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Technical Specification

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Evolved Universal Terrestrial Radio Access (E-UTRA);
Special conformance testing function
for User Equipment (UE)
(3GPP TS 36.509 version 8.1.0 Release 8)

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Contents

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Introduction

UE Test Loop functionality is a mandatory feature to support E-UTRA / EPC conformance testing. It forms part of the core requirements and thus has a direct impact on the design of User Equipment (UE) for E-UTRA / EPC networks.

The test methods applied in RF Conformance Test Specification TS 36.521-1 [27] and the test models used in Protocol Conformance Test Specifications TS 36.523-1 [30] and TS 36.523-3 [32] actually define the corresponding UE Test Loop functionality. The following specification describes the location of the data loop in the protocol stack as well as the procedure and specific messages to activate the Test Loop functionality in the UE.

1 Scope

The present document defines for User Equipment (UE) in E-UTRA FDD or TDD mode those special functions and their activation methods that are required in User Equipment (UE) for conformance testing purposes.

This document also includes the operation of these special functions for UEs supporting E-UTRA FDD or TDD mode, when operating in UTRA FDD and TDD mode, in GSM/GPRS mode, and in CDMA2000 mode.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[3] 3GPP TS 23.122: "Non-Access-Stratum functions related to Mobile Station (MS) in idle mode".

[4] 3GPP TS 23.401: "3GPP System Architecture Evolution; GPRS enhancements for E-UTRAN access".

[5] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[6] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".

[7] 3GPP TR 24.801: "3GPP System Architecture Evolution; CT WG1 Aspects".

[8] 3GPP TS 27.007: "AT command set for User Equipment (UE)".

[9] 3GPP TS 31.101: "UICC-Terminal Interface; Physical and Logical Characteristics".

[10] 3GPP TS 34.108: "Common Test Environments for User Equipment (UE) Conformance Testing".

[11] 3GPP TS 34.109: "Terminal logical test interface; Special conformance testing functions".

[12] 3GPP TS 34.123-1: "User Equipment (UE) conformance specification; Part 1: Protocol conformance specification".

[13] 3GPP TS 34.123-2: "User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification".

[14] 3GPP TS 34.123-3: "User Equipment (UE) conformance specification; Part 3: Abstract Test Suites (ATS)".

[15] 3GPP TS 36.133: "Requirements for support of Radio Resource Management".

[16] 3GPP TS 36.211: "Physical Channels and Modulation".

[17] 3GPP TS 36.212: "Multiplexing and Channel Coding".

[18] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[19] 3GPP TS 36.302: "Services provided by the physical layer for E-UTRA".

[20] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (EUTRA) User Equipment (UE) Procedures in idle mode ".

[21] 3GPP TS 36.306: "Evolved Universal Terrestrial Radio Access (EUTRA) User Equipment (UE) Radio Access capabilities ".

[22] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (EUTRA) Medium Access Control (MAC) protocol specification".

[23] 3GPP TS 36.322: "Evolved Universal Terrestrial Radio Access (EUTRA) Radio Link Control (RLC) protocol specification".

[24] 3GPP TS 36.323: "Evolved Universal Terrestrial Radio Access (EUTRA) Packet Data Convergence Protocol (PDCP) specification".

[25] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (EUTRA) Radio Resource Control (RRC) Protocol Specification".

[26] 3GPP TS 36.508: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE); Conformance Testing".

[27] 3GPP TS 36.521-1: " Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification Radio transmission and reception; Part 1: Conformance Testing".

[28] 3GPP TS 36.521-2: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)".

[29] 3GPP TS 36.521-3: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification Radio transmission and reception; Part 3: Radio Resource Management Conformance Testing".

[30] 3GPP TS 36.523-1: " Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification".

[31] 3GPP TS 36.523-2: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification".

[32] 3GPP TS 36.523-3: " Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC)); User Equipment (UE) conformance specification; Part 3: Abstract Test Suites (ATS)".

[33] 3GPP TS 44.014: "Individual equipment type requirements and interworking; Special conformance testing functions".

[34] 3GPP TS 51.010-1: "Mobile Station (MS) conformance specification; Part 1: Conformance specification ".

[35] ISO/IEC 9646 (all parts): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] apply, unless specified below:

UE (User Equipment): user equipment that is under test

SS (System Simulator): test system (or equipment) that drives the test process between UE, like eNB (evolved Node B) simulator

User: test user, who handles the test and measurement process via the logical test interface

Logical Test Interface: interface which provides the logical service to interwork and to communicate between UE and System Simulator during the test of a UE

TC (Test Control): UE protocol entity used by the SS to control the UE specific testing functions

Bi-directional Data Radio Bearer: Data radio bearer identified by a data radio bearer identifier capable to deliver data in both downlink and uplink

3.2 Abbreviations

For the purposes of the present document, the abbreviations specified in TR 21.905 [1] apply, with any additional abbreviations specified below:

DRB	Data Radio Bearer
E-UTRA	Evolved Universal Terrestrial Radio Access
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
EMM	EPS Mobility Management
ENB	Evolved Node B
EPS	Evolved Packet System
EPS Bearer	Evolved Packet System Bearer
ESM	EPS Session Management
FDD	Frequency Division Duplex
FFS	For Further Study
GERAN	GSM/EDGE Radio Access Network
GPRS	General Packet Radio System
GSM	Global System for Mobile Communications
IETF	Internet Engineering Task Force
LB	Loop Back
MAC	Media Access Control
NAS	Non Access Stratum
PDCP	Packet Data Convergence Protocol
RAB	Radio Access Bearer
RB	Radio Bearer
RLC	Radio Link Control
RLP	Radio Link Protocol
RMC	Reference Measurement Channel
ROHC	Robust Header Compression
RRC	Radio Resource Control
SAP	Service Access Point
SAPI	Service Access Point Indicator
SDF	Service Data Flow
SNDCP	Sub-Network Dependent Convergence Protocol
SS	System Simulator
TC	Test Control
TDD	Time Division Duplex

UE	User Equipment
UICC	UMTS Integrated Circuit Card
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identity Module
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

4 UE special conformance test functions

4.1 General description

The SS performs activation and deactivation of the conformance test functions in the UE by sending Security Protected NAS Layer 3 messages. Apart from sending the appropriate deactivation command to the UE the functions shall be deactivated by:

- switching off the UE; or
- by removing the USIM.

Editor"s note: Further changes may be required to support USIM removal (e.g. to ensure that UE state variables are reset).

The following special UE conformance testing functions can be activated (and deactivated):

- UE test loop function.

The following TC procedures are used to control the UE test loop function:

- Close UE test loop;
- Open UE test loop.

5 Test Control (TC) protocol procedures and test loop operation

5.1 General description

The UE test loop function provides access to isolated functions of the UE via the radio interface without introducing new physical interfaces just for the reason of conformance testing.

NOTE: It should be emphasised that the UE test loop function only describes the functional behaviour of the UE with respect to its external interfaces; physical implementation of the UE test loop function is completely left open to the manufacturer.

The UE test loop function is activated by transmitting the appropriate Test Control (TC) message to the UE, see clause 6.

The UE test loop function can be operated in two different loopback modes:

- UE test loop mode A; and
- UE test loop mode B.

UE test loop mode A provides loopback of PDCP SDUs for bi-directional data radio bearers while UE is operating in E-UTRA mode. The downlink PDCP SDUs received by the UE on each bi-directional data radio bearer are returned on the same radio bearer regardless of the PDCP SDU contents and of the TFT of the associated EPS bearer context.

