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Test Application Specification (TAS) for High Rate Packet Data Air Interface

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REFERENCES

1 The following standards and documents contain provisions, which, through reference in
2 this text, constitute provisions of this specification. At the time of publication, the
3 editions indicated were valid. All standards are subject to revision, and parties to
4 agreements based on this standard are encouraged to investigate the possibility of
5 applying the most recent editions of the standards indicated below.

6

7 3GPP2 C.S0024, Version 2.0, cdma2000 High Rate Packet Data Air Interface
8 Specification.

9 3GPP2 C.P9012, Recommended Minimum Performance Standards for cdma2000 High
10 Rate Packet Data Access Terminal.

11 3GPP2 C.P9011, Recommended Minimum Performance Standards for cdma2000 High
12 Rate Packet Data Access Network.

13 3GPP2 C.R1001-B, Administration of Parameter Value Assignments for cdma2000
14 Spread Spectrum Standards, Release B.

15

1 No Text.

1 OVERVIEW

1.1 Scope of This Document

1 These technical requirements form a compatibility standard for test applications in
2 cdma2000 high rate packet data systems. These requirements ensure that a compliant
3 access terminal and a compliant access network can interoperate to execute tests in
4 meeting the objectives stated in 1.2. The details of the tests are beyond the scope of this
5 document; an informational chapter illustrating some examples is provided.

6 This specification is primarily oriented toward requirements necessary for the design
7 and implementation of access terminals. As a result, detailed procedures are specified
8 for access terminals to ensure a uniform response to all access networks. Access
9 network procedures, however, are specified only to the extent necessary for
10 compatibility with those specified for the access terminal.

1.2 Objectives

11 The Test Application Protocol specified in this document meets the following objectives.
12 It provides a set of procedures that the access terminal and the access network can use,

- 13 • To conduct the access terminal minimum performance tests 0 in a
14 factory/laboratory environment.
- 15 • To conduct measurement of certain forward and reverse link performances in a
16 field environment.

1.3 Requirements Language

17 Compatibility, as used in connection with this standard, is understood to mean: Any
18 access terminal can obtain service through any access network conforming to this
19 standard. Conversely, all access networks conforming to this standard can service
20 access terminals.

21 “Shall” and “shall not” identify requirements to be followed strictly to conform to the
22 standard and from which no deviation is permitted. “Should” and “should not” indicate
23 that one of several possibilities is recommended as particularly suitable, without
24 mentioning or excluding others, that a certain course of action is preferred but not
25 necessarily required, or that (in the negative form) a certain possibility or course of
26 action is discouraged but not prohibited. “May” and “need not” indicate a course of
27 action permissible within the limits of the standard. “Can” and “cannot” are used for
28 statements of possibility and capability, whether material, physical, or causal.

1.4 Protocol Overview

1 The following is a brief overview of the Test Application Protocol; complete description of
2 the components can be found in the following chapters. The Test Application Protocol is
3 specified in terms of two independent protocols:

- 4 1. Forward Test Application Protocol (FTAP): This protocol specifies the procedures
5 and messages to control the Forward Traffic Channel and to configure reverse
6 channels associated with the Forward Traffic Channel. It specifies generation
7 and transmission of test packets sent on the Forward and Reverse Traffic
8 Channels for the purpose of testing the Forward Traffic Channel. It also specifies
9 statistics collection procedures for certain statistics as seen at the access
10 terminal to meet the requirements in 0.
- 11 2. Reverse Test Application Protocol (RTAP): This protocol specifies the procedures
12 and messages to control and configure the Reverse Traffic Channel. It generates
13 test packets sent on the Reverse Traffic Channel for testing the channel.

1.5 Basic Protocol Numbers

14 The Test Application Protocol shall use the application subtype value 0 of 0x0003.

1.6 Document Organization

15 This document is organized into the following chapters:

- 16 • Chapter 1 Overview: This chapter describes the document scope and objectives
17 as well as document organization, list of acronyms and notations.
- 18 • Chapter 2 Forward Test Application Protocol (FTAP) Specifications: This chapter
19 describes the procedures and messages of the Forward Test Application
20 Protocol.
- 21 • Chapter 3 Reverse Test Application Protocol (RTAP) Specifications: This chapter
22 describes the procedures and messages of the Reverse Test Application Protocol.
- 23 • Chapter 4 Test Application Examples: This chapter describes some examples
24 using the procedures and messages specified in the document. This is for
25 informational purpose only.

1.7 Acronyms

1

Table 1.7-1 List of Acronyms

Acronym	Expansion
AC	Access Channel
AN	Access Network
ASP	Active Set Pilot
AT	Access Terminal
CC	Control Channel
CDMA	Code Division Multiple Access
DRC	Data Rate Control
FTAP	Forward Test Application Protocol
FTC	Forward Traffic Channel
MAC	Media Access Control
NA	Not Applicable
PER	Packet Error Rate
RTAP	Reverse Test Application Protocol
RTC	Reverse Traffic Channel
SS	Serving Sector

1.8 Notation

- 2 **A[i]** The (i+1)th element of array A. The first element of the array is
3 A[0].
- 4 **x mod y** Indicates the remainder after dividing x by y: $x \text{ mod } y = x - (y \times$
5 $\lfloor x/y \rfloor)$.
- 6

1 No text.

2 FORWARD TEST APPLICATION PROTOCOL (FTAP) SPECIFICATION

2.1 Overview

1 The Forward Test Application Protocol (FTAP) provides the procedures and messages
2 used by the access terminal and the access network to:

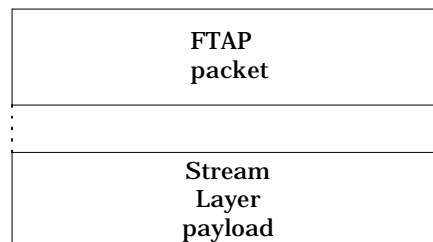
- 3 • Control FTAP test configurations at both the access terminal and the access
4 network.
- 5 • Generate FTAP Test Packets at the access network for transmission on the
6 Forward Traffic Channel and process the received packets at the access
7 terminal.
- 8 • Generate and transmit information about the received FTAP packets at the
9 access terminal through FTAP Loop Back Packets.
- 10 • Transmit configured ACK Channel bits, DRC values and DRC covers.
- 11 • Collect statistics on the changes in the serving sector as seen at the access
12 terminal in the Idle State and the Connected State.
- 13 • Collect statistics on the number of successfully received first Synchronous
14 Control Channel packets.

2.2 Data Encapsulation

15 In the transmit direction, the FTAP generates test packets and forwards them to the
16 stream layer.

17 In the receive direction the FTAP receives test packets from the stream layer and
18 processes them.

19 Figure 2.2-1 illustrates the relationship between the FTAP packets and the Stream
20 Layer payload.



21

22

Figure 2.2-1 FTAP Packet Encapsulation

2.3 Primitives and Public Data

2.3.1 Commands

1 This protocol does not define any commands.

2.3.2 Indications

2 This protocol returns the following indications:

- 3 • *LoopbackSyncLost*

2.3.3 Public Data

4 None.

2.4 Basic Protocol Numbers

5 FTAP is a protocol associated with the Test Application. This protocol shall use the
6 application subtype value for the Test Application as specified in 1.5.

2.5 Protocol Data Unit

7 The transmission unit of this protocol is an FTAP packet. The FTAP packet size is
8 determined by the lower layers negotiated during session configuration.

9 The FTAP also uses signaling messages for controlling and configuring the access
10 terminal and the access network for conducting tests on the Forward Traffic Channel.
11 When FTAP sends these messages it shall use the Signaling Application 0.

2.6 Test Statistics

2.6.1 Access Terminal Requirements

12 The access terminal shall maintain the following statistics:

- 13 • **IdleASPChange:** This counts the number of changes in the Active Set pilot in the
14 Idle State. The Active Set pilot (ASP) is the pilot associated with the Control
15 Channel the access terminal is currently monitoring. A pilot is characterized by
16 a PN offset and a CDMA Channel.
- 17 • **IdleTime:** Elapsed time in slots in the Idle State since the start of statistics
18 collection.
- 19 • **ConnectedSSChange:** This counts the number of changes in the Serving Sector
20 (SS) in the connected State. The serving sector is the one the DRC is pointed at.
21 When the DRC is re-pointed from one sector to another, the DRC cover
22 transitions through a NULL cover. For example, if the DRC cover changes from a
23 sector cover A through NULL cover to a sector cover B (with A not equal to B), it

1 is counted as one SS change. On the other hand, if DRC cover changes from a
 2 sector cover A through NULL cover to a sector cover A again, it is counted as
 3 zero SS change.

- 4 • ConnectedTime: Elapsed time in slots in the Connected State since the start of
 5 statistics collection.
- 6 • FirstSyncCCPkt: The number of successfully received first CC MAC Layer
 7 packets in synchronous capsules.
- 8 • CCTime: Elapsed time in Control Channel Cycles since the start of statistics
 9 collection.

