

3GPP2 C.S0029-0 Version 2.0



3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"

Date: July 12, 2001

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

(Ballot Resolution Version)

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- 2

FOREWORD

1 **(This foreword is not part of this Standard)**

2 This standard was prepared by Technical Specification Group C of the Third Generation
3 Partnership Project 2 (3GPP2). This standard is a companion to the cdma2000 high rate
4 packet data standards. This specification provides a set of procedures that the access
5 terminal and the access network can use to conduct the access terminal minimum
6 performance tests in a factory/laboratory environment. It also allows measurements of
7 certain forward and reverse link performances in a field environment.

1 No text

NORMATIVE REFERENCES

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

6

7

[1] 3GPP2 C.S0024, cdma2000 High Rate Packet Data Air Interface Specification.

8

9

[2] 3GPP2 C.S0033, Recommended Minimum Performance Standards for cdma2000
High Rate Packet Data Access Terminal.

10

11

[3] 3GPP2 C.S0032, Recommended Minimum Performance Standards for cdma2000
High Rate Packet Data Access Network.

12

13

[4] 3GPP2 C.R1001-B, Administration of Parameter Value Assignments for cdma2000
Spread Spectrum Standards, Release B.

14

15

REFERENCES

- 1 No text.

1 OVERVIEW

1.1 Scope of This Document

These technical requirements form a compatibility standard for test applications in cdma2000 high rate packet data systems. These requirements ensure that a compliant access terminal and a compliant access network can interoperate to execute tests in meeting the objectives stated in 1.2. While the details of the tests are beyond the scope of this document, an informative section illustrating some examples is provided.

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

1.2 Objectives

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

- To conduct the access terminal minimum performance tests [2] in a factory/laboratory environment.
- To conduct measurement of certain forward and reverse link performances in a field environment.

1.3 Requirements Language

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

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

1.4 Protocol Overview

The following is a brief overview of the Test Application Protocol. A complete description of the components can be found in the following sections. The Test Application Protocol is specified in terms of two independent protocols:

1. Forward Test Application Protocol (FTAP): This protocol specifies the procedures and messages to control the Forward Traffic Channel and to configure reverse channels associated with the Forward Traffic Channel. It specifies generation and

1 transmission of test packets sent on the Forward and Reverse Traffic Channels for
2 the purpose of testing the Forward Traffic Channel. It also specifies statistics
3 collection procedures for certain statistics as seen at the access terminal to meet the
4 requirements in [2].

- 5 2. Reverse Test Application Protocol (RTAP): This protocol specifies the procedures and
6 messages to control and configure the Reverse Traffic Channel. It generates test
7 packets sent on the Reverse Traffic Channel for testing the channel.

8 **1.5 Basic Protocol Numbers**

9 The Test Application Protocol shall use the application subtype value [4] of 0x0003.

10 **1.6 Document Organization**

11 This document is organized into the following sections:

- 12 • Section 1 Overview: This section describes the document scope and objectives as
13 well as document organization, list of acronyms and notations.
- 14 • Section 2 Forward Test Application Protocol (FTAP) Specifications: This section
15 describes the procedures and messages of the Forward Test Application Protocol.
- 16 • Section 3 Reverse Test Application Protocol (RTAP) Specifications: This section
17 describes the procedures and messages of the Reverse Test Application Protocol.
- 18 • Section 4 Test Application Example Flow Diagrams: This section describes some
19 examples using the procedures and messages specified in the document. This is for
20 informational purpose only.

1 **1.7 Acronyms**

2

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

3 **1.8 Notation**4 **A[i]**The (i+1)th element of array A. The first element of the array is A[0].5 **x mod y**Indicates the remainder after dividing x by y: $x \text{ mod } y = x - (y \times \lfloor x/y \rfloor)$.6 **Min(a,b)**

The minimum of the two arguments a and b.

7

- 1 No text.

2 FORWARD TEST APPLICATION PROTOCOL (FTAP) SPECIFICATION

2.1 Overview

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

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

2.2 Data Encapsulation

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

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

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

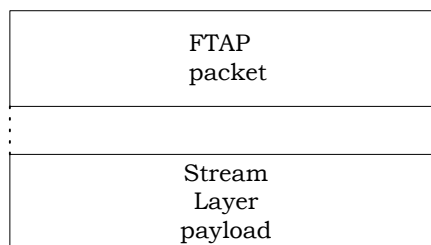


Figure 2.2-1 FTAP Packet Encapsulation

2.3 Primitives and Public Data

2.3.1 Commands

This protocol does not define any commands.

1 2.3.2 Indications

2 This protocol returns the following indications:

- 3
 - *LoopbackSyncLost*

4 2.3.3 Public Data

5 None.

6 **2.4 Basic Protocol Numbers**

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

9 **2.5 Protocol Data Unit**

10 The transmission unit of this protocol is an FTAP packet. The FTAP packet size is
11 determined by the lower layers that are negotiated during session configuration.

12 The FTAP also uses signaling messages for controlling and configuring the access terminal
13 and the access network for conducting tests on the Forward Traffic Channel. When FTAP
14 sends these messages it shall use the Signaling Application [1].

15 **2.6 Test Statistics**

16 2.6.1 Access Terminal Requirements

17 The access terminal shall maintain the following statistics:

- 18
 - **IdleASPChange:** This counts the number of changes in the Active Set Pilot in the Idle
19 State. The Active Set Pilot (ASP) is the pilot associated with the Control Channel the
20 access terminal is currently monitoring. A pilot is characterized by a PN offset and a
21 CDMA Channel.
 - **IdleTime:** Elapsed time in slots in the Idle State since the start of statistics
22 collection.
 - **ConnectedSSChange:** This counts the number of changes in the Serving Sector (SS)
23 in the connected State. The serving sector is the one the DRC is pointed at. When
24 the DRC is re-pointed from one sector to another, the DRC cover transitions through
25 a NULL cover. For example, if the DRC cover changes from a sector cover A through
26 NULL cover to a sector cover B (with A not equal to B), it is counted as one SS
27 change. On the other hand, if DRC cover changes from a sector cover A through
28 NULL cover to a sector cover A again, it is not counted as an SS change.
 - **ConnectedTime:** Elapsed time in slots in the Connected State since the start of
29 statistics collection.
 - **FirstSyncCCPkt:** The number of successfully received first CC MAC Layer packets in
30 synchronous capsules.
 - **CCTime:** Elapsed time in Control Channel Cycles since the start of statistics
31 collection.