UE test loop mode B provides loopback of PDCP SDUs (E-UTRA and UTRA), SNDCP PDUs (GSM/GPRS) and RLP PDUs (CDMA2000) for bi-directional EPS bearers while UE is operated in E-UTRA, UTRA, GSM/GPRS and CDMA2000 modes. When operating in E-UTRA, the downlink PDCP SDUs received by the UE on all bi-directional data radio bearers are returned by the UE on the data radio bearer associated with an EPS bearer context with a TFT matching the TCP/UDP/IP protocol information within the PDCP SDU. When operating in UTRA, GSM/GPRS and CDMA2000 modes, the downlink PDCP SDUs received by the UE on all bi-directional data radio bearers are returned by the UE on the data radio bearer with the smallest identity, regardless of the PDCP SDU contents and of the TFT of the associated EPS bearer context.

UE test loop mode A is mandatory to all E-UTRA UEs.

UE test loop mode B for operation in E-UTRA mode is mandatory to all E-UTRA UEs.

UE test loop mode B for operation in UTRA mode is mandatory to all E-UTRA UEs supporting UTRA radio access.

UE test loop mode B for operation in GSM/GPRS mode is mandatory to all E-UTRA UEs supporting GSM/GPRS radio access.

UE test loop mode B for operation in CDMA2000 mode is mandatory to all E-UTRA UEs supporting CDMA2000 radio access.

For E-UTRA UE supporting multiple radio access technologies then UE reception of Test Control messages is limited to UE operating in E-UTRA mode, while continuation of loopback of user data is provided over the change to other UE supported radio access technologies.

UE test loop mode B for operation in UTRA, GSM/GPRS and CDMA2000 mode is only applicable for loopback of user data in PS domain.

The Test Control (TC) entity may be seen as a L3 or a NAS entity.

Figure 5.1-1 shows a functional block diagram of UE test loop function for Test Control (TC) entity and UE test loop mode A. The loopback of PDCP SDUs for UE test loop mode A is specified in sub clause 5.3.3.

Figure 5.1-2 shows a functional block diagram of UE test loop function for Test Control (TC) entity and UE test loop mode B. The loopback of IP PDUs/PDCP SDUs for UE test loop mode B and UE in E-UTRA mode is specified in subclauses 5.3.4.2 and 5.3.4.3.

Figure 5.1-3 shows a functional block diagram of UE test loop function for UE test loop mode B and UE operating in UTRA mode. The loopback of IP PDUs/PDCP SDUs for UE test loop mode B and UE in UTRA mode is specified in subclauses 5.3.4.4 and 5.3.4.5.

Figure 5.1-4 shows a functional block diagram of UE test loop function for UE test loop mode B for UE operating in GSM/GPRS mode. The loopback of IP PDUs/SNDCP SDUs for UE test loop mode B and UE in GSM/GPRS mode is specified in subclauses 5.3.4.6 and 5.3.4.7.

Figure 5.1-5 shows a functional block diagram of UE test loop function for UE test loop mode B for UE operating in CDMA2000 mode. The loopback of IP PDUs/RLP SDUs for UE test loop mode B and UE in CDMA2000 mode is specified in subclauses 5.3.4.8 and 5.3.4.9.

NOTE: ROHC functionality in PDCP Layer 2 is optional for UE implementations.

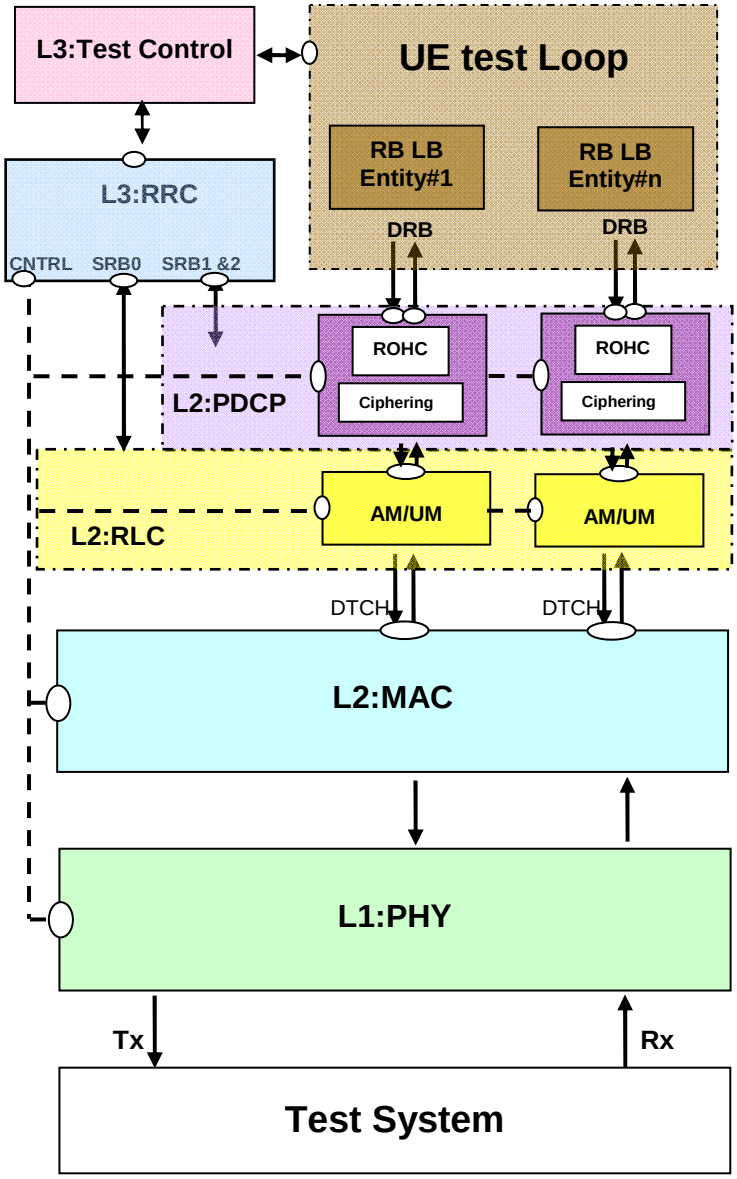

Figure 5.1-1: Model for Test Control and UE Test Loop Mode A on UE side for E-UTRA

