

ETSI TS 136 509 V14.8.0 (2023-10)



**LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA)
and Evolved Packet Core (EPC);
Special conformance testing functions
for User Equipment (UE)
(3GPP TS 36.509 version 14.8.0 Release 14)**

<https://standards.iteh.ai/catalog/standards/sist/1cc0db55-c697-457d-93a0-87c1a7a70c2a/etsi-ts-136-509-v14-8-0-2023-10>



Reference

RTS/TSGR-0536509ve80

Keywords

LTE

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:

<https://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our

Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2023.
All rights reserved.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables. (2023-10)

The cross reference between 3GPP and ETSI identities can be found under <https://webapp.etsi.org/key/queryform.asp>.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	6
Introduction	6
1 Scope	7
2 References	7
3 Definitions and abbreviations.....	9
3.1 Definitions	9
3.2 Abbreviations	9
4 UE special conformance test functions	10
4.1 General description.....	10
4.2 Requirements for UE support of test functions	10
5 Test Control (TC) protocol procedures and test loop operation.....	10
5.1 General description.....	10
5.2 Security protection of test control messages	29
5.3 UE test mode procedures.....	29
5.3.1 General.....	29
5.3.2 Activate UE test mode	30
5.3.2.1 General.....	30
5.3.2.2 Initiation.....	31
5.3.2.3 Reception of ACTIVATE TEST MODE message or AT Command +CATM by UE.....	31
5.3.3 Deactivate UE test mode.....	32
5.3.3.1 General.....	33
5.3.3.2 Initiation.....	33
5.3.3.3 Reception of DEACTIVATE TEST MODE message or AT Command +CATM by UE	33
5.4 UE test loop procedures	34
5.4.1 General.....	34
5.4.2 Close UE test loop	34
5.4.2.1 General	35
5.4.2.1a UE test loop mode A PDCP SDU and UE test loop mode B IP PDU buffer size requirement.....	36
5.4.2.1b UE test loop mode G and UE test loop mode H buffer size, User data container size and TP- User-Data buffer size requirements.....	36
5.4.2.2 Initiation.....	37
5.4.2.3 Reception of CLOSE UE TEST LOOP message by the UE	37
5.4.2.4 Reception of AT Command +CCUTLE by the UE.....	43
5.4.3 UE test loop mode A operation.....	44
5.4.4 UE test loop mode B operation.....	46
5.4.4.1 Void.....	46
5.4.4.2 Reception of IP PDUs when UE is in E-UTRA or NB-IoT mode	46
5.4.4.3 Expiry of T_delay_modeB timer when UE is in E-UTRA or NB-IoT mode.....	46
5.4.4.4 Reception of IP PDUs when UE is in UTRA mode	46
5.4.4.5 Expiry of T_delay_modeB timer when UE is in UTRA mode	47
5.4.4.6 Reception of IP PDUs when UE is in GSM/GPRS mode	47
5.4.4.7 Expiry of T_delay_modeB timer when UE is in GSM/GPRS mode.....	47
5.4.4.8 Reception of IP PDUs when UE is in CDMA2000 mode.....	47
5.4.4.9 Expiry of T_delay_modeB timer when UE is in CDMA2000 mode	48
5.4.4.10 Establishment of the RRC/RR connection in E-UTRA, NB-IoT, UTRA, GSM/GPRS and CDMA2000 mode.....	48
5.4.4.11 Release of RRC/RR connection in E-UTRA, NB-IoT, UTRA, GSM/GPRS and CDMA2000 mode after T_delay_modeB timer has expired	48
5.4.4a UE test loop mode C operation.....	48