32
33
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35
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2.6.2 Access Network Requirements

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

- FTAPTestPktSent: This counts the number of FTAP Test Packets sent by the access network on the Forward Traffic Channel.
- FTAPTestPktRecd: This counts the number of FTAP Test Packets that were received by the access terminal on the Forward Traffic Channel.
- FTAPMACPktRecd: This counts the number of Forward Traffic Channel MAC layer packets that were received by the access terminal, in the Physical Layer packets containing the FTAP Test Packets.
- FTAPTestTime: This counts FTAP test duration in frames [1].
- FTAPPhysPktSlots: This counts the number of slots over which the Physical Layer packets containing the FTAP Test Packets were received by the access terminal.

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

- FTAPLBPktSent: This counts the number of FTAP Loop Back Packets that were sent by the access terminal on the Reverse Traffic Channel.
- FTAPLBPktRecd: This counts the number of FTAP Loop Back Packets that were received by the access network on the Reverse Traffic Channel.

2.7 Procedures

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

- Test Parameter Configuration: Procedures and messages for configuring parameters for different tests.
- Access Terminal Statistics Collection and Retrieval: Procedures and messages for resetting the statistics being collected at the access terminal and for retrieving them.
- FTAP Test Packet Transmission and Reception: Procedures for sending and receiving FTAP Test Packets on the Forward Traffic Channel.
- FTAP Loop Back Packet Transmission and Reception: Procedures for sending and receiving FTAP Loop Back Packets on the Reverse Traffic Channel.
- DRC Channel Transmission: Procedures for sending fixed DRC values and DRC covers on the DRC channel.
- ACK Channel Transmission: Procedures for sending fixed ACK Channel bits on the ACK Channel.

1 2.7.1 Test Parameter Configuration

2 2.7.1.1 Access Terminal Requirements

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

5 When the protocol receives a *ConnectedState.ConnectionClosed* or
6 *RouteUpdate.ConnectionLost* [1] indication, the access terminal shall execute the
7 configuration initialization procedure in 2.7.1.1.2.

8 If the access terminal receives an FTAPPParameterAssignment message, it shall do the
9 following steps in sequence:

- 10 • Execute the configuration initialization procedure in 2.7.1.1.1.
- 11 • If the message includes a DRCValueFixedMode attribute, the DRC Value Fixed mode
12 is enabled and the received DRCValue field is stored.
- 13 • If the message includes DRCCoverFixedMode attribute, the DRC Cover Fixed mode
14 is enabled and the received DRCCover field is stored.
- 15 • If the message includes an ACKChannelBitFixedMode attribute, the ACK Channel
16 Bit Fixed mode is enabled and the received ACKChannelBit field is stored.
- 17 • If the message includes a LoopBackMode attribute, the Loop Back mode is enabled
18 and the received LoopBackPersistence field is stored. The Loop Back Buffer is
19 cleared and the LBOverflowBit (see 2.7.4.1) is set to '0'.
- 20 • Send an FTAPPParameterComplete message. The TransactionID field shall be set to
21 the same value as that received in the FTAPPParameterAssignment message. The
22 FTAPPParameterComplete message shall be sent within $T_{FTAPConfig}$ from when the
23 FTAPPParameterAssignment message is received.

24 2.7.1.1.1 Access Terminal Configuration Initialization

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

- 27 • The Loop Back mode is disabled.
- 28 • The ACK Channel Bit Fixed mode is disabled.
- 29 • The DRC Value Fixed mode is disabled.
- 30 • The DRC Cover Fixed mode is disabled.

31 2.7.1.1.2 Access Terminal Configuration for Lost or Closed Connection

32 When the protocol receives a *ConnectedState.ConnectionClosed* or
33 *RouteUpdate.ConnectionLost* indication [1], the access terminal shall initialize the test
34 configuration as follows:

- 1 • If the Loop Back mode is enabled, and the value of the LoopBackPersistence field of
- 2 the LoopBackMode attribute in the last received FTAPPParameterAssignment message
- 3 is '00', then the Loop Back Mode is disabled.
- 4 • The ACK Channel Bit Fixed mode is disabled.
- 5 • The DRC Fixed mode is disabled.
- 6 • The DRC Cover Fixed mode is disabled.

7 2.7.1.2 Access Network Requirements

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

- 9 • Send an FTAPPParameterAssignment message to the access terminal and wait for an
- 10 FTAPPParameterComplete message containing the same TransactionID as the
- 11 FTAPPParameterAssignment message.
- 12 • When the expected FTAPPParameterComplete message is received, execute the Test
- 13 Statistics and Parameters Initialization procedure in 2.7.1.2.1.

14 2.7.1.2.1 Access Network Test Statistics and Parameters Initialization

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

- 16 • FTAPTestPktSent to zero for each sector.
- 17 • FTAPTestPktRecd to zero for each sector.
- 18 • FTAPMACPktRecd to zero for each sector.
- 19 • FTAPLBPktSent to zero.
- 20 • FTAPLBPktRecd to zero.
- 21 • FTAPPhysPktSlots to zero for each sector.
- 22 • FTAPTestTime to zero.
- 23 • $V(S_{Test})$, the 14-bit sequence number associated with FTAP Test Packets, to zero.

24 2.7.2 Access Terminal Statistics Collection and Retrieval

25 2.7.2.1 Access Terminal Requirements

26 When the protocol is instantiated, the access terminal shall execute the Statistics

27 Initialization procedure in 2.7.2.1.1.

28 If the access terminal receives an FTAPStatsClearRequest message, the access terminal

29 shall

- 30 • execute the Statistics Initialization procedure as follows:
 - 31 ○ If AttributeID is equal to 0x04, set IdleASPChange and IdleTime to zero.
 - 32 ○ If AttributeID is equal to 0x05, set ConnectedSSChange and ConnectedTime to
 - 33 zero.

- 1 o If AttributeID is equal to 0x06, set FirstSyncCCPkt and CCTime to zero.
- 2 • send an FTAPStatsClearResponse message within $T_{FTAPStat}$.

3 When the Air Link Management Protocol [1] is in the Idle State, the Idle State statistics
4 collection shall be enabled and the Connected State statistics collection shall be disabled.
5 While the Idle State statistics collection is enabled

- 6 • IdleASPChange shall be incremented whenever a *RouteUpdate.IdleHO* [1] indication
7 is received.
- 8 • IdleTime shall be incremented every slot.