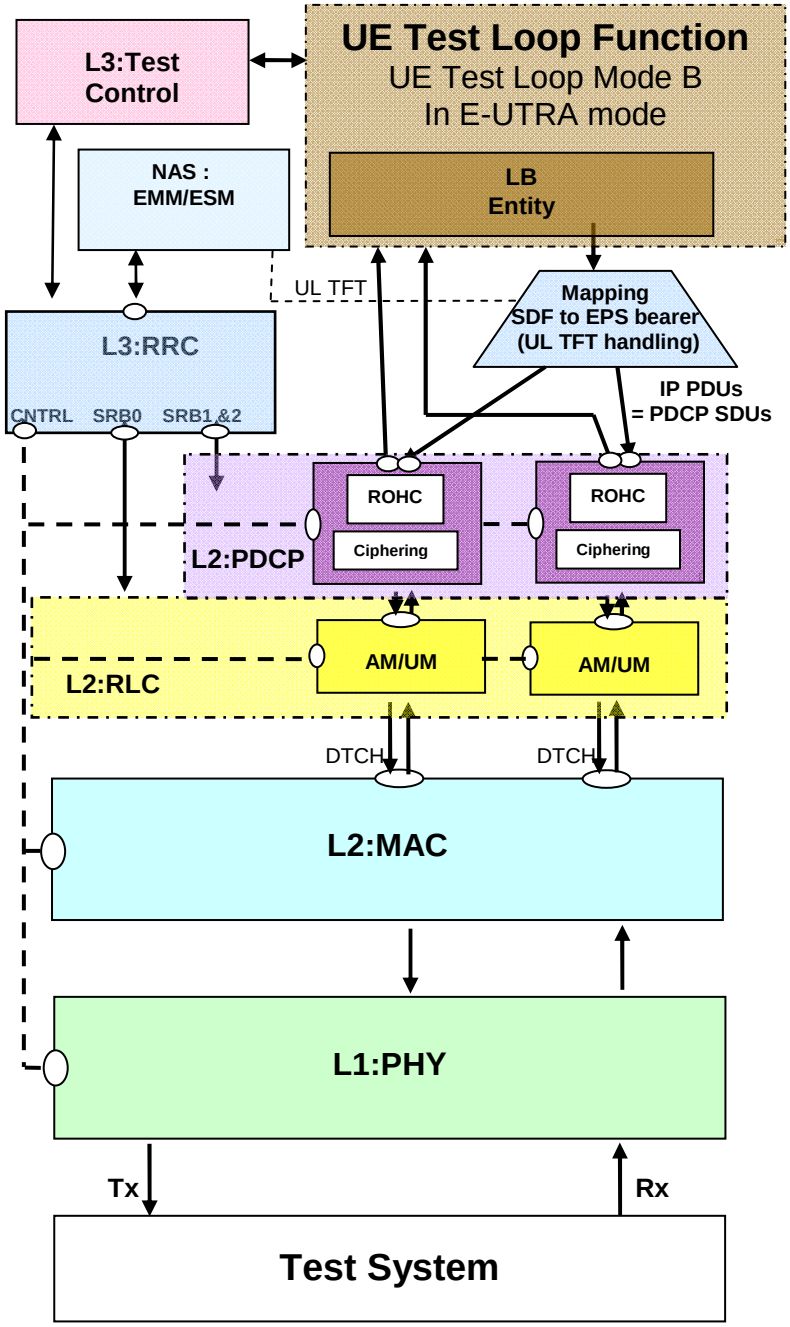

Figure 5.1-2: Model for Test Control and UE Test Loop Mode B on UE side for E-UTRA

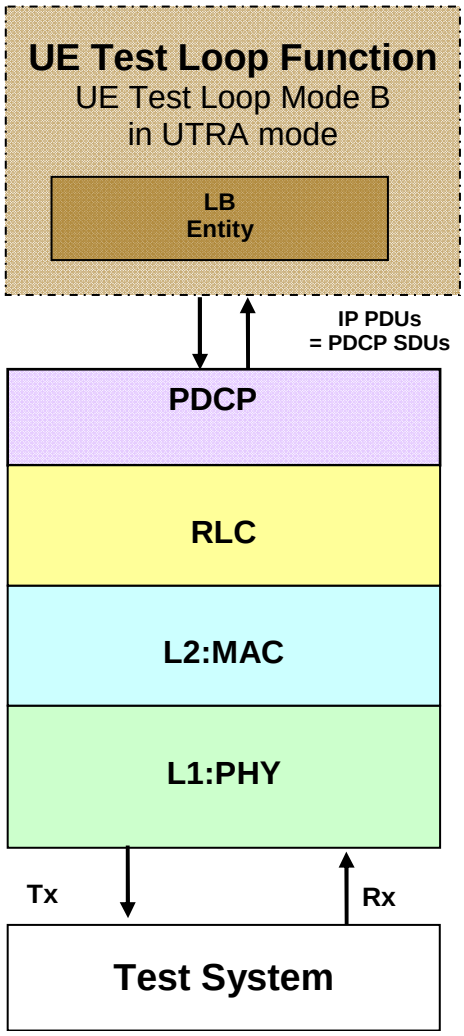

Figure 5.1-3: Model for UE Test Loop Mode B on UE side for UTRA

Editor"s note: It is FFS if the entity handling mapping of SDF to PS bearer in uplink (UL TFT handling) for the UTRA case needs to be included in figure 5.1-3. Currently UE test loop mode B is limited to loopback of a single PS radio bearer in UTRA mode.

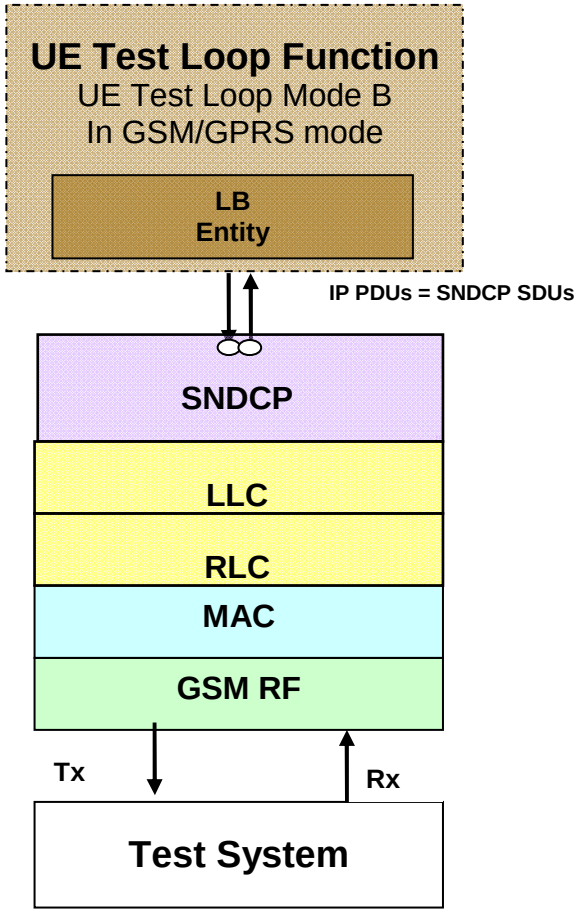

Figure 5.1-4: Model for UE Test Loop Mode B on UE side for GSM/GPRS

Editor"s note: It is FFS if the entity handling mapping of SDF to NSAPI in uplink (UL TFT handling) for the GSM/GPRS case needs to be included in figure 5.1-4. Currently UE test loop mode B is limited to a single PS radio bearer in GSM/GPRS mode.

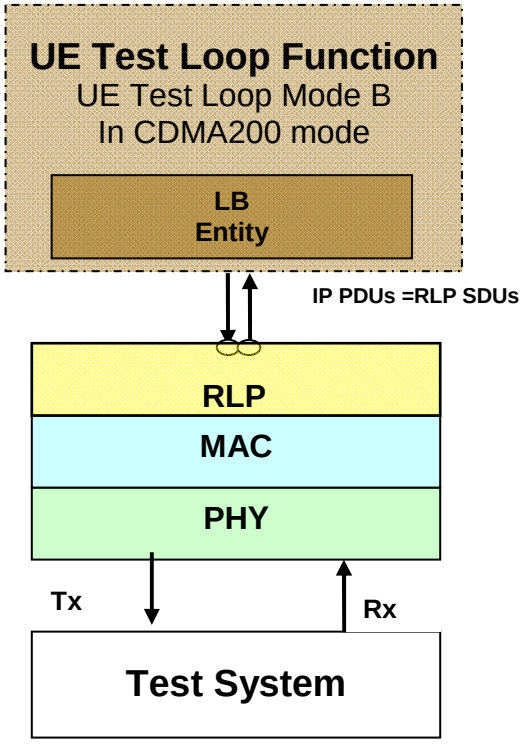

Figure 5.1-5: Model for UE Test Loop Mode B on UE side for CDMA2000

5.2 Loopback delay requirement

Editor"s note The loopback delay requirement is FFS. For UE test loop mode A it is expected that the requirement will not be more stringent than it was for UTRA in TS 34.109. For UE test loop mode B it is expected that the timing/delay requirement will be even less stringent.