2.6.2 Access Network Requirements

10 The access network may maintain the following statistics for each sector when the Loop
 11 Back mode is enabled:

- 12 • FTAPTestPktSent: This counts the number of FTAP Test Packets sent by the
 13 access network on the Forward Traffic Channel.
- 14 • FTAPTestPktRecd: This counts the number of FTAP Test Packets that were
 15 received by the access terminal on the Forward Traffic Channel.
- 16 • FTAPMACPktRecd: This counts the number of Forward Traffic Channel MAC
 17 layer packets that were received by the access terminal, in the Physical Layer
 18 packets containing the FTAP Test Packets.
- 19 • FTAPTestTime: This counts FTAP test duration in frames 0.
- 20 • FTAPPhysPktSlots: This counts the number of slots over which the Physical
 21 Layer packets containing the FTAP Test Packets were received by the access
 22 terminal.

23 The access network may also maintain the following statistics for the overall test when
 24 the Loop Back mode is enabled:

- 25 • FTAPLBPktSent: This counts the number of FTAP Loop Back Packets that were
 26 sent by the access terminal over the Reverse Traffic Channel.
- 27 • FTAPLBPktRecd: This counts the number of FTAP Loop Back Packets that were
 28 received over the Reverse Traffic Channel.

2.7 Procedures

29 FTAP is specified by the following procedures, which control and configure different
 30 aspects of the Forward Traffic Channel tests.

- 1 • Test Parameter Configuration: Procedures and messages for configuring
2 parameters for different tests.
- 3 • Access Terminal Statistics Collection and Retrieval: Procedures and messages
4 for resetting the statistics being collected at the access terminal and for
5 retrieving them.
- 6 • FTAP Test Packet Transmission and Reception: Procedures for sending and
7 receiving FTAP Test Packets on the Forward Traffic Channel.
- 8 • FTAP Loop Back Packet Transmission and Reception: Procedures for sending
9 and receiving FTAP Loop Back Packets on the Reverse Traffic Channel.
- 10 • DRC Channel Transmission: Procedures for sending fixed DRC values and DRC
11 covers on the DRC channel.
- 12 • ACK Channel Transmission: Procedures for sending fixed ACK Channel bits on
13 the ACK Channel.

2.7.1 Test Parameter Configuration

2.7.1.1 Access Terminal Requirements

14 When the protocol is instantiated, the access terminal shall execute the configuration
15 initialization procedure in 2.7.1.1.1.

16 When the protocol receives a *ConnectedState.ConnectionClosed* or
17 *RouteUpdate.ConnectionLost* 0 indication, the access terminal shall execute the
18 configuration initialization procedure in 2.7.1.1.2.

19 If the access terminal receives an FTAPParameterAssignment message, it shall do the
20 following steps in sequence:

- 21 • Execute the configuration initialization procedure in 2.7.1.1.1.
- 22 • If the message includes a DRCFixedMode attribute, the DRC Fixed mode is
23 enabled and the received DRCValue field is stored.
- 24 • If the message includes DRCCoverFixedMode attribute, the DRC Cover Fixed
25 mode is enabled and the received DRCCover field is stored.
- 26 • If the message includes an ACKChannelBitFixedMode attribute, the ACK
27 Channel Bit Fixed mode is enabled and the received ACKChannelBit field is
28 stored.

- 1 • If the message includes a LoopBackMode attribute, the Loop Back mode is
2 enabled and the received LoopBackPersistence field is stored. The Loop Back
3 Buffer is cleared and the LBOverflowBit (see 2.7.4.1) is set to '0'.
- 4 • Send an FTAPPParameterComplete message. The TransactionID field shall be set
5 to the same value as that received in the FTAPPParameterAssignment message.
6 The FTAPPParameterComplete message shall be sent within $T_{FTAPConfig}$ from when
7 the FTAPPParameterAssignment message is received.

2.7.1.1.1 Access Terminal Configuration Initialization

8 When the protocol is instantiated or an FTAPPParameterAssignment message is received,
9 the access terminal shall initialize the test configuration as follows:

- 10 • The Loop Back mode is disabled.
- 11 • The ACK Channel Bit Fixed mode is disabled.
- 12 • The DRC Fixed mode is disabled.
- 13 • The DRC Cover Fixed mode is disabled.

2.7.1.1.2 Access Terminal Configuration for Lost or Closed Connection

14 When the protocol receives a *ConnectedState.ConnectionClosed* or
15 *RouteUpdate.ConnectionLost* indication 0, the access terminal shall initialize the test
16 configuration as follows:

- 17 • If the Loop Back mode is enabled, and the value of the LoopBackPersistence
18 field of the LoopBackMode attribute in the last received
19 FTAPPParameterAssignment message is '00', then the Loop Back Mode is
20 disabled.
- 21 • The ACK Channel Bit Fixed mode is disabled.
- 22 • The DRC Fixed mode is disabled.
- 23 • The DRC Cover Fixed mode is disabled.

2.7.1.2 Access Network Requirements

24 To change the test configuration the access network shall perform the following steps:

- 25 • Send an FTAPPParameterAssignment message to the access terminal and wait for
26 an FTAPPParameterComplete message containing the same TransactionID as the
27 FTAPPParameterAssignment message.

- 1 • When the expected FTAPParameterComplete message is received, execute the
2 Test Statistics and Parameters Initialization procedure in 2.7.1.2.1.

2.7.1.2.1 Access Network Test Statistics and Parameters Initialization

3 The access network shall set the test statistics and parameters as follows:

- 4 • FTAPTestPktSent to zero for each sector.
- 5 • FTAPTestPktRecd to zero for each sector.
- 6 • FTAPMACPktRecd to zero for each sector.
- 7 • FTAPLBPktSent to zero.
- 8 • FTAPLBPktRecd to zero.
- 9 • FTAPPhysPktSlots to zero for each sector.
- 10 • FTAPTestTime to zero.
- 11 • $V(S_{Test})$, the 14-bit sequence number associated with FTAP Test Packets to zero.

2.7.2 Access Terminal Statistics Collection and Retrieval

2.7.2.1 Access Terminal Requirements

12 When the protocol is instantiated, the access terminal shall execute the Statistics
13 Initialization procedure in 2.7.2.1.1.

14 If the access terminal receives an FTAPStatsClearRequest message, the access terminal
15 shall,

- 16 • execute the Statistics Initialization procedure as follows:
- 17 ○ If AttributeID is equal to 0x04, set IdleASPChange and IdleTime to zero.
- 18 ○ If AttributeID is equal to 0x05, set ConnectedSSChange and
19 ConnectedTime to zero.
- 20 ○ If AttributeID is equal to 0x06, set FirstSyncCCPkt and CCTime to zero.
- 21 • send an FTAPStatsClearResponse message.

22 When the Air Link Management Protocol 0 is in the Idle State, the Idle State statistics
23 collection shall be enabled and the Connected State statistics collection shall be
24 disabled. While the Idle State statistics collection is enabled,

1 • IdleASPChange shall be incremented whenever a *RouteUpdate.IdleHO* 0
2 indication is received.

3 • IdleTime shall be incremented every slot.

4 When the Air Link Management Protocol 0 is in the Connected State, the Idle State
5 statistics collection shall be disabled and the Connected State statistics collection shall
6 be enabled. While the Connected State statistics collection is enabled,

7 • ConnectedSSChange shall be incremented whenever there is a change in the
8 Serving Sector as defined in 2.6.1.

9 • ConnectedTime shall be incremented every slot.

10 When the Air Link Management Protocol 0 is in the Idle State or in the Connected State,
11 the Control Channel statistics collection shall be enabled. While the Control Channel
12 statistics collection is enabled,

13 • FirstSyncCCPkt shall be incremented whenever the first CC MAC Layer packet
14 in a synchronous capsule is successfully received.

15 • CCTime shall be incremented at the beginning of every Control Channel Cycle.

16 If the access terminal receives an FTAPStatsGetRequest message, it shall respond with
17 an FTAPStatsGetResponse containing the requested attributes.

2.7.2.1.1 Statistics Initialization

18 The access terminal shall set

19 • IdleASPChange to 0.

20 • IdleTime to 0.

21 • ConnectedSSChange to 0.

22 • ConnectedTime to 0.

23 • FirstSyncCCPkt to 0.

24 • CCTime to 0.

2.7.2.2 Access Network Requirements

25 To reset the statistics collected at the access terminal, the access network shall send an
26 FTAPStatsClearRequest message, and wait for an FTAPStatsClearResponse message
27 containing the same TransactionID as the FTAPStatsClearRequest message. Reception

1 of the expected FTAPStatsClearResponse message indicates that the test statistics at
2 the access terminal have been cleared.

3 To retrieve the statistics collected at the access terminal, the access network shall send
4 an FTAPStatsGetRequest message, and wait for an FTAPStatsGetResponse message
5 containing the same TransactionID as the FTAPStatsGetRequest message.

2.7.3 FTAP Test Packet Transmission and Reception

2.7.3.1 Access Terminal Requirements

6 In the Connected State of the Default Air Link Management Protocol 0 the access
7 terminal shall monitor the Forward Traffic Channel to receive the FTAP Test Packets.

2.7.3.2 Access Network Requirements

8 The access network shall transmit FTAP Test Packets on the Forward Traffic Channel
9 according to the following rules:

- 10 • The access network shall assign a transmission priority of 55 to FTAP Test
11 Packets.
- 12 • FTAP Test Packets shall use Forced Single Encapsulation feature as described in
13 [1].
- 14 • The access network shall include a 14-bit state variable $V(S_{\text{Test}})$ in every
15 transmitted FTAP Test packet. After sending an FTAP Test Packet for
16 transmission $V(S_{\text{Test}})$ shall be incremented by one.
- 17 • The FTAP Test Packets shall be generated fast enough to ensure that they are
18 always available for transmission on the Forward Traffic Channel.