9 When the Air Link Management Protocol [1] is in the Connected State, the Idle State
10 statistics collection shall be disabled and the Connected State statistics collection shall be
11 enabled. While the Connected State statistics collection is enabled

- 12 • ConnectedSSChange shall be incremented whenever there is a change in the
13 Serving Sector as defined in 2.6.1.
- 14 • ConnectedTime shall be incremented every slot.

15 When the Air Link Management Protocol [1] is in the Idle State or in the Connected State,
16 the Control Channel statistics collection shall be enabled. While the Control Channel
17 statistics collection is enabled

- 18 • FirstSyncCCPkt shall be incremented whenever the first CC MAC Layer packet in a
19 synchronous capsule is successfully received.
- 20 • CCTime shall be incremented at the beginning of every Control Channel Cycle.

21 If the access terminal receives an FTAPStatsGetRequest message, it shall respond within
22 $T_{FTAPStat}$ with an FTAPStatsGetResponse containing the requested attributes.

23 2.7.2.1.1 Statistics Initialization

24 The access terminal shall set

- 25 • IdleASPChange to 0.
- 26 • IdleTime to 0.
- 27 • ConnectedSSChange to 0.
- 28 • ConnectedTime to 0.
- 29 • FirstSyncCCPkt to 0.
- 30 • CCTime to 0.

31 2.7.2.2 Access Network Requirements

32 To reset the statistics collected at the access terminal, the access network shall send an
33 FTAPStatsClearRequest message, and wait for an FTAPStatsClearResponse message
34 containing the same TransactionID as the FTAPStatsClearRequest message. Reception of
35 the expected FTAPStatsClearResponse message indicates that the test statistics at the
36 access terminal have been cleared.

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

4 2.7.3 FTAP Test Packet Transmission and Reception

5 2.7.3.1 Access Terminal Requirements

6 In the Connected State of the Default Air Link Management Protocol [1] the access terminal
7 shall monitor the Forward Traffic Channel to receive the FTAP Test Packets.

8 2.7.3.2 Access Network Requirements

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

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

18 2.7.4 FTAP Loop Back Packet Transmission and Reception

19 2.7.4.1 Access Terminal Requirements

20 If the Loop Back mode is enabled, the access terminal shall generate one or more FTAP
21 Loop Back Packets for every 16-slot interval aligned to the CDMA System Time [1]. The
22 contents of the packet shall be based on the FTAP Test Packets received over the interval.
23 The 16-slot interval is referred to as the observation interval. A packet that was successfully
24 decoded is considered to be “received” in an observation interval if its first slot of
25 transmission fell in that observation interval.

26 The access terminal shall assign a transmission priority of 55 to FTAP Loop Back 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 at least 8 FTAP Loop Back Packets.
29 The LBOverflowBit indicates if any FTAP Loop Back Packets have been lost due to lack of
30 buffer space. When a packet is lost due to lack of buffer space, the access terminal shall
31 set LBOverflowBit to ‘1’.

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

- 33 • The FTAP Loop Back Packet shall be generated only in the Connected State of the
34 Air Link Management Protocol.
- 35 • The FwdSysTime field shall be set to CDMA System Time in frames corresponding to
36 the start (0th slot) of the 16-slot observation interval mod 32768.

- 1 • The RecordCount field shall be set to the number of FTAP Test packets received over
2 the observation interval.
- 3 • FTAP Test Packet records shall be listed in ascending order of the FwdSeq field
4 values in the received FTAP Test packets. If all the FTAP Test Packet records from
5 one observation interval do not fit in a single Reverse Traffic Channel MAC Packet,
6 then the remaining FTAP Test Packet records shall be included in additional FTAP
7 Loop Back packets in the ascending order of FwdSeq field. Each of these FTAP Loop
8 Back Packets shall have an identical header.
- 9 • An FTAP Loop Back Packet shall be generated even if no FTAP Test Packets are
10 received during the 16-slot observation interval.

11 The access terminal shall follow the following rules for transmitting an FTAP Loop Back
12 Packet:

- 13 • The access terminal shall transmit the queued FTAP Loop Back Packets in the
14 Connected State of the Air Link Management Protocol [1].
- 15 • If the access terminal receives a *ConnectedState.ConnectionClosed* or a
16 *RouteUpdate.ConnectionLost* [1] indication, and it has queued FTAP Loop Back
17 Packets, it shall not attempt to establish a connection for transmission of the
18 packets.

19 2.7.4.2 Access Network Requirements

20 The access network shall maintain the following variables:

- 21 • $V(R_{LB})$: A 15-bit variable representing the sequence number of the next FTAP Loop
22 Back Packet expected to be received by the access network.
- 23 • $V(R_{Test})$: A 14-bit variable representing the sequence number of the next expected
24 FTAP Test Packet to be received at the access terminal.

25 When the first FTAP Loop Back Packet containing one or more FTAP Test Packet Records
26 arrives following the receipt of an FTAPParameterComplete message indicating successful
27 Loop Back Mode configuration, the variables $V(R_{LB})$ and $V(R_{Test})$ shall be initialized as
28 follows:

- 29 • $V(R_{LB})$ shall be set to the FwdSysTime field of the FTAP Loop Back Packet.
- 30 • $V(R_{Test})$ shall be set to the FwdSeq field of the first FTAP Test Packet Record in the
31 FTAP Loop Back Packet.

32 All operations and comparisons performed on packet sequence numbers shall be carried
33 out in unsigned modulo 2^S arithmetic, where S is the number of bits used to represent the
34 sequence number. For a packet sequence number x, the numbers in the range $[x+1, x + 2^{S-1}$
35 $-1]$ are considered greater than x and numbers in the range $[x-1, x - 2^{S-1}]$ are considered
36 smaller than x.

37 The access network shall ensure that the FTAP Loop Back Packets associated with a
38 particular observation interval jointly contain RecordCount occurrences of the FTAP Test

1 Packet records before processing them. Otherwise, the access network shall discard the
2 FTAP Loop Back Packets associated with that observation interval.

3 For the first received FTAP Loop Back Packet associated with each observation interval, the
4 access network shall perform the following procedure:

- 5 • If $FwdSysTime \geq V(R_{LB})$, then
 - 6 ○ FTAPLBpktSent shall be incremented by $FwdSysTime - V(R_{LB}) + 1$.
 - 7 ○ FTAPLBpktRecd shall be incremented by 1.
 - 8 ○ FTAPTstTime shall be incremented by $FwdSysTime - V(R_{LB}) + 1$.
 - 9 ○ $V(R_{LB})$ shall be set to $FwdSysTime + 1$.
- 10 • If $FwdSysTime < V(R_{LB})$, then the access network shall generate a *LoopBackSyncLost*
11 indication.