5.4.4a.1	Reception of MBMS packets	48
5.4.4a.2	Release of RRC connection.....	49
5.4.4b	UE test loop mode D operation.....	49
5.4.4b.1	Monitor or Announce ProSe Direct Discovery	49
5.4.4b.2	Release of RRC connection.....	50
5.4.4c	UE test loop mode E operation	50
5.4.4c.1	Receive or Transmit ProSe Direct or V2X Communication	50
5.4.4c.2	Release of RRC connection.....	52
5.4.4c.3	Transition from RRC Idle/Connected to Any Cell Selection state.....	52
5.4.4c.4	V2X operation.....	52
5.4.4d	UE test loop mode F operation	53
5.4.4d.1	Reception of MBMS packets	53
5.4.4d.2	Release of RRC connection.....	53
5.4.4e	UE test loop mode G operation.....	53
5.4.4e.1	Reception of ESM DATA TRANSPORT message	53
5.4.4e.2	Expiry of T_delay_modeGH timer when UE test loop mode G is active	54
5.4.4f	UE test loop mode H operation.....	54
5.4.4f.1	Reception of TPDU.....	54
5.4.4f.2	Expiry of T_delay_modeGH timer when UE test loop mode H is active	55
5.4.4g	UE test loop mode I operation	56
5.4.4g.1	Reception of ESM DATA TRANSPORT message	56
5.4.5	Open UE test loop.....	56
5.4.5.1	General	56
5.4.5.2	Initiation.....	56
5.4.5.3	Reception of OPEN UE TEST LOOP message or AT Command +CCUTLE by the UE	56
5.5	UE Positioning test mode procedures.....	57
5.5.1	Reset UE Positioning Stored Information.....	57
5.5.1.1	General	57
5.5.1.2	Initiation.....	58
5.5.1.3	Reception of RESET UE POSITIONING STORED INFORMATION message by UE.....	58
5.5.2	Update UE Location Information	58
5.5.2.1	General	59
5.5.2.2	Initiation.....	59
5.5.2.3	Reception of UPDATE UE LOCATION INFORMATION message by UE	59
5.5.3	UTC time reset.....	59
5.5.3.1	General	59
5.5.3.2	Initiation.....	59
5.5.3.3	Reception of AT Command +CUTCR by UE.....	59
5.6	MBMS Packet Counter reporting procedure	60
5.6.1	Request MBMS Packet Counter value.....	60
5.6.1.1	General	60
5.6.1.2	Initiation.....	60
5.6.1.3	Reception of UE TEST LOOP MODE C MBMS PACKET COUNTER REQUEST by the UE.....	60
5.7	ProSe Packet Counter reporting procedure	61
5.7.1	Request ProSe Packet Counter value	61
5.7.1.1	General	61
5.7.1.2	Initiation.....	61
5.7.1.3	Reception of UE TEST LOOP PROSE COUNTER REQUEST by the UE	62
5.7.1.4	Reception of AT Command +CUSPCREQ by the UE	62
5.8	SC-PTM Packet Counter reporting procedure.....	63
5.8.1	Request SC-PTM Packet Counter value	63
5.8.1.1	General	63
5.8.1.2	Initiation.....	63
5.8.1.3	Reception of UE TEST LOOP MODE F SCPTM PACKET COUNTER REQUEST by the UE	63
5.9	Antenna Test Function measurement procedure	63
5.9.1	Request Antenna Information values	64
5.9.1.1	General	64
5.9.1.2	Initiation.....	64
5.9.1.3	Reception of ANTENNA INFORMATION REQUEST by the UE	64
5.9.2	UE ATF requirements.....	65
5.9.2.1	RSAP.....	65
5.9.2.2	RSARP.....	65