2.7.4 FTAP Loop Back Packet Transmission and Reception

2.7.4.1 Access Terminal Requirements

19 If the Loop Back mode is enabled, the access terminal shall generate an FTAP Loop
20 Back Packet for every 16-slot interval aligned to the CDMA System Time 0. The contents
21 of the packet shall be based on the FTAP Test Packets received over the interval. The
22 above 16-slot interval is referred to here as the observation interval for clarity of
23 specification. A packet that was successfully decoded is considered to be “received” in
24 an observation interval if its first slot of transmission fell in that observation interval.

25 The access terminal shall assign a transmission priority of 55 to FTAP Loop Back
26 Packets.

27 The FTAP Loop Back Packets shall be queued for transmission on the Reverse Traffic
28 Channel. The access terminal shall provide buffering for 8 FTAP Loop Back Packets.

1 The LBOverflowBit indicates if any FTAP Loop Back Packets have been lost due to lack
 2 of buffer space. When a packet is lost due to lack of buffer space, the access terminal
 3 shall set LBOverflowBit to '1'.

4 The FTAP Loop Back Packet shall be created according to the following rules:

- 5 • The FTAP Loop Back shall be generated only in the Connected State of the Air
 6 Link Management Protocol.
- 7 • The FwdSysTime field shall be set to CDMA System Time in frames
 8 corresponding to the start (0th slot) of the 16-slot observation interval
 9 mod32768.
- 10 • The RecordCount field shall be set to the number of FTAP Test packets received
 11 over the observation interval.
- 12 • FTAP Test Packet records shall be listed in ascending order of the
 13 ForwardSequence field values in the received FTAP Test packets.
- 14 • An FTAP Loop Back Packet shall be generated even if no FTAP Test Packets are
 15 received during the 16-slot observation interval.

16 The access terminal shall follow the following rules for transmitting an FTAP Loop back
 17 Test Packet:

- 18 • The access terminal shall transmit the queued FTAP Loop Back Packets in the
 19 Connected State of the Air Link Management Protocol 0.
- 20 • If the access terminal receives a *ConnectedState.ConnectionClosed* or a
 21 *RouteUpdate.ConnectionLost* 0 indication, and it has queued Loop Back Packets,
 22 it shall not attempt to establish a connection for transmission of the packets.

2.7.4.2 Access Network Requirements

23 The access network shall maintain the following variables:

- 24 • V(R_{LB}): A 15-bit variable representing the sequence number of the next FTAP
 25 Loop Back Packet expected to be received by the access network.
- 26 • V(R_{Test}): A 14-bit variable representing the sequence number of the last FTAP
 27 Test Packet that was successfully received at the access terminal.

28 When the first FTAP Loop Back Packet arrives following the receipt of an
 29 FTAPParameterComplete message indicating successful Loop Back Mode configuration,
 30 the variables V(R_{LB}) and V(R_{Test}) shall be initialized as follows:

- 31 • V(R_{LB}) shall be set to the FwdSysTime field of the FTAP Loop Back Packet.

1 The LBOverflowBit indicates if any FTAP Loop Back Packets have been lost due to lack
 2 of buffer space. When a packet is lost due to lack of buffer space, the access terminal
 3 shall set LBOverflowBit to '1'.

4 The FTAP Loop Back Packet shall be created according to the following rules:

- 5 • The FTAP Loop Back shall be generated only in the Connected State of the Air
 6 Link Management Protocol.
- 7 • The FwdSysTime field shall be set to CDMA System Time in frames
 8 corresponding to the start (0th slot) of the 16-slot observation interval
 9 mod32768.
- 10 • The RecordCount field shall be set to the number of FTAP Test packets received
 11 over the observation interval.
- 12 • FTAP Test Packet records shall be listed in ascending order of the
 13 ForwardSequence field values in the received FTAP Test packets.
- 14 • An FTAP Loop Back Packet shall be generated even if no FTAP Test Packets are
 15 received during the 16-slot observation interval.

16 The access terminal shall follow the following rules for transmitting an FTAP Loop back
 17 Test Packet:

- 18 • The access terminal shall transmit the queued FTAP Loop Back Packets in the
 19 Connected State of the Air Link Management Protocol 0.
- 20 • If the access terminal receives a *ConnectedState.ConnectionClosed* or a
 21 *RouteUpdate.ConnectionLost* 0 indication, and it has queued Loop Back Packets,
 22 it shall not attempt to establish a connection for transmission of the packets.

2.7.4.2 Access Network Requirements

23 The access network shall maintain the following variables:

- 24 • V(R_{LB}): A 15-bit variable representing the sequence number of the next FTAP
 25 Loop Back Packet expected to be received by the access network.
- 26 • V(R_{Test}): A 14-bit variable representing the sequence number of the last FTAP
 27 Test Packet that was successfully received at the access terminal.

28 When the first FTAP Loop Back Packet arrives following the receipt of an
 29 FTAPParameterComplete message indicating successful Loop Back Mode configuration,
 30 the variables V(R_{LB}) and V(R_{Test}) shall be initialized as follows:

- 31 • V(R_{LB}) shall be set to the FwdSysTime field of the FTAP Loop Back Packet.

- 1 • $V(R_{Test})$ shall be set to the FwdSeq field of the first FTAP Test Packet Record in
2 the FTAP Loop Back Packet.

3 All operations and comparisons performed on packet sequence numbers shall be
4 carried out in unsigned modulo 2^S arithmetic, where S is the number of bits used to
5 represent the sequence number. For a packet sequence number x, the numbers in the
6 range $[x+1, x + 2^{S-1} - 1]$ are considered greater than x and numbers in the range $[x-1, x -$
7 $2^{S-1}]$ are considered smaller than x.

8 For each received FTAP Loop Back Packet the access network shall perform the
9 following procedure:

- 10 • If $FwdSysTime \geq V(R_{LB})$, then
- 11 ○ FTAPLBpktSent shall be incremented by $FwdSysTime - V(R_{LB}) + 1$.
 - 12 ○ FTAPLBpktRecd shall be incremented by 1.
 - 13 ○ FTAPTestTime shall be incremented by $FwdSysTime - V(R_{LB}) + 1$.
 - 14 ○ $V(R_{LB})$ shall be set to $FwdSysTime + 1$.
- 15 • If $FwdSysTime < V(R_{LB})$, then the access network shall generate a
16 *LoopBackSyncLost* indication.

17 The FTAP Test Packet Records in the received FTAP Loop Back Packet shall be
18 processed sequentially as follows:

- 19 • The Serving Sector, from which the FTAP Test Packet was received at the access
20 terminal, shall be determined based on the TCAMsgSeqIncluded, TCAMsgSeq,
21 and the DRCCover fields included in the FTAP Loop Back Packet 0.
- 22 • FTAPPhysPktSlots for the Serving Sector shall be incremented by FwdPhysSlots.
- 23 • FTAPMACPktRecd for the Serving Sector shall be incremented by FwdMACPkts.
- 24 • FTAPTestPktSent for the Serving Sector shall be incremented by $FwdSeq -$
25 $V(R_{Test}) + 1$.
- 26 • FTAPTestPktRecd for the Serving Sector shall be incremented by 1.
- 27 • $V(R_{Test})$ shall be set to $FwdSeq + 1$.

2.7.5 DRC Channel Transmission

2.7.5.1 Access Terminal Requirements

1 If the DRC Fixed mode is enabled, then the access terminal shall set its transmitted
2 DRC to the value specified by the DRCFixedMode attribute.

3 If the DRC Cover Fixed mode is enabled, then the access terminal shall set its
4 transmitted DRC cover to the value specified by the DRCCoverFixedMode attribute.

2.7.6 ACK Channel Transmission

2.7.6.1 Access Terminal Requirements

5 If the ACK Channel Bit Fixed mode is enabled, then the access terminal shall transmit
6 the ACK Channel in all slots and set the transmitted ACK Channel Bit to the value
7 specified by the ACKChannelBitFixedMode attribute.

8 If the ACK Channel Bit value is '0', the access terminal shall receive packets on the
9 Forward Traffic Channel as if all the packets were successfully received in one slot
10 duration. Even if a packet has not been successfully decoded in a single slot and its
11 full-length in slots 0 is greater than one, the access terminal shall stop receiving the
12 packet after one slot. It shall accordingly continue generating and transmitting FTAP
13 Loop Back Packets, if the Loop Back mode is enabled.

14 If the ACK Channel Bit value is '1', the access terminal shall receive packets on the
15 Forward Traffic Channel as if all the packets were of full-length duration as per 0. The
16 access terminal shall continue receiving the packet until the full-length in slots has
17 elapsed even if the packet was successfully decoded earlier. It shall accordingly
18 continue generating and transmitting Loop Back Packets if the Loop Back mode is
19 enabled.