12 The FTAP Test Packet Records in the received FTAP Loop Back Packets shall be processed
13 sequentially as follows:

- 14 • If $FwdSeq \geq V(R_{Test})$, then the access network shall perform the following:
 - 15 ○ The Serving Sector, from which the FTAP Test Packet was received at the access
16 terminal, shall be determined based on the TCAMsgSeqIncluded, TCAMsgSeq,
17 and the DRCCover fields included in the FTAP Loop Back Packet [1].
 - 18 ○ FTAPPhysPktSlots for the Serving Sector shall be incremented by FwdPhysSlots.
 - 19 ○ FTAPMACPktRecd for the Serving Sector shall be incremented by FwdMACPkts.
 - 20 ○ FTAPTstPktSent for the Serving Sector shall be incremented by $FwdSeq -$
21 $V(R_{Test}) + 1$.
 - 22 ○ FTAPTstPktRecd for the Serving Sector shall be incremented by 1.
 - 23 ○ $V(R_{Test})$ shall be set to $FwdSeq + 1$.
- 24 • If $FwdSeq < V(R_{Test})$, then the access network shall generate a
25 *LoopBackSyncLost* indication.

26 2.7.5 DRC Channel Transmission

27 2.7.5.1 Access Terminal Requirements

28 If the DRC Value Fixed mode is enabled, then the access terminal shall set its transmitted
29 DRC to the value specified by the DRCValueFixedMode attribute.

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

2.7.6 ACK Channel Transmission

2.7.6.1 Access Terminal Requirements

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

If the ACK Channel Bit value is '0', the access terminal shall receive packets on the Forward Traffic Channel as if all the packets were successfully received in one slot duration. Even if a packet has not been successfully decoded in a single slot and its full-length in slots [1] is greater than one, the access terminal shall stop receiving the packet after one slot. It shall accordingly continue generating and transmitting FTAP Loop Back Packets, if the Loop Back mode is enabled.

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

2.8 Message Formats

2.8.1 FTAPParameterAssignment

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

Field	Length (bits)
MessageID	8
TransactionID	8

Zero or more occurrences of the following record:

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

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

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

AttributeRecord The AttributeRecord is a simple record defined in [1]. The permissible attribute records are DRCValueFixedMode, DRCCoverFixedMode, ACKChannelBitFixedMode, and LoopBackMode as specified in 2.8.1.1 to 2.8.1.4.

Channels	CC FTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.1.1 DRCHandleFixedMode Attribute

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

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

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

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

DRCValue This field is coded as per DRC value specification in [1]. All values in the range 0x00-0x0c are permissible.

2.8.1.2 DRCCoverFixedMode Attribute

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

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

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

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

DRCCover This field represents the index of the 8-ary Walsh function, defined in [1], to be used as the DRC cover.

2.8.1.3 ACKChannelBitFixedMode Attribute

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

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

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

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

ACKChannelBit This field is coded as per ACK Channel bit value specification in [1]. Only values in the range 0x00-0x01 are permissible. This field shall be set to 0x00, if the ACK Channel bit value of '0' has to be transmitted. This field shall be set to 0x01, if the ACK Channel bit value of '1' has to be transmitted.

2.8.1.4 LoopBackMode Attribute

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

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

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

AttributeID The access network shall set this field to 0x03.

LoopBackPersistence This field indicates to the access terminal if the Loop Back mode is to be maintained in the event of a connection closure or a lost connection.

1 A value of 0x00 indicates that the Loop Back mode is not to be
 2 maintained, i.e. it defaults to no Loop Back mode. A value of 0x01
 3 indicates that the Loop Back mode is to be maintained. All other
 4 values are reserved.

5 2.8.2 FTAPParameterComplete

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

8

Field	Length (bits)
MessageID	8
TransactionID	8

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

10 TransactionID The access terminal shall set this field to the TransactionID field
 11 value of the associated FTAPParameterAssignment message.

12

Channels	RTC	SLP	Reliable
Addressing	unicast	Priority	40

13 2.8.3 FTAPStatsClearRequest

14 The access network sends this message to command the access terminal to reset the
 15 statistics collected at the access terminal.

16

Field	Length (bits)
MessageID	8
TransactionID	8

One or more occurrences of the following record:

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

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

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

21 AttributeID The access network shall set this field to the AttributeID of the
 22 IdleASPStats, or the ConnectedSSStats or the FirstSyncCCPktStats
 23 as per 2.8.6.1, 2.8.6.2 or 2.8.6.3, respectively.

24

Channels	CC FTC	SLP	Best Effort
Addressing	unicast	Priority	40

1 2.8.4 FTAPStatsClearResponse

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

4

Field	Length (bits)
MessageID	8
TransactionID	8

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

6 TransactionID The access terminal shall set this field to the TransactionID field of
7 the associated FTAPStatsClearRequest message.

8

Channels	RTC	SLP	Best Effort
Addressing	unicast	Priority	40

9 2.8.5 FTAPStatsGetRequest

10 The access network sends this message to retrieve collected statistics from the access
11 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 0x04.

14 TransactionID The access network shall set this field to 1 higher than the
15 TransactionID field of the last FTAPStatsGetRequest message (mod
16 256) sent to this access terminal.

17 AttributeID The access network shall set this field to the AttributeID of the
18 IdleASPStats, or the ConnectedSSStats or the FirstSyncCCPktStats
19 as per 2.8.6.1, 2.8.6.2 or 2.8.6.3, respectively.

Channels	CC FTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.6 FTAPStatsGetResponse

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

Field	Length (bits)
MessageID	8
TransactionID	8

One or more occurrences of the following record:

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

MessageID The access terminal shall set this field to 0x05.

TransactionID The access terminal shall set this field to the TransactionID field of the corresponding FTAPStatsGetRequest message.

AttributeRecord The AttributeRecord is a simple attribute as defined in [1]. The IdleASPStats Attribute has the format as described in 2.8.6.1. The ConnectedSSStats Attribute has the format as described in 2.8.6.2. The FirstSyncCCPktStats Attribute has the format as described in 2.8.6.3.

Channels	RTC	SLP	Reliable
Addressing	unicast	Priority	40

2.8.6.1 IdleASPStats Attribute

This AttributeRecord provides the Active Set Pilot Change statistics collected by the access terminal.

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 set
2 this field to 0x06. It gives the length of the attribute excluding the
3 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 statistics
7 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} .