5.3 UE test mode procedures

5.3.1 General

The UE test mode is intended for setting the UE into a test mode where the SS can set up data radio bearers (UE test loop mode A) or EPS bearers (UE test loop mode B) to be terminated in the UE test loop function.

Editor"s note: It is FFS if any specific UE behaviour needs to be specified to prevent that NAS or applications don"t interfere with UE test loop function.

5.3.2 Activate UE test mode

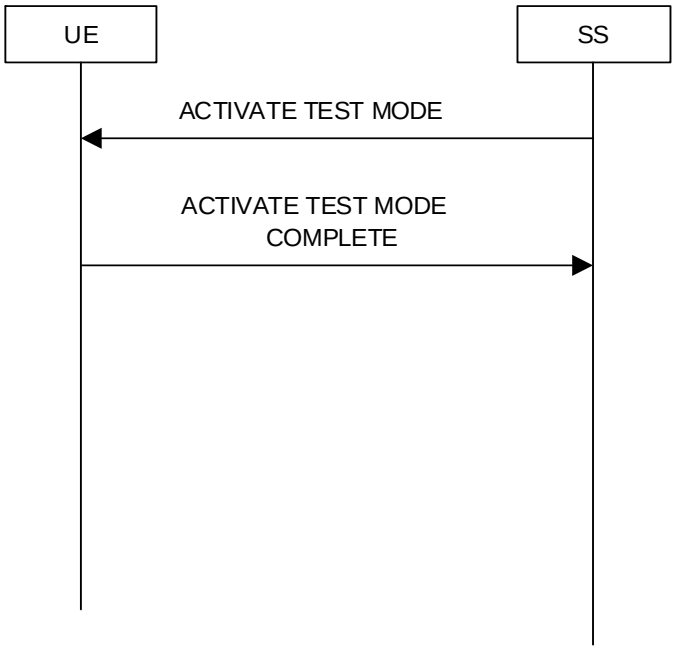

Figure 5.3.2-1: Activate UE test mode procedure

5.3.2.1 General

The SS uses the activate UE test mode procedure to get the UE into a test mode where the SS can set up one or more sets of data radio bearers, associated EPS bearer context (UE test loop mode A) or EPS bearers (UE test loop mode B) before commanding the UE to terminate them in the UE test loop function. The activation of the UE test loop function in UE test loop mode A or UE test loop mode B will control if the UE is terminating the data radio bearers or the EPS bearers in the UE test loop function.

5.3.2.2 Initiation

The SS can activate the UE test mode when UE is in E-UTRA connected state.

The SS requests the UE to activate the UE test mode by transmitting an ACTIVATE TEST MODE message.

5.3.2.3 Reception of ACTIVATE TEST MODE message by UE

When receiving the ACTIVATE TEST MODE message the UE shall:

1>-activate the UE test mode;

1>-send ACTIVATE TEST MODE COMPLETE message.

When the UE test mode is active, the UE shall:

1> accept any request to establish a data radio bearer with an associated EPS bearer context, both included in the same RRC message, and within the radio access capabilities of the UE;

1> if neither test loop mode A operation nor test loop mode B operation is ongoing:

2> not transmit any uplink PDCP SDU.

5.3.3 Deactivate UE test mode

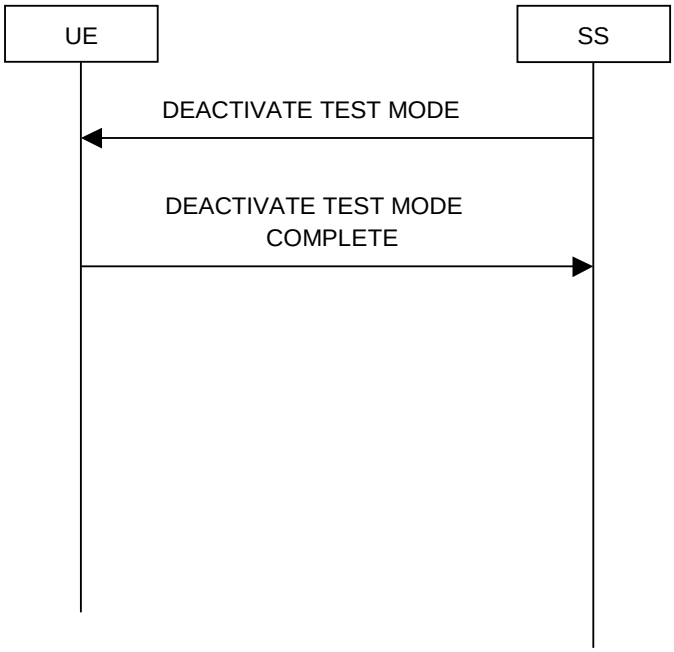

Figure 5.3.3-1: Deactivate UE test mode procedure

5.3.3.1 General

The purpose of this procedure is to deactivate the UE test mode and return UE to normal operation.

5.3.3.2 Initiation

The SS can deactivate the UE test mode when UE is in E_UTRA connected state and the UE test mode is active.

The SS requests the UE to deactivate the UE test mode by transmitting a DEACTIVATE TEST MODE message.

5.3.3.3 Reception of DEACTIVATE TEST MODE message by UE

When receiving the DEACTIVATE TEST MODE message the UE shall:

1>deactivate the UE test mode;

1>send a DEACTIVATE TEST MODE COMPLETE message.

5.4 UE test loop procedures

5.4.1 General

The UE test loop function is intended for:

- E-UTRA RF receiver and transmitter testing to generate data transfer in downlink and uplink.
- E-UTRA layer 2 (MAC, RLC, PDCP) and data radio bearer testing to generate data transfer in downlink and uplink.
- EPC and E-UTRA layer 3 testing to verify data transfer continuation over RRC and EPC procedures.
- EPC NAS user-plane testing to verify uplink TFT handling.
- E-UTRA/EPC Inter-system testing to verify data transfer continuation over Inter-system change procedures to and from UTRA, GSM/GPRS and CDMA2000.

5.4.2 Close UE test loop

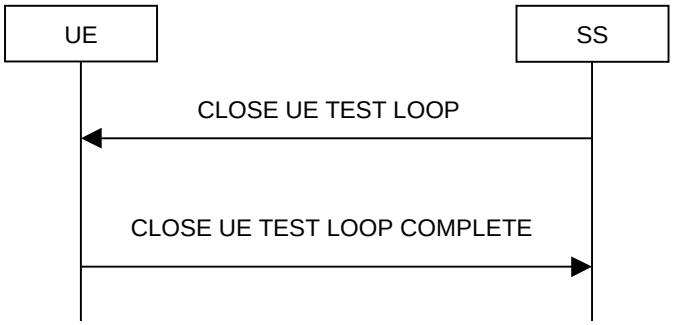

Figure 5.4.2-1: Close UE test loop procedure

5.4.2.1 General

The SS uses the close UE test loop procedure to start the UE Test Loop function in the UE while in E-UTRA mode.

A prerequisite for UE test loop mode A is that at least one bi-directional data radio bearer has been established between SS and UE.

A prerequisite for UE test loop mode B is that at least one EPS bearer context has been established between SS and UE.