2.8 Message Formats

2.8.1 FTAPParameterAssignment

20 The access network sends this message to configure the FTAP parameters.

21

Field	Length (bits)
MessageID	8
TransactionID	8

Zero or more occurrences of the following record:

AttributeRecord	Attribute Dependent
-----------------	------------------------

- 1 MessageID The access network shall set this field to 0x00.
- 2 TransactionID The access network shall set this field to 1 higher than the
- 3 TransactionID field of the last FTAPPparameterAssignment
- 4 message (mod 256) sent to this access terminal.
- 5 AttributeRecord The AttributeRecord is a simple record defined in 10.3 of [1]. The
- 6 permissible attribute records are DRCFixedMode,
- 7 DRCCoverFixedMode, ACKChannelBitFixedMode, and
- 8 LoopbackMode as specified in 2.8.1.1 to 2.8.1.4.
- 9

Channels	CC FTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.1.1 DRCFixedMode Attribute

- 10 If the DRC transmitted by the access terminal is to be set to a fixed value, then the
- 11 access network shall include this AttributeRecord.
- 12

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

- 1 Length Length of the simple attribute in octets. The access network shall
2 set this field to 0x02. It gives the length of the attribute excluding
3 the Length field.
- 4 AttributeID The access network shall set this field to 0x00.
- 5 DRCValue This field is coded as per DRC value specification in [1]. All values
6 in the range 0x00-0x0c are permissible.

2.8.1.2 DRCCoverFixedMode Attribute

- 7 This AttributeRecord is included if the access network requires the access terminal to
8 use a particular fixed DRC cover for transmission of DRC.

9

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

- 10 Length Length of the simple attribute in octets. The access network shall
11 set this field to 0x02. It gives the length of the attribute excluding
12 the Length field.
- 13 AttributeID The access network shall set this field to 0x01.
- 14 DRCCover This field represents the index of the 8-ary Walsh function,
15 defined in [1], to be used as the DRC cover.

2.8.1.3 ACKChannelBitFixedMode Attribute

- 16 The access network includes this AttributeRecord if the ACK Channel bits are to be
17 transmitted by the access terminal during every slot and are to be set at a fixed value.

18

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

- 1 Length Length of the simple attribute in octets. The access network shall
2 set this field to 0x02. It gives the length of the attribute excluding
3 the Length field.
- 4 AttributeID The access shall set this field to 0x02.
- 5 ACKChannelBit This field is coded as per ACK Channel bit value specification in
6 [1]. Only values in the range 0x00-0x01 are permissible. This
7 field shall be set to 0x00, if the ACK Channel bit value of '0' has
8 to be transmitted. This field shall be set to 0x01, if the ACK
9 Channel bit value of '1' has to be transmitted.

2.8.1.4 LoopBackMode Attribute

- 10 This AttributeRecord is included if the access network requires the access terminal to
11 transmit FTAP Loop Back Packets on the Reverse Traffic Channel.
- 12

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

- 13 Length Length of the simple attribute in octets. The access network shall
14 set this field to 0x02. It gives the length of the attribute excluding
15 the Length field.
- 16 AttributeID The access network shall set this field to 0x03.
- 17 LoopBackPersistence This field indicates to the access terminal if the Loop Back mode
18 is to be maintained in the event of a connection closure or a lost
19 connection.
- 20 A value of 0x00 indicates that the Loop Back mode is not to be
21 maintained, i.e. it defaults to no Loop Back mode. A value of 0x01

1 indicates that the Loop Back mode is to be maintained. All other
 2 values are reserved.

2.8.2 FTAPParameterComplete

3 The access terminal sends this message to indicate completion of test configurations
 4 specified by the associated FTAPParameterAssignment message.

5

Field	Length (bits)
MessageID	8
TransactionID	8

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

7 **TransactionID** The access terminal shall set this field to the TransactionID field
 8 value of the associated FTAPParameterAssignment message.

9

Channels	RTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.3 FTAPStatsClearRequest

10 The access network sends this message to command the access terminal to reset the
 11 statistics collected at the access terminal.

12

Field	Length (bits)
MessageID	8
TransactionID	8

One or more occurrences of the following record:

AttributeID	8
-------------	---

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

1 TransactionID The access network shall set this field to 1 higher than the
 2 TransactionID field of the last FTAPStatsClearRequest message
 3 (mod 256) sent to this access terminal.

4 AttributeID The access network shall set this field to the AttributeID of the
 5 IdleASPStats, or the ConnectedSSStats or the
 6 FirstSyncCCPktStats as per 2.8.6.1, 2.8.6.2 or 2.8.6.3,
 7 respectively.

8

Channels	CC FTC	SLP	Best Effort
Addressing	unicast	Priority	40

2.8.4 FTAPStatsClearResponse

9 The access terminal sends this message to indicate that the statistics have been cleared
 10 in response to the received FTAPStatsClearRequest message.

11

Field	Length (bits)
MessageID	8
TransactionID	8

12 MessageID The access terminal shall set this field to 0x03.

13 TransactionID The access terminal shall set this field to the TransactionID field
 14 of the associated FTAPStatsClearRequest message.

15

Channels	RTC	SLP	Best Effort
Addressing	unicast	Priority	40

2.8.5 FTAPStatsGetRequest

16 The access network sends this message to retrieve collected statistics from the access
 17 terminal.

1

Field	Length (bits)
MessageID	8
TransactionID	8

One or more occurrences of the following record:

AttributeID	8
-------------	---

- 2 MessageID The access network shall set this field to 0x04.
- 3 TransactionID The access network shall set this field to 1 higher than the
- 4 TransactionID field of the last FTAPStatsGetRequest message
- 5 (mod 256) sent to this access terminal.
- 6 AttributeID The access network shall set this field to the AttributeID of the
- 7 IdleASPStats, or the ConnectedSSStats or the
- 8 FirstSyncCCPktStats as per 2.8.6.1, 2.8.6.2 or 2.8.6.3,
- 9 respectively.

10

Channels	CC FTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.6 FTAPStatsGetResponse

- 11 The access terminal sends this message to the access network to provide the requested
- 12 attributes in the FTAPStatsGetRequest message.

13

Field	Length (bits)
MessageID	8
TransactionID	8

One or more occurrences of the following record:

AttributeRecord	8
-----------------	---

- 1 MessageID The access terminal shall set this field to 0x05.
- 2 TransactionID The access terminal shall set this field to the TransactionID field
- 3 of the corresponding FTAPStatsGetRequest message.
- 4 AttributeRecord The AttributeRecord is a simple attribute as defined in 10.3 of [1].
- 5 The IdleASPStats Attribute has the format as described in 2.8.6.1.
- 6 The ConnectedSSStats Attribute has the format as described in
- 7 2.8.6.2. The FirstSyncCCPktStats Attribute has the format as
- 8 described in 2.8.6.3.
- 9

Channels	RTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.6.1 IdleASPStats Attribute

- 10 This AttributeRecord provides the Active Set Pilot Change statistics collected by the
- 11 access terminal.
- 12

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A
IdleASPChangeOverflow	1	0
IdleASPChange	15	0
IdleTimeOverflow	1	0
IdleTime	23	0

- 1 Length Length of the simple attribute in octets. The access terminal shall
2 set this field to 0x06. It gives the length of the attribute excluding
3 the Length field.
- 4 AttributeID The access terminal shall set this field to 0x04.
- 5 IdleASPChangeOverflow
- 6 This bit shall be set to '1' if the value of the IdleASPChange
7 statistics exceeds $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 8 IdleASPChange The value of IdleASPChange statistics mod 2^{15} .
- 9 IdleTimeOverflow This bit shall be set to '1' if the value of the IdleTime statistics
10 exceeds $(2^{23} - 1)$. Otherwise, it shall be set to '0',
- 11 IdleTime The value of IdleTime statistics mod 2^{23} .

2.8.6.2 ConnectedSSStats Attribute

- 12 This AttributeRecord provides the Serving Sector Change statistics collected by the
13 access terminal.

14

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A
ConnectedSSChangeOverflow	1	0
ConnectedSSChange	15	0
ConnectedTimeOverflow	1	0
ConnectedTime	23	0

- 1 Length Length of the simple attribute in octets. The access terminal shall
2 set this field to 0x06. It gives the length of the attribute excluding
3 the Length field.
- 4 AttributeID The access terminal shall set this field to 0x05.
- 5 ConnectedSSChangeOverflow
- 6 This bit shall be set to '1' if the value of the ConnectedSSChange
7 statistics exceeds $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 8 ConnectedSSChange The value of ConnectedSSChange statistics mod 2^{15} .
- 9 ConnectedTimeOverflow
- 10 This bit shall be set to '1' if the value of the ConnectedTime
11 statistics exceeds $(2^{23} - 1)$. Otherwise, it shall be set to '0',
- 12 ConnectedTime The value of ConnectedTime statistics mod 2^{23} .

2.8.6.3 FirstSyncCCPktStats

- 13 This AttributeRecord provides the First Synchronous CC packet statistics collected by
14 the access terminal.
- 15

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A
FirstSyncCCPktOverflow	1	0
FirstSyncCCPkt	15	0
CCTimeOverflow	1	0
CCTime	15	0

- 1 Length Length of the simple attribute in octets. The access terminal shall
2 set this field to 0x05. It gives the length of the attribute excluding
3 the Length field.
- 4 AttributeID The access terminal shall set this field to 0x06.
- 5 FirstSyncCCPktOverflow
- 6 This bit shall be set to '1' if the value of the FirstSyncCCPkt
7 statistics exceeds $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 8 FirstSyncCCPkt The value of FirstSyncCCPkt statistics mod 2^{15} .
- 9 CCTimeOverflow This bit shall be set to '1' if the value of the CCTime statistics
10 exceeds $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 11 CCTime The value of CCTime statistics mod 2^{15} .