12 2.8.6.2 ConnectedSSStats Attribute

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

15

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

- 16 Length Length of the simple attribute in octets. The access terminal shall set
17 this field to 0x06. It gives the length of the attribute excluding the
18 Length field.

- 1 AttributeID The access terminal shall set this field to 0x05.
- 2 ConnectedSSChangeOverflow
- 3 This bit shall be set to '1' if the value of the ConnectedSSChange
4 statistics exceeds $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 5 ConnectedSSChange The value of ConnectedSSChange statistics mod 2^{15} .
- 6 ConnectedTimeOverflow
- 7 This bit shall be set to '1' if the value of the ConnectedTime statistics
8 exceeds $(2^{23} - 1)$. Otherwise, it shall be set to '0',
- 9 ConnectedTime The value of ConnectedTime statistics mod 2^{23} .

10 2.8.6.3 FirstSyncCCPktStats

11 This AttributeRecord provides the First Synchronous CC packet statistics collected by the
12 access terminal.

13

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

- 14 Length Length of the simple attribute in octets. The access terminal shall set
15 this field to 0x05. It gives the length of the attribute excluding the
16 Length field.
- 17 AttributeID The access terminal shall set this field to 0x06.
- 18 FirstSyncCCPktOverflow
- 19 This bit shall be set to '1' if the value of the FirstSyncCCPkt statistics
20 exceeds $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 21 FirstSyncCCPkt The value of FirstSyncCCPkt statistics mod 2^{15} .
- 22 CCTimeOverflow This bit shall be set to '1' if the value of the CCTime statistics exceeds
23 $(2^{15} - 1)$. Otherwise, it shall be set to '0',
- 24 CCTime The value of CCTime statistics mod 2^{15} .

1 **2.9 FTAP Packet Formats**

2 2.9.1 FTAP Test Packet

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

4

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

5 ProtocolID This field identifies the protocol to which this packet belongs. This
6 field shall be set to '00' for the FTAP packets.

7 PacketType This field identifies the packet type within the FTAP protocol. This
8 field shall be set to 0x0.

9 SEQ The sequence number of this FTAP Test Packet. This is set to the
10 value of $V(S_{Test})$ when the packet is generated.

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

13 2.9.2 FTAP Loop Back Packet

14 This packet is sent by the access terminal on the Reverse Traffic Channel to convey
15 information about the received FTAP Test Packets on the Forward Traffic Channel.

16

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

Up to 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
2		field shall 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 0x1.
5	FwdSysTime	CDMA System Time in frames mod 32768 corresponding to the start
6		(0 th slot) of the 16-slot observation interval covered by this FTAP Loop
7		Back Packet.
8	LBPktOverflow	This field indicates if any FTAP Loop Back Packets were lost due to
9		buffer overflow. It is set to the value of the LBOverflowBit (see
10		2.7.4.1).
11	RecordCount	This is the Number of FTAP Test Packet Records associated with the
12		observation interval. If no FTAP Test Packet Records are included,
13		this field shall be set to 0. The valid range for this field shall be 0
14		through 16.
15	TCAMsgSeqIncluded	For the first record this field shall be set to '1'. For subsequent
16		records, if the TCAMsgSeq value is the same as the last record, then
17		this field shall be set to '0'. Otherwise, this field shall be set to '1'.
18	TCAMsgSeq	The MessageSequence field of the last TrafficChannelAssignment
19		message [1], that assigned the Channel on which the current FTAP

1		Test Packet was received. If the TCAMsgSeqIncluded field is set to 1,
2		this field shall be included. Otherwise, this field shall be omitted.
3	DRCCover	Sector cover associated with the Serving Sector for the current FTAP
4		Test Packet.
5	FwdPhysSlots	The number of slots over which the Physical Layer packet containing
6		the current FTAP Test Packet was received.
7	FwdMACPkts	The number of MAC packets received in the Physical Layer packet
8		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

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

2.10 Protocol Numeric Constants

Constant	Meaning	Value
$T_{\text{FTAPConfig}}$	Maximum time for the access terminal to send an FTAPParameterComplete message after receiving an FTAPParameterAssignment message.	2 s
T_{FTATStat}	Maximum time for the access terminal to respond to an FTAPStatsClearRequest or FTAPStatsGetRequest message.	4 s

1 **2.11 Interface to Other Protocols**

2 2.11.1 Commands

3 This protocol does not issue any commands.

4 2.11.2 Indications

5 This protocol registers to receive the following indications:

- 6 • *ConnectedState.ConnectionClosed.*
- 7 • *RouteUpdate.IdleHO.*
- 8 • *RouteUpdate.ConnectionLost.*
- 9 • *IdleState.ConnectionOpened*

10

11

- 1 No text.

3 REVERSE TEST APPLICATION PROTOCOL (RTAP) SPECIFICATION

3.1 Overview

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

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

3.2 Data Encapsulation

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

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

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

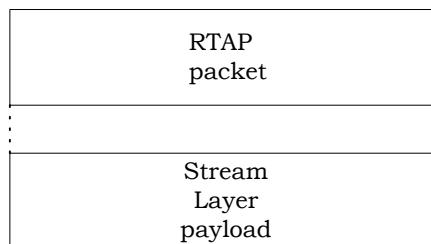


Figure 3.2-1 RTAP Packet Encapsulation

3.3 Primitives and Public Data

3.3.1 Commands

This protocol does not define any commands.

3.3.2 Indications

This protocol returns the following indications:

- *RTAPSyncLost*

1 3.3.3 Public Data

2 None.

3 **3.4 Protocol Data Unit**

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

6 The RTAP also uses signaling messages for controlling and configuring the access terminal
7 and the access network. When RTAP sends these messages it shall use the Signaling
8 Application [1].

9 **3.5 Test Statistics**

10 3.5.1 Access Network Requirements

11 The access network may maintain the following statistics:

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

19 **3.6 Procedures**

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

- 22 • Test Parameter Configuration: Procedures and messages for configuring test
23 parameters.
- 24 • RTAP Packet Transmission and Reception: Procedures for sending and receiving
25 RTAP Test Packets and RTAP Fill Packets on the Reverse Traffic Channel.

26 3.6.1 Test Parameter Configuration

27 3.6.1.1 Access Terminal Requirements

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

30 When the protocol receives a *ConnectedState.ConnectionClosed* or
31 *RouteUpdate.ConnectionLost* [1] indication, the access terminal shall execute the
32 configuration initialization procedure in 3.6.1.1.2.

