table 5.1-1. Application Subtypes for Applications Defined in this Specification

Value	Meaning
0x0001	Default Packet Application bound to the radio network.
0x0002	Default Packet Application bound to the service network.
0x0008	Enhanced Multi-Flow Packet Application bound to the radio network.
0x0009	Enhanced Multi-Flow Packet Application bound to the service network.

5.1.2 Data Encapsulation for the InUse Protocol Instance

Figure 5.1.2-1 illustrates the relationship between an Application Layer packet, a Stream Layer packet and a Session Layer payload.

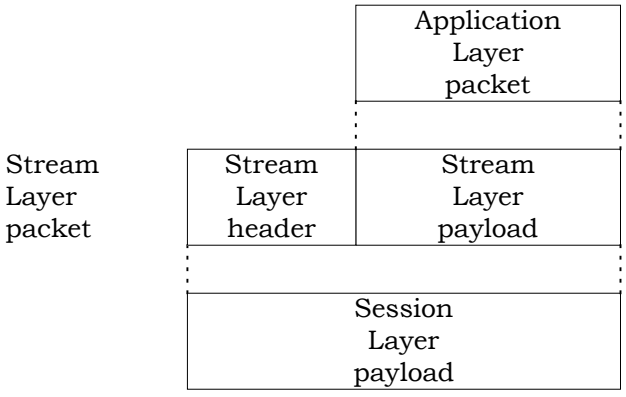

Figure 5.1.2-1. Stream Layer Encapsulation

5.2 Default Stream Protocol

The Default Stream Protocol is same as defined in[5].

5.3 Generic Virtual Stream Protocol

The Generic Virtual Stream Protocol is same as defined in[5].

6 DEFAULT SIGNALING APPLICATION

The Default Signaling Application Protocol is same as defined in [5] with the exception of $T_{SLPWaitAck}$ =1000 ms.

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7 DEFAULT PACKET APPLICATION

The Default Packet Application Protocol is same as defined in[5].

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8 ENHANCED MULTI-FLOW PACKET APPLICATION

The Enhanced Multi-flow Packet Application Protocol is same as defined in [28].

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