2.9 FTAP Packet Formats

2.9.1 FTAP Test Packet

- 12 The access network transmits these packets on the Forward Traffic Channel.

13

Field	Length (bits)
ProtocolID	2
PacketType	4
SEQ	14
Reserved	2

- 1 ProtocolID This field identifies the protocol to which this packet belongs. This
2 field should be set to '00' for the FTAP packets.
- 3 PacketType This field identifies the packet type within the FTAP protocol. This
4 field shall be set to 0x0.
- 5 SEQ The sequence number of this FTAP Test Packet. This is set to the
6 value of $V(S_{\text{Test}})$ when the packet is generated.

2.9.2 FTAP Loop Back Packet

- 7 This packet is sent by the access terminal on the Reverse Traffic Channel to convey
8 information about the received FTAP Test Packets on the Forward Traffic Channel.
- 9

Field	Length (bits)
ProtocolID	2
PacketType	4
FwdSysTime	15
LBPktOverflow	1
RecordCount	5

RecordCount occurrences of the following record:

TCAMsgSeqIncluded	1
TCAMsgSeq	0 or 8
DRCCover	3
FwdPhysSlots	4
FwdMACPkts	2
FwdSeqIncluded	1
FwdSeq	0 or 14

Reserved	variable
----------	----------

1	ProtocolID	This field identifies the protocol to which this packet belongs. This field should be set to '00' for the FTAP packets.
2		
3	PacketType	This field identifies the packet type within the FTAP protocol. This field shall be set to 0x1.
4		
5	FwdSysTime	CDMA System Time in frames mod 32768 corresponding to the start (0 th slot) of the 16-slot observation interval covered by this FTAP Loop Back Packet.
6		
7		
8	LBPktOverflow	This field indicates if any FTAP Loop Back Packets were lost due to buffer overflow. It is set to the value of the LBPktOverflowBit (see 2.7.4.1).
9		
10		
11	RecordCount	Number of FTAP Test Packet Records included in this payload. If no FTAP Test Packet Records are included, this field shall be set to 0. The valid range for this field shall be 0 through 16.
12		
13		

1 2 3 4	TCAMsgSeqIncluded	For the first record this field shall be set to '1'. For subsequent records, if the TCAMsgSeq value is the same as the last record, then this field shall be set to '0'; otherwise, this field shall be set to '1'.										
5 6 7 8 9	TCAMsgSeq	The MessageSequence field of the last TrafficChannelAssignment message 0, that assigned the Channel on which the current FTAP Test Packet was received. If the TCAMsgSeqIncluded field is set to 1, this field shall be included. Otherwise, this field shall be omitted.										
10 11	DRCCover	Sector cover associated with the Serving Sector for the current FTAP Test Packet.										
12 13	FwdPhysSlots	Number of slots over which the Physical Layer packet containing the current FTAP Test Packet was received.										
14 15	FwdMACPkts	The number of MAC packets received in the Physical Layer packet containing this FTAP Test Packet. It shall be coded as follows:										
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">FwdMACPkts Value</th> <th style="text-align: center;">Meaning</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">00</td> <td style="text-align: center;">1 MAC Packet</td> </tr> <tr> <td style="text-align: center;">01</td> <td style="text-align: center;">2 MAC Packets</td> </tr> <tr> <td style="text-align: center;">10</td> <td style="text-align: center;">3 MAC Packets</td> </tr> <tr> <td style="text-align: center;">11</td> <td style="text-align: center;">4 MAC Packets</td> </tr> </tbody> </table>			FwdMACPkts Value	Meaning	00	1 MAC Packet	01	2 MAC Packets	10	3 MAC Packets	11	4 MAC Packets
FwdMACPkts Value	Meaning											
00	1 MAC Packet											
01	2 MAC Packets											
10	3 MAC Packets											
11	4 MAC Packets											
16 17 18 19	FwdSeqIncluded	For the first FTAP Test Packet record this field shall set to '1'. For subsequent record, if the FwdSeq field for this record is one more than the one in the previous record, then this field shall be set to '0'. Otherwise, this field shall be set to '1'.										
20 21 22 23	FwdSeq	This field contains the value of the SEQ field of the FTAP Test Packet associated with the current record. If the FwdSeqIncluded field is '1', then this field shall be included. Otherwise, this field shall be omitted.										
24 25 26 27	Reserved	The length of this field is the smallest value that will make the packet length x satisfy the constraint $x \bmod 8 = 6$. The access terminal shall set this field to zero. The access network shall ignore this field.										

2.10 Protocol Numeric Constants

28

- 1 TCAMsgSeqIncluded For the first record this field shall be set to '1'. For subsequent
 2 records, if the TCAMsgSeq value is the same as the last record,
 3 then this field shall be set to '0'; otherwise, this field shall be set
 4 to '1'.
- 5 TCAMsgSeq The MessageSequence field of the last TrafficChannelAssignment
 6 message 0, that assigned the Channel on which the current FTAP
 7 Test Packet was received. If the TCAMsgSeqIncluded field is set to
 8 1, this field shall be included. Otherwise, this field shall be
 9 omitted.
- 10 DRCCover Sector cover associated with the Serving Sector for the current
 11 FTAP Test Packet.
- 12 FwdPhysSlots Number of slots over which the Physical Layer packet containing
 13 the current FTAP Test Packet was received.
- 14 FwdMACPkts The number of MAC packets received in the Physical Layer packet
 15 containing this FTAP Test Packet. It shall be coded as follows:

FwdMACPkts Value	Meaning
00	1 MAC Packet
01	2 MAC Packets
10	3 MAC Packets
11	4 MAC Packets

- 16 FwdSeqIncluded For the first FTAP Test Packet record this field shall set to '1'. For
 17 subsequent record, if the FwdSeq field for this record is one more
 18 than the one in the previous record, then this field shall be set to
 19 '0'. Otherwise, this field shall be set to '1'.
- 20 FwdSeq This field contains the value of the SEQ field of the FTAP Test
 21 Packet associated with the current record. If the FwdSeqIncluded
 22 field is '1', then this field shall be included. Otherwise, this field
 23 shall be omitted.
- 24 Reserved The length of this field is the smallest value that will make
 25 thepacket length x satisfy the constraint $x \bmod 8 = 6$. The access
 26 terminal shall set this field to zero. The access network shall
 27 ignore this field.

2.10 Protocol Numeric Constants

28

Constant	Meaning	Value
T _{FTAPConfig}	Maximum time for the access terminal to send an FTAPPParameterComplete message after receiving an FTAPPParameterAssignment message.	2 seconds

1

2.11 Interface to Other Protocols

2.11.1 Commands

2 This protocol does not issue any commands.

2.11.2 Indications

3 This protocol registers to receive the following indications:

- 4 • *ConnectedState.ConnectionClosed.*
- 5 • *RouteUpdate.IdleHO.*
- 6 • *RouteUpdate.ConnectionLost.*
- 7 • *IdleState.ConnectionOpened*

8

3 REVERSE TEST APPLICATION PROTOCOL (RTAP) SPECIFICATION

3.1 Overview

1 The Reverse Test Application Protocol (RTAP) provides the procedures and messages
2 used by the access network and the access terminal to:

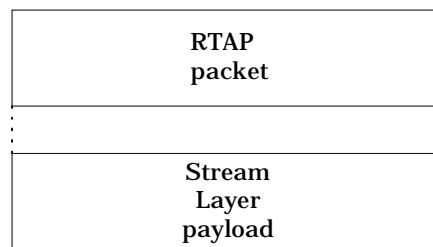
- 3 • Control RTAP test configurations at both the access terminal and the access
4 network.
- 5 • Generate RTAP Test Packets and RTAP Fill Packets at the access terminal for
6 transmission on the Reverse Traffic Channel, and process the received packets
7 at the access network.
- 8 • Transmit packets at configured Reverse Traffic Channel rates.

3.2 Data Encapsulation

9 In the transmit direction, the RTAP generates test packets and forwards them to the
10 stream layer.

11 In the receive direction the RTAP receives test packets from the stream layer and
12 processes them.

13 Figure 3.2-1 illustrates the relationship between the RTAP packets and the Stream
14 Layer payload.



15

16 **Figure 3.2-1 RTAP Packet Encapsulation**

3.3 Primitives and Public Data

3.3.1 Commands

17 This protocol does not define any commands.

3.3.2 Indications

18 This protocol returns the following indications:

- 1 • *RTAPSyncLost*

3.3.3 Public Data

- 2 None.

3.4 Protocol Data Unit

3 The transmission unit of this protocol is an RTAP packet. The RTAP packet size is
4 determined by the lower layers negotiated during session configuration.

5 The RTAP also uses signaling messages for controlling and configuring the access
6 terminal and the access network. When RTAP sends these messages it shall use the
7 Signaling Application 0.

3.5 Test Statistics

3.5.1 Access Network Requirements

8 The access network may maintain the following statistics:

- 9 • *RTAPTestPktSent[i]*: Array whose $(i+1)^{\text{th}}$ element contains the number of RTAP
10 Test Packets that were sent by the access terminal at a rate corresponding to the
11 RateIndex *i*, as per Table 3.7.1.2-1.
- 12 • *RTAPTestPktRecd[i]*: Array whose $(i+1)^{\text{th}}$ element contains the number of RTAP
13 Test Packets that were received by the access network at a rate corresponding to
14 the RateIndex *i*, as per Table 3.7.1.2-1.
- 15 • *RTAPTestTime*: The duration of the RTAP test in frames.