33 If the access terminal receives an RTAPParameterAssignment message, it shall do the
34 following steps in sequence:

- 35 • Execute the configuration initialization procedure in 3.6.1.1.1.

- 1 • Execute the test parameter initialization procedure in 3.6.1.1.3.
- 2 • If the message includes the RTAPTestPktEnable attribute, then the RTAP Test
- 3 Packet mode is enabled, and the value of the RTAPTestPktPersistence field is stored.
- 4 The RTAP Test Packet buffer is cleared and the RTAPTestPktOverflowBit is set to '0'
- 5 (see 3.6.2.1.1).
- 6 • If the message includes the PacketRateMode attribute, then the Configured Packet
- 7 Rate mode is enabled. The values of the MinRate and MaxRate fields are stored (see
- 8 3.6.2.1.2).
- 9 • Send an RTAPPParameterComplete message. The TransactionID field shall be set to
- 10 the same value as that received in the RTAPPParameterAssignment message. The
- 11 RTAPPParameterComplete message shall be sent within $T_{RTAPConfig}$ from when the
- 12 RTAPPParameterAssignment message is received.

13 3.6.1.1.1 Access Terminal Configuration Initialization

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

- 16 • The RTAP Test Packet mode is disabled.
- 17 • The Configured Packet Rate mode is disabled.

18 3.6.1.1.2 Access Terminal Configuration for Closed or Lost Connection

19 When the protocol receives a *ConnectedState.ConnectionClosed* or
20 *RouteUpdate.ConnectionLost* indication [1], the access terminal shall initialize the test
21 configuration as follows:

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

27 3.6.1.1.3 Access Terminal Test Parameter Initialization

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

31 3.6.1.2 Access Network Requirements

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

- 33 • Send an RTAPPParameterAssignment message to the access terminal and wait for an
- 34 RTAPPParameterComplete message containing the same TransactionID as that in the
- 35 RTAPPParameterAssignment message.
- 36 • When the expected RTAPPParameterComplete message is received, execute the Test
- 37 Statistics Initialization procedure in 3.6.1.2.1.

1 3.6.1.2.1 Access Network Test Statistics Initialization

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

- 3 • RTAPTestPktSent[i] to zero for all possible i.
- 4 • RTAPTestPktRecd[i] to zero for all possible i.
- 5 • RTAPTestTime to zero.

6 3.6.2 RTAP Packet Transmission and Reception

7 3.6.2.1 Access Terminal Requirements

8 3.6.2.1.1 Generation and Transmission

9 If the RTAP Test Packet mode is enabled, the access terminal shall generate an RTAP Test
10 Packet at the beginning of every 16-slot interval aligned to the CDMA System Time [1] in
11 frames.

12 The access terminal shall obey the following rules:

- 13 • The RTAP Packets shall be generated only in the Connected State of the Air Link
14 Management Protocol.
- 15 • The information contained in the RTAP Test Packet (see 3.8.1) shall cover RTC
16 Physical Layer packets transmitted up to, but not including, the time instant of
17 generation.
- 18 • The access terminal shall assign a transmission priority of 55 to RTAP Test Packets.
- 19 • The transmission rate for the RTAP Test Packet shall be determined as specified in
20 3.6.2.1.2.
- 21 • The access terminal shall queue the generated RTAP Test Packets. The access
22 terminal shall provide buffering for at least 8 RTAP Test Packets. The
23 RTAPTestPktOverflowBit indicates if any RTAP Test Packets have been lost due to
24 lack of buffer space. When a packet is lost due to lack of buffer space, the
25 RTAPTestPktOverflowBit shall be set to '1'.

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

- 27 • The access terminal shall transmit the queued RTAP Test Packets in the Connected
28 State of the Air Link Management Protocol [1].
- 29 • If the Configured Packet Rate mode is enabled, the access terminal shall transmit an
30 RTAP Fill Packet of the size necessary for the Reverse Traffic Channel MAC Layer
31 packet containing the RTAP Test Packet at the selected rate. The access terminal
32 shall set the priority of the RTAP Fill Packet to 255.
- 33 • When the access terminal transmits a Reverse Traffic Channel MAC Layer packet
34 containing an RTAP Test Packet at a rate with RateIndex i (Table 3.7.1.2-1), it shall
35 increment the sequence number $V_i(S_{Rev})$.

- 1 • If the access terminal receives a *ConnectedState.ConnectionClosed* or a
2 *RouteUpdate.ConnectionLost* [1] indication, and it has queued RTAP Test packets, it
3 shall not attempt to establish a connection to transmit the packets.

4 3.6.2.1.2 Rate Selection

5 If the Configured Packet Rate mode is enabled, the access terminal shall obey the following
6 rules to select a Reverse Traffic Channel rate; otherwise, the access terminal shall select a
7 rate as per the Reverse Traffic Channel MAC Protocol [1].

8 The access terminal shall maintain the following variables:

- 9 • **MinRate:** Value of the MinRate field received in the PacketRateMode attribute of the
10 RTAPPParameterAssignment message.
- 11 • **MaxRate:** Value of the MaxRate field received in the PacketRateMode attribute of the
12 RTAPPParameterAssignment message.
- 13 • **MACMaxRate:** RateIndex as per Table 3.7.1.2-1 corresponding to the maximum rate
14 allowed by the Reverse Traffic Channel MAC protocol [1].
- 15 • **TargetRate:** RateIndex corresponding to the desired rate.
- 16 • **SelectedRate:** RateIndex corresponding to the selected rate.

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

20 TargetRate = TargetRate + 1;

21 If (TargetRate > MaxRate)

22 TargetRate = MinRate;

23 SelectedRate = Min (TargetRate, MACMaxRate);

24 3.6.2.2 Access Network Requirements

25 The access network shall maintain the following variables:

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

31 When an RTAP Test packet arrives for the first time, following the receipt of an
32 RTAPPParameterComplete message, the access network shall

- 33 • Set V(R_{RTAP}) to the value of the RevSysTime field of the RTAP Test Packet.
- 34 • Set X[i] to the value of the (Seq_i field of the RTAP Test Packet) + 1 for all possible
35 values of i.

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

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

- 8 • If $\text{RevSysTime} \geq V(R_{\text{RTAP}})$,
 - 9 ○ RTAPTestPktRecd[k] is incremented by 1.
 - 10 ○ RTAPTestTime shall be incremented by $\text{RevSysTime} - V(R_{\text{RTAP}}) + 1$.
 - 11 ○ $V(R_{\text{RTAP}})$ is set to $\text{RevSysTime} + 1$.
- 12 • If $\text{RevSysTime} < V(R_{\text{RTAP}})$, then the access network shall generate an *RTAPSyncLost*
 13 indication.