The UE shall provide for normal layer 1, layer 2, RRC, EMM and ESM functionality while the UE test loop function is active. This includes (but is not limited to) handover procedures and normal disconnection of the data radio bearer.

For UE test loop mode A the loopback shall be maintained across handovers within E-UTRA, but after data radio bearer release, the loopback shall cease to exist.

For UE test loop mode B the loopback shall be maintained across handovers within E-UTRA and between radio access system (E-UTRA to/from UTRA, E-UTRA to/from GSM/GPRS and E-UTRA to/from CDMA2000). This means that any buffered IP PDUs in the UE test loop function at the time of the intra- or inter-system change shall be kept in the UE test loop function and being scheduled for transmission transparently to the intra- or inter-system change.

5.4.2.2 Initiation

The SS can request the UE to close a test loop in mode A if at least one bi-directional data radio bearer is established and the UE test mode is active.

The SS can request the UE to close a test loop in mode B if at least one EPS bearer is established and the UE test mode is active.

The SS requests the UE to close its UE test loop mode A or UE test loop mode B test loop(s) by transmitting a CLOSE UE TEST LOOP message.

5.4.2.3 Reception of CLOSE UE TEST LOOP message by the UE

When receiving the CLOSE UE TEST LOOP message the UE shall:

1>-if UE test loop mode A has been selected;

2>-if no bi-directional data radio bearers are established or if the UE test mode is not active; or

2>- if test loop mode A or test loop mode B operation is already closed on one or more data radio bearers:

3>- the UE behaviour is unspecified

2>-else:

3>-terminate all bi-directional data radio bearers in the UE Test Loop Function;

3> for LB_ID=0 to MAX_ ModeA_LB-1_entities:

4> set DRB_ID(LB_ID) to 0 (indicate no DRB mapped)

4> set UL_PDCP_SDU_scaling(LB_ID) to FALSE

3> set LB_ID to 0

3> for each established bi-directional data radio bearer in ascending order and starting with the data radio bearer with the lowest configured Data Radio bearer identity number:

4> if LB_ID is less than MAX_ ModeA_LB_entities:

5> set DRB_ID(LB_ID) to the Data Radio bearer identity number

5> increment LB_ID by 1

4> else:

5> the UE behaviour is unspecified

3> if the UE test loop mode A setup IE is included:

4> for each LB Setup DRB IE in the LB setup list of the UE test loop mode A setup IE:

5>-for LB_ID=0 to MAX_ ModeA_LB_entities-1:

6> if DRB_ID(LB_ID) is equal to the Data Radio bearer identity number parameter of the LB Setup DRB IE:

7>-if the LB Setup DRB(LB_ID) IE is included:

7>-set UL_PDCP_SDU_scaling(LB_ID) to TRUE

7>-set UL_PDCP_SDU_size(LB_ID) to UL PDCP SDU size parameter of the LB Setup DRB(LB_ID) IE

3>-activate the UE Test Loop Functions for UE Test Loop Mode A operation loopback; and

3>-send CLOSE UE TEST LOOP COMPLETE message (the loopback shall be operational prior to the sending of the acknowledgement).

1>-else if UE test loop mode B has been selected;

2>-if no EPS bearer is established or if the UE test mode is not active; or

2>-if the test loop is already active on one or more EPS bearers:

3>-the UE behaviour is unspecified.

2>-otherwise:

3>-set TEST_LOOP_MODE_B_ACTIVE to TRUE

3>-terminate all established EPS bearers in downlink in the UE Test Loop Function;

3>-if the IP PDU delay timer parameter of the UE test loop mode B IE has a value larger than zero:

4>-set timer T_delay_modeB to the value of IP PDU delay timer parameter of the UE test loop mode B IE; and

4>-set BUFFER_IP_PDUs to TRUE

3>-else if IP PDU delay timer parameter of the UE test loop mode B IE is equal to zero:

4>-if T_delay_modeB timer is running:

5>-Stop T_delay_modeB timer;

4>-set timer T_delay_modeB equal to zero;

4>-set BUFFER_IP_PDUs = FALSE

3>-activate the loopback; and

3>-send CLOSE UE TEST LOOP COMPLETE message (the loopback shall be operational prior to the sending of the acknowledgement).

1>-else;

2>- the UE behaviour is unspecified.

5.4.3 UE test loop mode A operation

When operating in E-UTRA mode and UE Test Loop Mode A is active and UE is receiving a PDCP SDU for the loopback entity identified by LB_ID the UE shall:

1>-if UL_PDCP_SDU_scaling(LB_ID) is FALSE:

2>-take the PDCP SDU from the output of the PDCP service access point (SAP) and input to the correspondent PDCP SAP in uplink and transmit, see Figure 5.4.3-1.

1>-else:

2>-if UL_PDCP_SDU_size(LB_ID) = 0:

3>-discard the PDCP SDU (no data is returned).

2>-else:

3>-if the size of the received PDCP SDU in downlink is equal to UL_PDCP_SDU_size(LB_ID):

4>-take the PDCP SDU from the output of the PDCP SAP and input to the correspondent PDCP SAP in uplink and transmit, see Figure 5.4.3-1.

3>-else if the size of the received PDCP SDU in downlink is bigger than UL_PDCP_SDU_size(LB_ID):

4>-create a UL PDCP SDU of size UL_PDCP_SDU_size(LB_ID) by taking the first K bits of the received PDCP SDU in downlink PDCP SAP, where K is equal to UL_PDCP_SDU_size(LB_ID) and input to the correspondent PDCP SAP in uplink and transmit, see Figure 5.4.3-2.

3>-else if the size of the received PDCP SDU in downlink is less than UL_PDCP_SDU_size(LB_ID):

4>-create a UL PDCP SDU of size UL_PDCP_SDU_size(LB_ID) by repeating the data received in downlink PDCP SDU in downlink to fill the UL PDCP SDU (truncating the last block if necessary), see Figure 5.4.3-3.

In both RLC AM and UM modes, UE shall be able to buffer minimum of [10kbytes] of UL PDCP SDU blocks. The UE shall discard the UL PDCP SDU block if its buffer capacity for UL PDCP SDU blocks is exceeded. The UE shall perform the discard either by the loopback entity or the UL PDCP entity.

Editor"s note: The value for minimum UL PDCP SDU buffer size is preliminary set to 10kByte. The value is for further study to secure that the required buffer size is enough to cover all RF testing scenarios and UE categories.

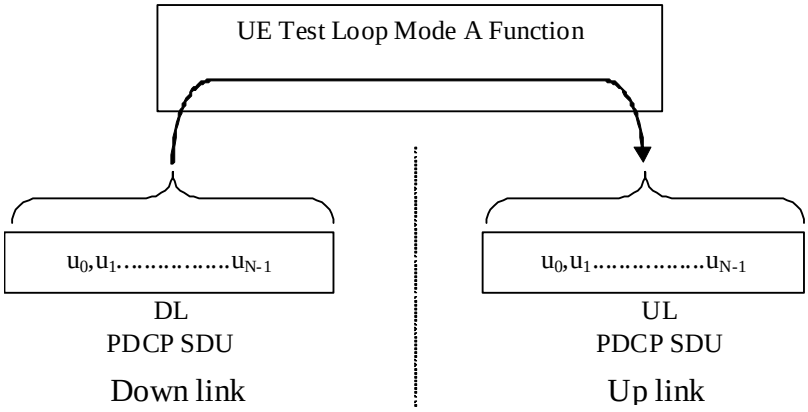

Figure 5.4.3-1: Loop back of PDCP SDU
(DL PDCP SDU size = UL PDCP SDU size = N)