3.6 Procedures

16 The RTAP is specified by the following procedures, which control and configure different
17 aspects of the Reverse Traffic Channel tests.

- 18 • **Test Parameter Configuration**: Procedures and messages for configuring test
19 parameters.
- 20 • **RTAP Packet Transmission and Reception**: Procedures for sending and receiving
21 RTAP Test Packets and RTAP Fill Packets on the Reverse Traffic Channel.

3.6.1 Test Parameter Configuration

3.6.1.1 Access Terminal Requirements

22 When the protocol is instantiated, the access terminal shall execute the configuration
23 initialization procedure in 3.6.1.1.1.

1 When the protocol receives a *ConnectedState.ConnectionClosed* or
 2 *RouteUpdate.ConnectionLost* 0 indication, the access terminal shall execute the
 3 configuration initialization procedure in 3.6.1.1.2.

4 If the access terminal receives an RTAPPParameterAssignment message, it shall do the
 5 following steps in sequence:

- 6 • Execute the configuration initialization procedure in 3.6.1.1.1.
- 7 • Execute the test parameter initialization procedure in 3.6.1.1.3.
- 8 • If the message includes the RTAPTestPktEnable attribute, then the RTAP Test
 9 Packet mode is enabled, and the value of the RTAPTestPktPersistence field is
 10 stored. The RTAP Test Packet buffer is cleared and the RTAPTestPktOverflowBit
 11 is set to '0' (see 3.6.2.1.1).
- 12 • If the message includes the PacketRateMode attribute, then the Configured
 13 Packet Rate mode is enabled. The values of the MinRate and MaxRate fields are
 14 stored.
- 15 • Send an RTAPPParameterComplete message. The TransactionID field shall be set
 16 to the same value as that received in the RTAPPParameterAssignment message.
 17 The RTAPPParameterComplete message shall be sent within $T_{RTAPConfig}$ from when
 18 the RTAPPParameterAssignment message is received.

3.6.1.1.1 Access Terminal Configuration Initialization

19 When the protocol is instantiated or an RTAPPParameterAssignment message is received,
 20 the access terminal shall initialize the test configuration as follows:

- 21 • The RTAP Test Packet mode is disabled.
- 22 • The Configured Packet Rate mode is disabled.

3.6.1.1.2 Access Terminal Configuration for Closed or Lost Connection

23 When the protocol receives a *ConnectedState.ConnectionClosed* or
 24 *RouteUpdate.ConnectionLost* indication 0, the access terminal shall initialize the test
 25 configuration as follows:

- 26 • If the RTAP Test Packet mode is enabled, and the value of the
 27 RTAPTestPktPersistence field of the RTAPTestPktEnable attribute in the last
 28 received RTAPPParameterAssignment message is '00', then the RTAP Test Packet
 29 mode is disabled.
- 30 • The Configured Packet Rate mode is disabled.

3.6.1.1.3 Access Terminal Test Parameter Initialization

1 The access terminal shall set $V_i(S_{Rev})$, the 12-bit sequence number associated with RTAP
 2 Test Packets transmitted at the rate corresponding to RateIndex i (Table 3.7.1.2-1), to
 3 zero, for all possible RTC rates 0 .

3.6.1.2 Access Network Requirements

4 To change the test configuration the access network shall perform the following steps:

- 5 • Send an RTAPParameterAssignment message to the access terminal and wait for
 6 an RTAPParameterComplete message containing the same TransactionID as that
 7 in the RTAPParameterAssignment message.
- 8 • When the expected RTAPParameterComplete message is received, execute the
 9 Test Statistics Initialization procedure in 3.6.1.2.1.

3.6.1.2.1 Access Network Test Statistics Initialization

10 The access network shall set the test statistics as follows:

- 11 • RTAPTestPktSent[i] to zero for all possible i .
- 12 • RTAPTestPktRecd[i] to zero for all possible i .
- 13 • RTAPTestTime to zero.

3.6.2 RTAP Packet Transmission and Reception

3.6.2.1 Access Terminal Requirements

3.6.2.1.1 Generation and Transmission

14 If the RTAP Test Packet mode is enabled, the access terminal shall generate an RTAP
 15 Test Packet at the beginning of every 16-slot interval aligned to the CDMA System Time
 16 0 in frames.

17 The access terminal shall obey the following rules:

- 18 • The RTAP Packets shall be generated only in the Connected State of the Air Link
 19 Management Protocol.
- 20 • The information contained in the RTAP Test Packet (see 3.8.1) shall cover RTC
 21 Physical Layer packets transmitted up to, but not including, the time instant of
 22 generation.
- 23 • The access terminal shall assign a transmission priority of 55 to RTAP Test
 24 Packets.

1 • The transmission rate for the RTAP Test Packet shall be determined as specified
2 in 3.6.2.1.2.

3 • The access terminal shall queue the generated RTAP Test Packets. The access
4 terminal shall provide buffering for 8 RTAP Test Packets. The
5 RTAPTestPktOverflowBit indicates if any RTAP Test Packets have been lost due
6 to lack of buffer space. When a packet is lost due to lack of buffer space, the
7 RTAPTestPktOverflowBit shall be set to '1'.

8 The access terminal shall follow the following rules for transmitting an RTAP Test
9 Packet:

- 10 • The access terminal shall transmit the queued RTAP Test Packets in the
11 Connected State of the Air Link Management Protocol 0.
- 12 • If the Configured Packet Rate mode is enabled, the access terminal shall
13 transmit an RTAP Fill Packet of the size necessary for the Reverse Traffic
14 Channel MAC Layer packet containing the RTAP Test Packet at the selected rate.
15 The access terminal shall set the priority of the RTAP Fill Packet to 255.
- 16 • When the access terminal transmits a Reverse Traffic Channel MAC Layer
17 packet containing an RTAP Test Packet at a rate with RateIndex i (Table
18 3.7.1.2-1), it shall increment the sequence number $V_i(S_{Rev})$.
- 19 • If the access terminal receives a *ConnectedState.ConnectionClosed* or a
20 *RouteUpdate.ConnectionLost* 0 indication, and it has queued RTAP Test packets,
21 it shall not attempt to establish a connection to transmit the packets.

3.6.2.1.2 Rate Selection

22 If the Configured Packet Rate mode is enabled, the access terminal shall obey the
23 following rules to select a Reverse Traffic Channel rate; otherwise, the access terminal
24 shall select a rate as per the Reverse Traffic Channel MAC Protocol 0.

25 The access terminal shall maintain the following variables:

- 26 • MinRate: Value of the MinRate field received in the PacketRateMode attribute of
27 the RTAPPParameterAssignment message.
- 28 • MaxRate: Value of the MaxRate field received in the PacketRateMode attribute of
29 the RTAPPParameterAssignment message.
- 30 • MACMaxRate: RateIndex as per Table 3.7.1.2-1 corresponding to the maximum
31 rate allowed by the Reverse Traffic Channel MAC protocol 0.
- 32 • TargetRate: RateIndex corresponding to the desired rate.

- 1 • SelectedRate: RateIndex corresponding to the selected rate.

2 For the first RTAP Test Packet, the access terminal shall set TargetRate to MinRate, and
3 the SelectedRate = Min (TargetRate,MACMaxRate). For all the subsequent RTAP Test
4 Packets, the access terminal shall choose the rate as follows:

5 TargetRate = TargetRate + 1;

6 If (TargetRate > MaxRate)

7 TargetRate = MinRate;

8 SelectedRate = Min (TargetRate, MACMaxRate);

3.6.2.2 Access Network Requirements

9 The access network shall maintain the following variables:

- 10 • $V(R_{RTAP})$: A 15-bit variable that corresponds to the sequence number of the next
11 expected RTAP Test Packet.
- 12 • $X[i]$: A 12-bit variable that corresponds to the sequence number of the next
13 expected RTAP Test Packet that will be contained in a Reverse Traffic Channel
14 Physical Layer packet transmitted at a rate corresponding to RateIndex i as per
15 Table 3.7.1.2-1.

16 When an RTAP Test packet arrives for the first time, following the receipt of an
17 RTAPParameterComplete message, the access network shall

- 18 • Set $V(R_{RTAP})$ to the value of the RevSysTime field of the RTAP Test Packet.
- 19 • Set $X[i]$ to the value of the Seq_i field of the RTAP Test Packet for all possible
20 values of i .

21 All operations and comparisons performed on packet sequence numbers shall be
22 carried out in unsigned modulo 2^S arithmetic, where S is the number of bits used to
23 represent the sequence number. For a packet sequence number x , the numbers in the
24 range $[x+1, x + 2^{S-1} - 1]$ are considered greater than x and numbers in the range $[x-1, x -$
25 $2^{S-1}]$ are considered smaller than x .

26 For each RTAP Test Packet received at a rate corresponding to the RateIndex k , the
27 access network shall perform the following procedure using the value of the RevSysTime
28 field:

- 29 • If $RevSysTime \geq V(R_{RTAP})$,
- 30 ○ RTAPTestPktRecd[k] is incremented by 1.

- 1 ○ RTAPTestTime shall be incremented by $\text{RevSysTime} - V(R_{\text{RTAP}}) + 1$.
- 2 ○ $V(R_{\text{RTAP}})$ is set to $\text{RevSysTime} + 1$.
- 3 • If $\text{RevSysTime} < V(R_{\text{RTAP}})$, then the access network shall generate an
- 4 *RTAPSyncLost* indication.