14 The fields of a received RTAP Test Packet shall be processed using the values of the Seq_i
 15 fields for all possible values of i as follows:

- 16 • RTAPTestPktSent[i] shall be incremented by $\text{Seq}_i - X[i] + 1$.
- 17 • X[i] shall be set to $\text{Seq}_i + 1$.

18 3.7 Message Formats

19 3.7.1 RTAPParameterAssignment

20 The access network sends this message to configure the RTAP parameters.
 21

Field	Length (bits)
MessageID	8
TransactionID	8

Zero or more occurrences of the following record:

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

22 MessageID The access network shall set this field to 0x80.

23 TransactionID The access network shall set this field to 1 higher than the
 24 TransactionID field of the last RTAPParameterAssignment message
 25 (mod 256) sent to this access terminal.

26 AttributeRecord The AttributeRecord is a simple record defined in [1]. The permissible
 27 attribute records are RTAPTestPktEnable, and PacketRateMode as
 28 specified in 3.7.1.1 to 3.7.1.2.
 29

Channels	CC FTC	SLP	Reliable
Addressing	unicast	Priority	40

3.7.1.1 RTAPTestPktEnable Attribute

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

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

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

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

RTAPTestPktPersistence

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

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

3.7.1.2 PacketRateMode Attribute

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

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 set
2 this field to 0x03. It gives the length of the attribute excluding the
3 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 can
7 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 can
10 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

12 3.7.2 RTAPParameterComplete

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

Field	Length (bits)
MessageID	8
TransactionID	8

16 MessageID The access terminal shall set this field to 0x81.

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

Channels	RTC	SLP	Reliable
Addressing	unicast	Priority	40

4 3.8 RTAP Packet Formats

5 3.8.1 RTAP Test Packet

6 The access terminal transmits these packets on the Reverse Traffic Channel.
 7

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

8 ProtocolID This field identifies the protocol to which this packet belongs. This
 9 field shall be set to '01' for the RTAP packets.

10 PacketType This field identifies the packet type within the RTAP protocol. This
 11 field shall be set to 0x0.

12 RevSysTime CDMA System Time in frames mod 32768 corresponding to the slot
 13 boundary when the RTAP Test Packet was generated.

14 RTAPTestPktOverflow This field indicates if any RTAP Test Packets were lost due to buffer
 15 overflow. It is set to the value of the RTAPTestPktOverflowBit (see
 16 3.6.2.1.1).

17 Seq_0 The sequence number of the last RTAP Test Packet that was
 18 transmitted at a rate of 0 kbps prior to the generation of this RTAP
 19 Test Packet.

1	Seq_1	The sequence number of the last RTAP Test Packet that was
2		transmitted at a rate of 9.6 kbps prior to the generation of this RTAP
3		Test Packet.
4	Seq_2	The sequence number of the last RTAP Test Packet that was
5		transmitted at a rate of 19.2 kbps prior to the generation of this RTAP
6		Test Packet.
7	Seq_3	The sequence number of the last RTAP Test Packet that was
8		transmitted at a rate of 38.4 kbps prior to the generation of this RTAP
9		Test Packet.
10	Seq_4	The sequence number of the last RTAP Test Packet that was
11		transmitted at a rate of 76.8 kbps prior to the generation of this RTAP
12		Test Packet.
13	Seq_5	The sequence number of the last RTAP Test Packet that was
14		transmitted at a rate of 153.6 kbps prior to the generation of this
15		RTAP Test Packet.

16 3.8.2 RTAP Fill Packet

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

19

Field	Length (bits)
ProtocolID	2
PacketType	4
DataFill	Variable

20	ProtocolID	This field identifies the protocol to which this packet belongs. This
21		field shall be set to '01' for the RTAP packets.
22	PacketType	This field identifies the packet type within the RTAP protocol. This
23		field shall be set to 0x1.
24	DataFill	The access terminal shall set this variable length field to zero. The
25		access network shall ignore this field.

3.9 Protocol Numeric Constants

Constant	Meaning	Value
$T_{RTAPConfig}$	Maximum time for the access terminal to send an RTAPPParameterComplete message after receiving an RTAPPParameterAssignment message.	2 s

3.10 Interface to Other Protocols

3.10.1 Commands

This protocol does not issue any commands.

3.10.2 Indications

This protocol registers to receive the following indications:

- *ConnectedState.ConnectionClosed.*
- *RouteUpdate.ConnectionLost.*
- *IdleState.ConnectionOpened.*

- 1 No text

4 TEST APPLICATION EXAMPLE FLOW DIAGRAMS

4.1 Overview

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

4.2 Forward Link Performance Tests

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

4.2.1 Statistics Collection and Retrieval at the Access Terminal

The first example illustrates a scenario for retrieving test statistics collected at the access terminal for verifying access terminal compliance in meeting Control Channel Packet Error Rate performance in the Idle State as required by [2].