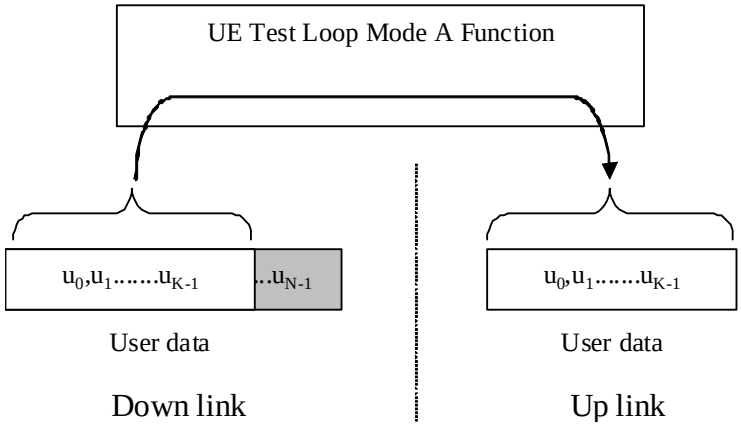

Figure 5.4.3-2: DL > UL PDCP SDU block size
(DL PDCP SDU size = N, UL PDCP SDU size = K)

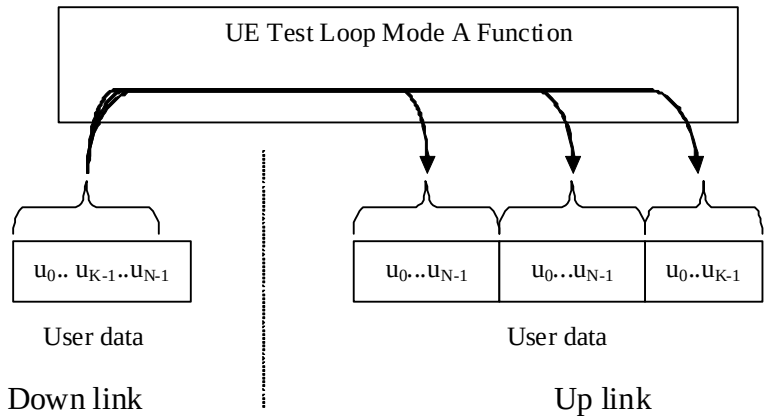

Figure 5.4.3-2: DL < UL PDCP SDU block size
(DL PDCP SDU size = N, UL PDCP SDU size = 2*N + K)

5.4.4 UE test loop mode B operation

5.4.4.1 UE test loop mode B IP PDU buffer size requirement

For UE test loop mode B, when the received IP PDU does not fit in the UE test loop buffer, the UE shall discard the IP PDU. For UE test loop mode B the minimum total IP PDU buffer size supported by the UE shall be [12160 bits].

Editor"s note: The value for minimum IP PDU buffer size is FFS, preliminary value set to 12160 bits correspondent to 1520 octets (maximum SDU size as specified in 24.008).

5.4.4.2 Reception of IP PDUs when UE is in E-UTRA mode

When UE receives a PDCP SDU (=IP PDU) when UE is operating in E-UTRA mode and has UE Test Loop Mode B active the UE shall:

1>-if T_delay_modeB timer is running:

2>-buffer the received PDCP SDU

1>-else

2>-if BUFFER_IP_PDUs is TRUE

3>-buffer the received PDCP SDU

3>-Start T_delay_modeB timer

2>-else

3>-submit the received PDCP SDU without any modification of the IP header to the UL TFT handling service access point (SAP) for transmission in uplink. See note 1.

NOTE: The UL TFT function in the UE is mapping IP PDUs received from SDF to EPS bearer/radio bearer as configured by SS in the UL TFT IE sent as part of the EPS bearer establishment procedures. See figure 5.1-2.

5.4.4.3 Expiry of T_delay_modeB timer when UE is in E-UTRA mode

When timer T_delay_modeB expires when UE is operating in E-UTRA mode and has UE Test Loop Mode B active the UE shall:

1>-return the buffered PDCP SDUs, in the same order as received (first-in-first-out), to the UL TFT handling service access point (SAP) for transmission in uplink on the EPS bearer/radio bearer as configured by SS in the UL TFT IE sent as part of the radio bearer establishment procedure. See note 1.

1>-stop T_delay_modeB timer

1>-set BUFFER_IP_PDUs to FALSE

NOTE 1: The UL TFT function in the UE is mapping IP PDUs received from SDF to EPS bearer/radio bearer as configured by SS in the UL TFT IE sent as part of the EPS bearer establishment procedures. See figure 5.1-2.

NOTE 2: After the PDCP SDU buffer becomes empty the loopback will return any received PDCP SDU in uplink directly as specified in clause 5.4.4.2. In order to reactivate the loopback delay and PDCP SDU buffering the SS shall deactivate UE test loop B function first.

5.4.4.4 Reception of IP PDUs when UE is in UTRA mode

When UE receives a PDCP SDU when UE is operating in UTRA mode and has UE Test Loop Mode B active the UE shall:

1>-if T_delay_modeB timer is running:

2>-buffer the received PDCP SDU

1>-else

2>-if BUFFER_IP_PDUs is TRUE

3>-buffer the received PDCP SDU

3>-Start T_delay_modeB timer

2>-else

3>-submit the received PDCP SDU without any modification of the IP header [to the PDCP service access point (SAP) for transmission in uplink on the radio bearer with the lowest radio bearer identity number].

Editor"s note: It is FFS at which layer the PDCP PDU is submitted for transmission, directly to the PDCP SAP or to the UL TFT handling service access point (SAP) for transmission in uplink on the EPS bearer/radio bearer as configured by SS in the UL TFT IE sent as part of the radio bearer establishment procedure.

5.4.4.5 Expiry of T_delay_modeB timer when UE is in UTRA mode

When timer T_delay_modeB expires when UE is operating in UTRA mode and has UE Test Loop Mode B active the UE shall:

1>-submit the buffered IP PDUs, in the same order as received (first-in-first-out), [to the PDCP service access point (SAP) for transmission in uplink on the radio bearer with the lowest radio bearer identity number].

1>-Stop T_delay_modeB timer.

1>-set BUFFER_IP_PDUs to FALSE.

Editor"s note: It is FFS at which layer the PDCP PDU is submitted for transmission, directly to the PDCP SAP or to the UL TFT handling service access point (SAP) for transmission in uplink on the EPS bearer/radio bearer as configured by SS in the UL TFT IE sent as part of the radio bearer establishment procedure.

NOTE: After the IP PDU buffer becomes empty the loopback will return any received PDCP SDU in uplink directly as specified in clause 5.4.4.4. In order to reactivate the loopback delay and PDCP SDU buffering the SS shall deactivate UE test loop B function and UE shall return to E-UTRA mode first.

5.4.4.6 Reception of IP PDUs when UE is in GSM/GPRS mode

When UE receives a SNDCP SDU when UE is operating in GSM/GPRS mode and has UE Test Loop Mode B active the UE shall:

1>-if T_delay_modeB timer is running:

2>-buffer the received SNDCP SDU.

1>-else

2>-if BUFFER_IP_PDUs is TRUE;

3>-buffer the received SNDCP SDU;

3>-Start T_delay_modeB timer.

2>-else

3>-submit the received SNDCP SDU without any modification of the IP header to the SNDCP service access point (SAP) for transmission in uplink.

Editor's note: It is FFS on which NSAPI the SNDCP SDU is submitted (i.e. a fixed NSAPI value or a value determined by the uplink TFT handling function).