5 The fields of a received RTAP Test Packet shall be processed using the values of the

6 *Seq_i* fields for all possible values of *i* as follows:

- 7 • *RTAPTestPktSent*[*I*] shall be incremented by $\text{Seq}_i - X[i] + 1$.
- 8 • *X*[*i*] shall be set to $\text{Seq}_i + 1$.

3.7 Message Formats

3.7.1 RTAPParameterAssignment

9 The access network sends this message to configure the RTAP parameters.

10

Field	Length (bits)
MessageID	8
TransactionID	8

Zero or more occurrences of the following record:

AttributeRecord	Attribute Dependent
-----------------	------------------------

- 11 MessageID The access network shall set this field to 0x80.
- 12 TransactionID The access network shall set this field to 1 higher than the
- 13 TransactionID field of the last RTAPParameterAssignment
- 14 message (mod 256) sent to this access terminal.
- 15 AttributeRecord The AttributeRecord is a simple record defined in 10.3 of [1]. The
- 16 permissible attribute records are RTAPTestPktEnable, and
- 17 PacketRateMode as specified in 3.7.1.1 to 3.7.1.2.

18

Channels	CC FTC	SLP	Reliable
Addressing	unicast	Priority	40

3.7.1.1 RTAPTestPktEnable Attribute

1 If the access terminal is to start sending RTAP Test Packets on the Reverse Traffic
2 Channel, then the access network includes this AttributeRecord.

3

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

4 **Length** Length of the simple attribute in octets. The access network shall
5 set this field to 0x02. It gives the length of the attribute excluding
6 the Length field.

7 **AttributeID** The access network shall set this field to 0x00.

8 **RTAPTestPktPersistence**

9 This field indicates to the access terminal if the RTAP Test Packet
10 Enable mode is to be maintained in the event of a connection
11 closure or a lost connection.

12 A value of 0x00 indicates that the RTAP Test Packet Enable mode
13 is not to be maintained. A value of 0x01 indicates that the RTAP
14 Test Packet Enable mode is to be maintained. All other values are
15 reserved.

3.7.1.2 PacketRateMode Attribute

16 The access network includes this AttributeRecord if the Reverse Traffic Channel rate is
17 to be configured.

18

Field	Length (bits)	Default
Length	8	N/A
AttributeID	8	N/A
MinRate	8	0x00
MaxRate	8	0x05

1 Length Length of the simple attribute in octets. The access network shall
2 set this field to 0x03. It gives the length of the attribute excluding
3 the Length field.

4 AttributeID The access network shall set this field to 0x01.

5 MinRate This field shall be set to the RateIndex (Table 3.7.1.2-1)
6 corresponding to the minimum RTC rate that the access terminal
7 can use to transmit the RTAP Test Packets.

8 MaxRate This field shall be set to the RateIndex (Table 3.7.1.2-1)
9 corresponding to the maximum RTC rate that the access terminal
10 can use to transmit the RTAP Test Packets.

11 **Table 3.7.1.2-1 Encoding of RTC Rates**

RateIndex	RTC Rate
0	0 kbps
1	9.6 kbps
2	19.2 kbps
3	38.4 kbps
4	76.8 kbps
5	153.6 kbps
All other values	Invalid

3.7.2 RTAPParameterComplete

12 The access terminal sends this message to indicate completion of test configurations
13 specified by the associated RTAPParameterAssignment message.

14

Field	Length (bits)
MessageID	8
TransactionID	8

- 1 MessageID The access terminal shall set this field to 0x81.
- 2 TransactionID The access terminal shall set this field to the TransactionID field
- 3 of the associated RTAPParameterAssignment message.

4

Channels	RTC	SLP	Reliable
Addressing	unicast	Priority	40

3.8 RTAP Packet Formats

3.8.1 RTAP Test Packet

- 5 The access terminal transmits these packets on the Reverse Traffic Channel.

6

Field	Length (bits)
ProtocolID	2
PacketType	4
RevSysTime	15
RTAPTestPktOverflow	1
Seq_0	12
Seq_1	12
Seq_2	12
Seq_3	12
Seq_4	12
Seq_5	12

- 1 ProtocolID This field identifies the protocol to which this packet belongs. This
2 field should be set to '01' for the RTAP packets.
- 3 PacketType This field identifies the packet type within the RTAP protocol. This
4 field shall be set to 0x0.
- 5 RevSysTime CDMA System Time in frames mod 32768 corresponding to the
6 slot boundary when the RTAP Test Packet was generated.
- 7 RTAPTestPktOverflow This field indicates if any RTAP Test Packets were lost due to
8 buffer overflow. It is set to the value of the
9 RTAPTestPktOverflowBit (see 3.6.2.1.1).
- 10 Seq_0 The sequence number of the last RTAP Test Packet that was
11 transmitted at a rate of 0 kbps prior to the generation of this
12 RTAP Test Packet.
- 13 Seq_1 The sequence number of the last RTAP Test Packet that was
14 transmitted at a rate of 9.6 kbps prior to the generation of this
15 RTAP Test Packet.
- 16 Seq_2 The sequence number of the last RTAP Test Packet that was
17 transmitted at a rate of 19.2 kbps prior to the generation of this
18 RTAP Test Packet.

- 1 Seq_3 The sequence number of the last RTAP Test Packet that was
 2 transmitted at a rate of 38.4 kbps prior to the generation of this
 3 RTAP Test Packet.
- 4 Seq_4 The sequence number of the last RTAP Test Packet that was
 5 transmitted at a rate of 76.8 kbps prior to the generation of this
 6 RTAP Test Packet.
- 7 Seq_5 The sequence number of the last RTAP Test Packet that was
 8 transmitted at a rate of 153.6 kbps prior to the generation of this
 9 RTAP Test Packet.

3.8.2 RTAP Fill Packet

- 10 This is a variable length packet used to fill a Reverse Traffic Channel MAC Layer packet
 11 for transmission at a configured rate.

12

Field	Length (bits)
ProtocolID	2
PacketType	4
DataFill	Variable

- 13 ProtocolID This field identifies the protocol to which this packet belongs. This
 14 field shall be set to '01' for the RTAP packets.
- 15 PacketType This field identifies the packet type within the RTAP protocol. This
 16 field shall be set to 0x1.
- 17 DataFill The access terminal shall set this variable length field to zero. The
 18 access network shall ignore this field.

3.9 Protocol Numeric Constants

1

Constant	Meaning	Value
$T_{RTAPConfig}$	Maximum time for the access terminal to send an RTAPParameterComplete message after receiving an RTAPParameterAssignment message.	2 seconds

3.10 Interface to Other Protocols

3.10.1 Commands

2 This protocol does not issue any commands.

3.10.2 Indications

3 This protocol registers to receive the following indications:

- 4 • *ConnectedState.ConnectionClosed.*
- 5 • *RouteUpdate.ConnectionLost.*
- 6 • *IdleState.ConnectionOpened.*

4 TEST APPLICATION EXAMPLE FLOW DIAGRAMS

4.1 Overview

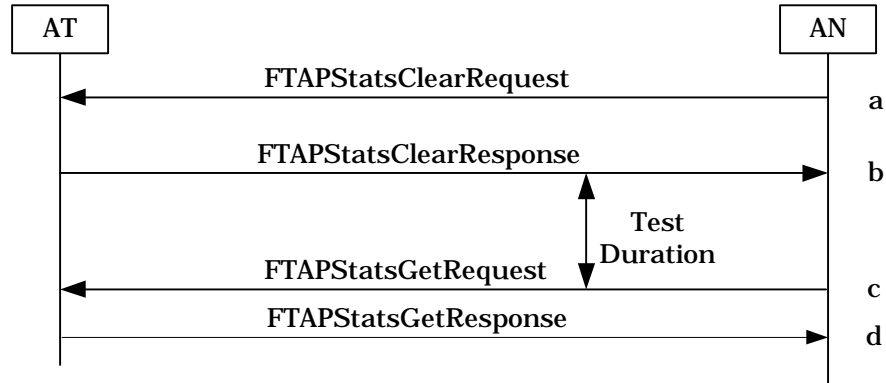
1 This chapter provides some Test Application flow diagrams to illustrate the use of FTAP
 2 and RTAP procedures for characterizing the Forward and Reverse Traffic Channels. It
 3 also provides some sample computations of performance measures. These are for
 4 informational purpose only. The tests that can be performed using these procedures
 5 and the manner, in which they can be conducted, are by no means limited to these few
 6 illustrations. In the test example flow diagrams, it is assumed that the Stream
 7 associated with the Test Application was successfully negotiated earlier as part of
 8 Stream Protocol Configuration.

4.2 Forward Link Performance Tests

9 This section illustrates the use of FTAP procedures for two scenarios, namely statistics
 10 retrieval from the access terminal, and throughput and packet error rate measurement
 11 on the Forward Link.

4.2.1 Statistics Collection and Retrieval at the Access Terminal

12 The first example illustrates a scenario for retrieving test statistics collected at the
 13 access terminal for verifying access terminal compliance in meeting Control Channel
 14 Packet Error Rate performance in the Idle State as required by 0.