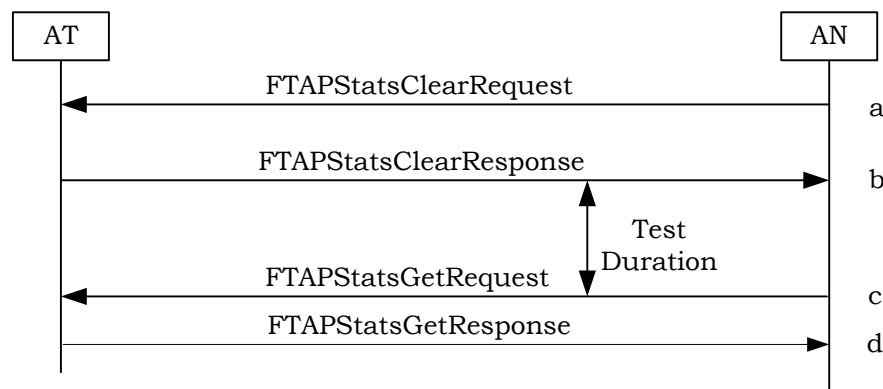


Figure 4.2-1. Flow Diagram for Control Channel Packet Error Rate Measurement

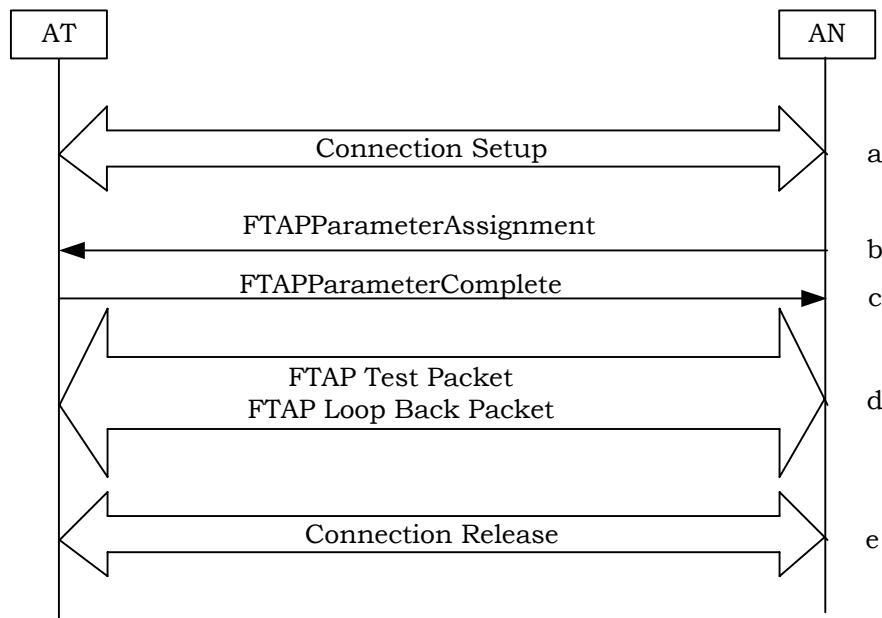
- a. The access network sends an FTAPStatsClearRequest message to clear the statistics maintained at the access terminal.
- b. The access terminal clears the requested statistics and responds with an FTAPStatsClearResponse message.
- c. After sufficient time has elapsed, the access network sends an FTAPStatsGetRequest message to the access terminal requesting FirstSyncCCPktStats Attribute.
- d. The access terminal responds with an FTAPStatsGetResponse message containing the requested attribute.

1 The statistics provided by the access terminal can be used to compute the Control Channel
 2 Packet Error Rate performance as outlined in 4.3.

3 4.2.2 Throughput and Packet Error Rate Measurement

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

6



7

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

9 a. The access network sets up a connection with the access terminal according to [1],
 10 assuming that there is no current connection between them.

11 b. The access network sends an FTAPPParameterAssignment message to configure FTAP
 12 with Loop Back Mode enabled.

13 c. The access terminal responds with an FTAPPParameterComplete message.

14 d. The access network and the access terminal exchange FTAP Test Packets and FTAP
 15 Loop Back Packets. The access network should generate FTAP Test Packets fast
 16 enough to ensure that they are always available for transmission on the Forward
 17 Traffic Channel.

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

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

4.3 Computation of Forward Link Performance

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

- Idle State ASP Change Rate (per second):

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

- Connected State Serving Sector Change Rate (per second):

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

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

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

- Throughput from a sector (kbps):

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

- Throughput from all sectors (kbps):

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

- Throughput over transmitted slots from a sector (kbps):

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

- Throughput over transmitted slots from all sectors (kbps):

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

- Forward link PER (%):

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

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

$$= (1 - \text{FTAPLBPktRecd} / \text{FTAPLBPktSent}) \times 100$$

4.4 Reverse Link Performance Tests

4.4.1 Throughput and Packet Error Rate

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

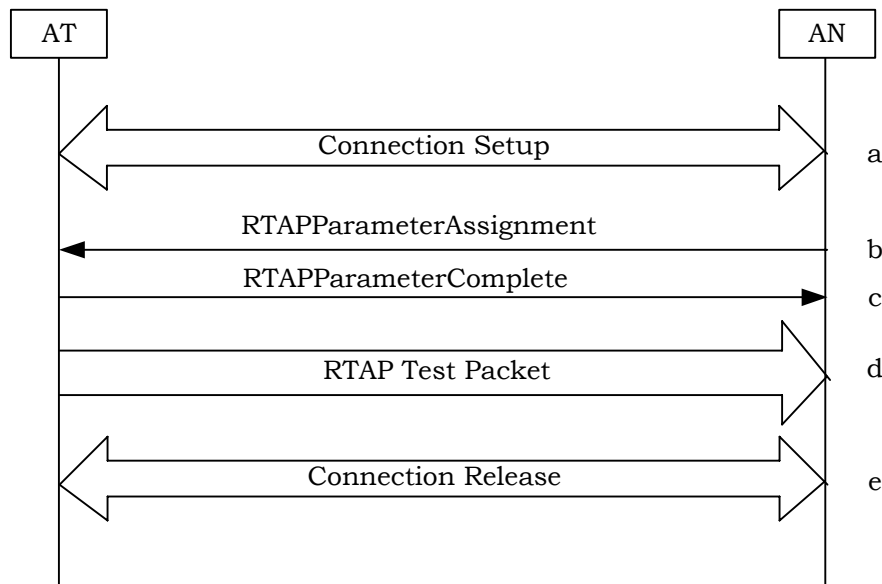


Figure 4.4-1. Flow Diagram for Reverse Link Throughput and PER Measurements

- a. The access network sets up a connection with the access terminal according to [1], assuming that there is no current connection between them.
- b. The access network sends an RTAPPParameterAssignment message containing the RTAPTestPktEnable attribute to enable transmission of RTAP Test Packets by the access terminal.
- c. The access terminal responds with an RTAPPParameterComplete message.
- d. The access terminal sends RTAP Test Packets to the access network.
- e. After sufficient statistics have been collected, the access network releases the connection. This step is not absolutely necessary; in fact, the access network may proceed to perform other tests.

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

4.5 Computation of Reverse Link Performance

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

- Throughput (kbps) for a rate with RateIndex i :

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

- Overall throughput (kbps):

$$= \left(\sum_i \text{RTAPTestPktRecd}[i] \times \text{PhysLayerPktSize}[i] \right) / (\text{RTAPTestTime} \times 16 \times 5 / 3)$$

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

1 = (RTAPTestPktSent[i] – RTAPTestPktRecd[i]) x 100 / RTAPTestPktSent[i]

2 • Overall Packet Error Rate (%):

3 = $\sum_i (RTAPTestPktSent[i] - RTAPTestPktRecd[i]) \times 100 / \sum_i RTAPTestPktSent[i]$

4

5

6

7

- 1 No text