5.4.4.7 Expiry of T_delay_modeB timer when UE is in GSM/GPRS mode

When timer T_delay_modeB expires when UE is operating in GSM/GPRS mode and has UE Test Loop Mode B active the UE shall:

1>-submit the buffered IP PDUs without any modification of the IP header in the same order as received (first-in-first-out), to the SNDCP service access point (SAP) for transmission in uplink.

1>-Stop T_delay_modeB timer

1>-set BUFFER_IP_PDUs to FALSE

Editor's note: It is FFS on which NSAPI the SNDCP SDU is submitted (i.e. a fixed NSAPI value or a value determined by the uplink TFT handling function).

NOTE: After the IP PDU buffer becomes empty the loopback will return any received SNDCP SDU in uplink directly as specified in clause 5.4.4.6. In order to reactivate the loopback delay and SNDCP SDU buffering the SS shall deactivate UE test loop B function and UE shall return to E-UTRA mode first.

5.4.4.8 Reception of IP PDUs when UE is in CDMA2000 mode

When UE receives a RLP SDU when UE is operating in CDMA2000 mode and has UE Test Loop Mode B active the UE shall:

1>-if T_delay_modeB timer is running:

2>-buffer the received RLP SDU

1>-else

2>-if BUFFER_IP_PDUs is TRUE

3>-buffer the received RLP SDU

3>-Start T_delay_modeB timer

2>-else

3>-submit the received RLP SDU without any modification of the IP header to the RLP service access point (SAP) for transmission in uplink.

5.4.4.9 Expiry of T_delay_modeB timer when UE is in CDMA2000 mode

When timer T_delay_modeB expires when UE is operating in CDMA2000 mode and has UE Test Loop Mode B active the UE shall:

1>-submit the buffered IP PDUs without any modification of the IP header in the same order as received (first-in-first-out), to the RLP service access point (SAP) for transmission in uplink.

1>-Stop T_delay_modeB timer

1>-set BUFFER_IP_PDUs to FALSE

5.4.4.10 Establishment of the RRC/RR connection in E-UTRA, UTRA, GSM/GPRS and CDMA2000 mode

When the RRC or the RR connection and one or more EPS bearers are is established, in E-UTRA, UTRA, GSM/GPRS and CDMA2000 mode the UE shall:

1>-if TEST_LOOP_MODE_B_ACTIVE is set to TRUE;

2>-terminate all established EPS bearers in downlink in the UE Test Loop Function.

5.4.4.11 Release of RRC/RR connection in E-UTRA, UTRA, GSM/GPRS and CDMA2000 mode after T_delay_modeB timer has expired

When the RRC or the RR connection is released in E-UTRA, UTRA, GSM/GPRS and CDMA2000 mode the UE shall:

1>-if UE test loop mode B is active; and

1>- if BUFFER_IP_PDUs is TRUE or T_delay_modeB timer is running:

2>-keep UE test loop mode B active

1>-else

2>- the UE behaviour is unspecified.

5.4.5 Open UE test loop

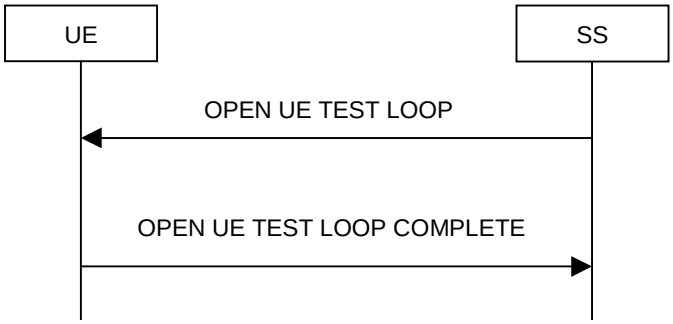

Figure 5.4.5-1: Open UE test loop procedure

5.4.5.1 General

The SS uses the procedure open UE test loop to deactivate the UE test loop function in the UE.

5.4.5.2 Initiation

The SS requests the UE to open all closed test loops by transmitting an OPEN UE TEST LOOP message.

5.4.5.3 Reception of OPEN UE TEST LOOP message by the UE

When UE receives the OPEN UE TEST LOOP message the UE shall:

1>-If no test loops are closed:

2>-the UE behaviour is unspecified;

1>-else if one or more test loops are closed:

2>-open all test loops;

2>-if TEST_LOOP_MODE_B_ACTIVE is TRUE

3>-set TEST_LOOP_MODE_B_ACTIVE to FALSE

2>-send OPEN UE TEST LOOP COMPLETE message;

1>-else (test loops already opened):

2>-the UE behaviour is unspecified.

6 Message definitions and contents

In this clause, only TC protocol messages are described. TC control messages are intended to be sent using the *DLInformationTransfer* and *ULInformationTransfer* procedures, see TS 36.331 [25], sub clause 5.6.1 and 5.6.2.

NOTE 1: A message received with skip indicator different from 0 will be ignored.

NOTE 2: For general definition of Layer 3 message format see TS 24.007 [1], clause 11.

NOTE 3: E-UTRA, UTRA and GSM/GPRS test messages uses the same protocol discriminator value ("1111"). Following message type value series are reserved for GSM/GPRS testing commands as specified by TS 44.014 [13]: 0000xxxx, 0001xxxx and 0010xxxx where x represent 0 or 1. Following message type value series are reserved for UTRA testing commands as specified by TS 34.109 [11]: 0100xxxx where x represent 0 or 1.For E-UTRA test commands the message type value series 1000xxxx is reserved.

Editor"s note: TS 24.007 [5], section 11.2.3.1.1 need to be updated to reflect that E-UTRA TC messages in 36.509 uses protocol discriminator value '1111'.

6.1 CLOSE UE TEST LOOP

This message is only sent in the direction SS to UE.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [5], sub clause 11.2.3.1.1	M	V	½
Skip indicator	TS 24.007 [5], sub clause 11.2.3.1.2	M	V	½
Message type		M	V	1
UE test loop mode		M	V	1
UE test loop mode A LB setup		CV-ModeA	LV	1-25
UE test loop mode B LB setup		CV-ModeA	V	1

Condition	Explanation
ModeA	This IE is mandatory present if the IE " UE test loop mode " is set to UE test loop Mode A. Else it shall be absent. See Note.
ModeB	This IE is mandatory present if the IE " UE test loop mode " is set to UE test loop Mode B. Else it shall be absent.

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	0	0	0	octet 1

where UE test loop mode is:

8	7	6	5	4	3	2	1	bit no.
0	0	0	0	0	0	X2	X1	octet 1

X2=0 and X1=0 then UE test loop mode A is selected.

X2=0 and X1=1 then UE test loop mode B is selected.

Other combinations of X1 and X2 are reserved for future versions of the protocol.

where UE test loop mode A LB setup is:

	8 7 6 5 4 3 2 1	
	Length of UE test loop mode A LB setup list in bytes	Octet 1
	LB setup list	Octet 2 Octet N*3+1

N is the number of LB entities in the LB setup list and is less than or equal to MAX_ ModeA_LB_entities.

where LB setup list is:

	8 7 6 5 4 3 2 1	
	LB setup DRB IE#1	Octet 2 Octet 3 Octet 4
	LB setup DRB IE#2	Octet 5 Octet 6 Octet 7
	…	
	LB setup DRB IE#N	Octet N*3-1 Octet N*3 Octet N*3+1

where LB Setup DRB#k IE is:

8	7	6	5	4	3	2	1	bit no.
Z15	Z14	Z13	Z12	Z11	Z10	Z9	Z8	octet 1
Z7	Z6	Z5	Z4	Z3	Z2	Z1	Z0	octet 2
Reserved			Q4	Q3	Q2	Q1	Q0	octet 3

Z15..Z0 = Uplink PDCP SDU size in bits 0.. 12160 (binary coded, Z15 is most significant bit and Z0 least significant bit). See Note 1.