15

16 **Figure 4.2-1. Flow Diagram for Control Channel Packet Error Rate Measurement**

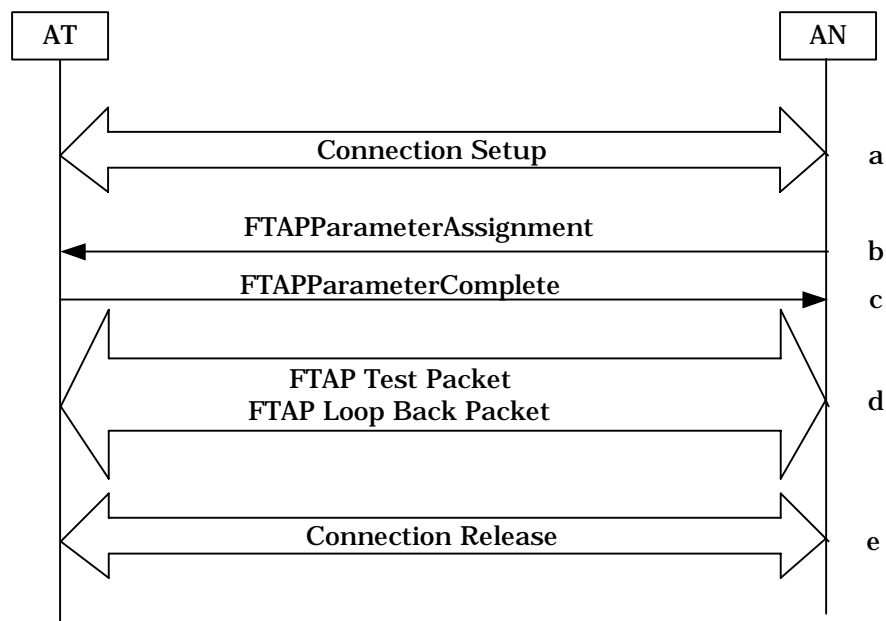
- 17 a. The access network sends an FTAPStatsClearRequest message to clear the
 18 statistics maintained at the access terminal.
- 19 b. The access terminal clears the requested statistics and responds with an
 20 FTAPStatsClearResponse message.
- 21 c. After sufficient time has elapsed, the access network sends an
 22 FTAPStatsGetRequest message to the access terminal requesting
 23 FirstSyncCCPktStats Attribute.

- 1 d. The access terminal responds with an FTAPStatsGetResponse message
 2 containing the requested attribute.
- 3 The statistics provided by the access terminal can be used to compute the Control
 4 Channel Packet Error Rate performance as outlined in 4.3.

4.2.2 Throughput and Packet Error Rate Measurement

- 5 This example illustrates a test scenario used for the Forward Traffic Channel
 6 throughput and packet error rate measurements.

7



8

9 **Figure 4.2-2. Flow Diagram for Forward Link Throughput and PER Measurement.**

- 10 a. The access network sets up a connection with the access terminal according to
 11 0, assuming that there is no current connection between them.
- 12 b. The access network sends an FTAPParameterAssignment message to configure
 13 FTAP with Loop Back Mode enabled.
- 14 c. The access terminal responds with an FTAPParameterComplete message.
- 15 d. The access network and the access terminal exchange FTAP Test Packets and
 16 FTAP Loop Back Packets. The access network should generate FTAP Test

1 Packets fast enough to ensure that they are always available for transmission on
2 the Forward Traffic Channel.

3 e. After sufficient statistics have been collected, the access network stops sending
4 FTAP Test Packets and releases the connection. This step is not absolutely
5 necessary; in fact, the access network may proceed to perform other tests.

6 The access network uses the collected statistics at the access network to compute the
7 packet error rate and the average throughput as described in 4.3.

4.3 Computation of Forward Link Performance

8 In this section some sample Forward Link performance computations are described. It
9 is assumed that the Loop Back mode was enabled for collection of the statistics
10 necessary for throughput and packet error rate computation.

11 • Idle State ASP Change Rate (per second):

$$12 \qquad = \text{IdleASPChange} \times 1000 / (\text{IdleTime} \times 5 / 3)$$

13 • Connected State Serving Sector Change Rate (per second):

$$14 \qquad = \text{ConnectedSSChange} \times 1000 / (\text{ConnectedTime} \times 5 / 3)$$

15 • Control Channel packet error rate in the Idle State (%):

$$16 \qquad = (1 - \text{FirstSyncCCPkt} / \text{CCTime}) \times 100$$

17 • Throughput from a sector (kbps):

$$18 \qquad = \text{FTAPMACPktRecd} \times 1024 / (\text{FTAPTestTime} \times 16 \times 5 / 3)$$

19 • Throughput from all sectors (kbps):

$$20 \qquad = \sum_{\text{AllSectors}} \text{Throughput from a sector (kbps)}$$

21 • Throughput over transmitted slots from a sector (kbps):

$$22 \qquad = \text{FTAPMACPktRecd for the sector} \times 1024 / (\text{FTAPPhysPktSlots for the sector} \\ 23 \qquad \times 5 / 3)$$

24 • Throughput over transmitted slots from all sectors (kbps):

$$25 \qquad = \sum_{\text{AllSectors}} \text{Throughput over transmitted slots from a sector (kbps)}$$

26 • Forward link PER (%):

$$1 \quad = (1 - \sum_{AllSectors} FTAPTestPktRecd / \sum_{AllSectors} FTAPTestPktSent) \times 100$$

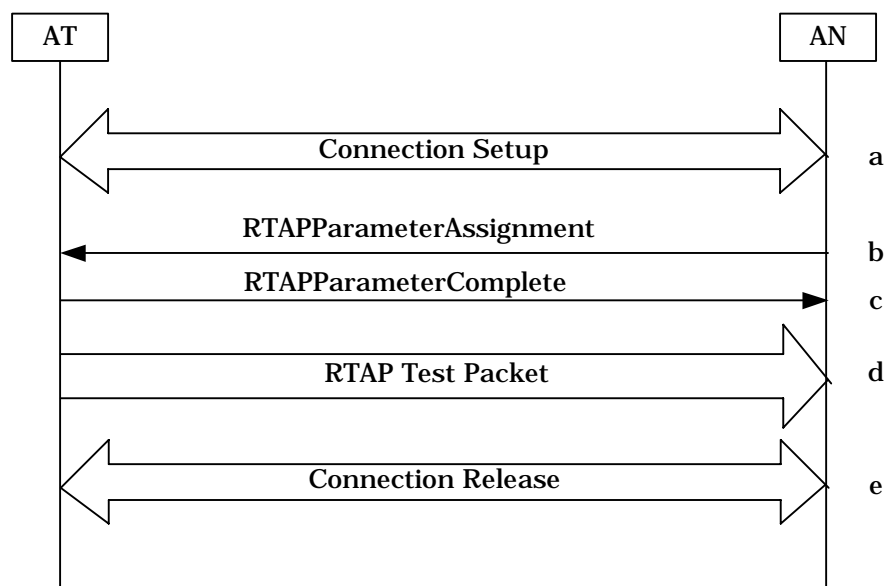
- 2 • Reverse link quality over the test duration (%):

$$3 \quad = (1 - FTAPLBPktRecd / FTAPLBPktSent) \times 100$$

4.4 Reverse Link Performance Tests

4.4.1 Throughput and Packet Error Rate

4 This section illustrates the use of RTAP procedures for throughput and packet error
5 rate measurement on the Reverse Link.



6

7 **Figure 4.4-1. Flow Diagram for Reverse Link Throughput and PER Measurements**

- 8 a. The access network sets up a connection with the access terminal according to
9 0, assuming that there is no current connection between them.
- 10 b. The access network sends an RTAPParameterAssignment message containing
11 the RTAPTestPktEnable attribute to enable transmission of RTAP Test Packets
12 by the access terminal.
- 13 c. The access terminal responds with an RTAPParameterComplete message.
- 14 d. The access terminal sends RTAP Test Packets to the access network.
- 15 e. After sufficient statistics have been collected, the access network releases the
16 connection. This step is not absolutely necessary; in fact, the access network
17 may proceed to perform other tests.

1 The access network uses the collected statistics to compute the PER and Throughput as
2 described in 4.5.

4.5 Computation of Reverse Link Performance

3 In this section some sample Reverse Link performance computations are described. In
4 the following, PhysLayerPktSize[i] gives the number of bits in a Physical Layer packet 0
5 at a rate with RateIndex i (see Table 3.7.1.2-1).

6 • Throughput (kbps) for a rate with RateIndex i :

$$7 \quad = \text{RTAPTestPktRecd}[i] \times \text{PhysLayerPktSize}[i] / (\text{RTAPTestTime} \times 16 \times 5 / 3)$$

8 • Overall throughput (kbps):

$$9 \quad = \left(\sum_i \text{RTAPTestPktRecd}[i] \times \text{PhysLayerPktSize}[i] \right) / (\text{RTAPTestTime} \times 16 \times 5$$

$$10 \quad / 3)$$

11 • Packet Error Rate (%) for a rate with rate index i :

$$12 \quad = (\text{RTAPTestPktSent}[i] - \text{RTAPTestPktRecd}[i]) \times 100 / \text{RTAPTestPktSent}[i]$$

13 • Overall Packet Error Rate (%):

$$14 \quad = \frac{\sum_i (\text{RTAPTestPktSent}[i] - \text{RTAPTestPktRecd}[i]) \times 100}{$$

$$15 \quad \sum_i \text{RTAPTestPktSent}[i]}$$