Q4..Q0 = Data Radio Bearer identity number, 1..32 (binary coded, Q4 is most significant bit and Q0 least significant bit), where Data Radio Bearer identity identifies the radio bearer, see [25] TS 36.331.

NOTE: The UL PDCP SDU size is limited to 12160 bits (1520 octets).

NOTE: A "LB Setup DRB IE" is only needed for a DRB if UL PDCP SDU scaling is needed. If there is no "LB Setup DRB IE" associated with a DRB in the CLOSE UE TEST LOOP message then the same size of the PDCP SDU received in downlink is returned in uplink.

And where UE test loop mode B setup is:

	8 7 6 5 4 3 2 1	
	UE test loop mode B setup IE	Octet 1

Where

8	7	6	5	4	3	2	1	bit no.
T7	Z6	T5	T4	T3	T2	T1	T0	octet 1

T7..T0 = IP PDU delay time 0..255 seconds (binary coded, T7 is most significant bit and T0 least significant bit)

6.2 CLOSE UE TEST LOOP COMPLETE

This message is only sent in the direction UE to SS.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [5], sub clause 11.2.3.1.1	M	V	1/2
Skip indicator	TS 24.007 [5], sub clause 11.2.3.1.2	M	V	1/2
Message type		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	0	0	1	octet 1

6.3 OPEN UE TEST LOOP

This message is only sent in the direction SS to UE.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [5], sub clause 11.2.3.1.1	M	V	½
Skip indicator	TS 24.007 [5], sub clause 11.2.3.1.2	M	V	½
Message type		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	0	1	0	octet 1

6.4 OPEN UE TEST LOOP COMPLETE

This message is only sent in the direction UE to SS.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [1], sub clause 11.2.3.1.1	M	V	1/2
Skip indicator	TS 24.007 [1], sub clause 11.2.3.1.2	M	V	1/2
Message type		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	0	1	1	octet 1

6.5 ACTIVATE TEST MODE

This message is only sent in the direction SS to UE.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [1], sub clause 11.2.3.1.1	M	V	½
Skip indicator	TS 24.007 [1], sub clause 11.2.3.1.2	M	V	½
Message type		M	V	1
UE test loop mode		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	1	0	0	octet 1

And where UE test loop mode is specified in clause 6.1.

NOTE: No specific UE action is currently specified upon reception of the "UE test loop mode" IE.

6.6 ACTIVATE TEST MODE COMPLETE

This message is only sent in the direction UE to SS.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [1], sub clause 11.2.3.1.1	M	V	½
Skip indicator	TS 24.007 [1], sub clause 11.2.3.1.2	M	V	½
Message type		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	1	0	1	octet 1

6.7 DEACTIVATE TEST MODE

This message is only sent in the direction SS to UE.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [1], sub clause 11.2.3.1.1	M	V	½
Skip indicator	TS 24.007 [1], sub clause 11.2.3.1.2	M	V	½
Message type		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	1	1	0	octet 1

6.8 DEACTIVATE TEST MODE COMPLETE

This message is only sent in the direction UE to SS.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [1], sub clause 11.2.3.1.1	M	V	½
Skip indicator	TS 24.007 [1], sub clause 11.2.3.1.2	M	V	½
Message type		M	V	1

where message type is:

8	7	6	5	4	3	2	1	bit no.
1	0	0	0	0	1	1	1	octet 1

6.9 RESET UE POSITIONING STORED INFORMATION

This message is only sent in the direction SS to UE.

FFS

Editor"s note: It is FFS if procedure for reset of UE positioning stored information will be included.

7 Variables, constants and timers

7.1 State variables

a) BUFFER_IP_PDUs

This boolean state variable is used to control if UE is to buffer IP PDUs or not.

b) TEST_LOOP_MODE_B_ACTIVE

This boolean state variable is used to indicate if UE test loop mode B is active. TEST_LOOP_MODE_B_ACTIVE shall be set to FALSE when UE is switched on.

7.2 Constants

a) MAX_ ModeA_LB_entities = 8.

7.3 Timers

a) T_delay_modeB

This timer is used to delay the transmission of the first IP PDU when UE test loop function is operated in UE test loop mode B. The timer value is configured by the UE test loop mode B setup IE in the CLOSE UE TEST LOOP message.

7.4 Configurable parameters

a) DRB_ID(LB_ID)

This parameter is used by the UE when operating in UE test loop mode A to map a bi-directional Data Radio bearer to a loopback entity. LB_ID = 0.. (MAX_ ModeA_LB_entities-1). The value is configured when UE receives the CLOSE UE TEST LOOP message DRB_ID(LB_ID)=0 indicate that no DRB is mapped to the loopback identity.

b) UL_PDCP_SDU_scaling(LB_ID)

This parameter is used to enable/disable scaling of UL PDCP SDU size. If UL_PDCP_SDU_scaling is set to TRUE then scaling based on UL_PDCP_SDU_size(LB_ID) parameter is performed, otherwise no scaling is done (UL PDCP

SDU size is equal to received DL PDCP SDU size). The value is configured by the UE test loop mode A setup IE in the CLOSE UE TEST LOOP message.

c) UL_PDCP_SDU_size(LB_ID)

This parameter is used to set the UL PDCP SDU size for returned UL PDCP SDUs on the data radio bearer with data radio bearer ID equal to DRB_ID(LB_ID). This parameter is only applicable for UE test loop mode A and when state variable UL_PDCP_SDU_scaling(LB_ID) is TRUE. The value is configured by the UE test loop mode A setup IE in the CLOSE UE TEST LOOP message.

Annex A (informative): UE test loop use scenarios

Void.

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2008-01	RAN5 #38	R5-080327			Initial skeleton proposal		
2008-05	RAN5 #39	R5-081117			First draft (text proposal)		0.0.1
2008-05	RAN5 #39	R5-081343			Outcome of RAN5 #39 meeting agreements	0.0.1	0.1.0
2008-08	RAN5 #40	R5-083498			Outcome of RAN5 #40 meeting agreements	0.1.0	1.0.0
2008-10	RAN5 #40"bis"	R5-084269			Outcome of RAN5 #40"bis" meeting agreements	1.0.0	1.1.0
2008-11	RAN5 #41	R5-085324			Outcome of RAN5 #41 meeting agreements	1.1.0	Draft 2.0.0
2008-11	RAN5 #41	R5-085526			Outcome of post-RAN5 #41 email agreements	Draft 2.0.0	2.0.0
2008-12	RAN#42	R5-080885			Approval of version 2.0.0 at RAN#42, then put to version 8.0.0.	2.0.0	8.0.0
2009-01	-	-			Editorial corrections.	8.0.0	8.0.1
2009-03	RAN#43	R5-086335	0001	-	Corrections to 36.509	8.0.1	8.1.0
2009-03	RAN#43	R5-086371	0002	-	Correction to 36.509 v8.0.0	8.0.1	8.1.0
2009-03	RAN#43	R5-090433	0003	-	Update of Abbreviations in 36.509	8.0.1	8.1.0
2009-03	RAN#43	R5-090700	0004	-	Corrections to 36.509	8.0.1	8.1.0

History

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V8.0.1	January 2009	Publication
V8.1.0	April 2009	Publication