6	Message definitions and contents.....	66
6.1	CLOSE UE TEST LOOP.....	66
6.2	CLOSE UE TEST LOOP COMPLETE.....	72
6.3	OPEN UE TEST LOOP.....	72
6.4	OPEN UE TEST LOOP COMPLETE.....	72
6.5	ACTIVATE TEST MODE.....	72
6.6	ACTIVATE TEST MODE COMPLETE.....	73
6.7	DEACTIVATE TEST MODE.....	73
6.8	DEACTIVATE TEST MODE COMPLETE.....	73
6.9	RESET UE POSITIONING STORED INFORMATION.....	74
6.10	UE TEST LOOP MODE C MBMS PACKET COUNTER REQUEST.....	74
6.11	UE TEST LOOP MODE C MBMS PACKET COUNTER RESPONSE.....	75
6.12	UPDATE UE LOCATION INFORMATION.....	75
6.13	UE TEST LOOP PROSE PACKET COUNTER REQUEST.....	76
6.14	UE TEST LOOP PROSE PACKET COUNTER RESPONSE.....	77
6.15	UE TEST LOOP MODE F SCPTM PACKET COUNTER REQUEST.....	80
6.16	UE TEST LOOP MODE F SCPTM PACKET COUNTER RESPONSE.....	80
6.17	ANTENNA INFORMATION REQUEST.....	80
6.18	ANTENNA INFORMATION RESPONSE.....	81
7	Variables, constants and timers.....	82
7.1	State variables.....	82
7.2	Constants.....	84
7.3	Timers.....	84
7.4	Configurable parameters.....	85
8	Electrical Man Machine Interface (EMMI).....	85
9	Test application definition.....	86
9.1	Definition of the UE ATF Client Application.....	86
9.1.2	Message Definitions and Contents.....	87
Annex A (informative):	Void.....	90
Annex B (informative):	Change history.....	91
History.....	ETSI TS 136 509 V14.8.0 (2023-10)	94

<https://standards.iteh.ai/catalog/standards/sist/1cc0db55-c697-457d-93a0-87c1a7a70c2a/etsi-ts-136-509-v14-8-0-2023-10>

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

User Equipment (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 the UE.

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] define the corresponding UE Test Loop functionality. The present specification describes the location of the data loop in the protocol stack as well as the procedure and specific messages to activate/deactivate the Test Loop functionality in the UE.

ETSI TS 136 509 V14.8.0 (2023-10)

<https://standards.iteh.ai/catalog/standards/sist/1cc0db55-c697-457d-93a0-87c1a7a70c2a/etsi-ts-136-509-v14-8-0-2023-10>

1 Scope

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

This document also describes 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".
- [36] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".
- [37] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".
- [38] 3GPP TS 24.334: "Proximity-services (ProSe) User Equipment (UE) to ProSe function protocol aspects; Stage 3".
- [39] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[40] 3GPP TR 36.978: “User Equipment (UE) antenna test function definition for two-stage Multiple Input Multiple Output (MIMO) Over The Air (OTA) test method”

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:

Uni-directional Data Radio Bearer: Data radio bearer identified by a data radio bearer identifier capable to deliver data only in downlink or uplink

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

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

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

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

UE (User Equipment): user equipment as defined in [1] that is under test

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

UE uplink Rate control entity: The UE entity in a UE supporting Control Plane CIoT EPS optimization that is handling the UE uplink rate control of control plane messages carrying user data as specified in [36] TS 24.301 clause 6.3.8 (Serving PLMN rate control) and in [36] TS 24.301 clause 6.3.9 (APN rate control).

EMM SAP for control plane user data: The service access point to the EMM sublayer for control plane user data handling the UE uplink rate control entity for uplink transmissions of the User data container via ESM DATA TRANSPORT messages.

SMR SAP for control plane user data: The service access point to the SMR entity for uplink SMS user data handling for uplink transmissions of the RP User data element in Uplink NAS Transport messages. For details on SMR entity and SM-RP protocol see [39].

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:

ATF	Antenna Test Function
DRB	Data Radio Bearer
EMM	EPS Mobility Management
E-MBMS	Evolved Multimedia Broadcast Multicast Service
ENB	Evolved Node B
EPS Bearer	Evolved Packet System Bearer
ESM	EPS Session Management
LB	Loop Back
MAC	Media Access Control
MBMS	Multimedia Broadcast Multicast Service
MBS	Metropolitan Beacon System
MTC	Main Test Component
ProSe	Proximity-based Services
RAB	Radio Access Bearer
RMC	Reference Measurement Channel

ROHC	Robust Header Compression
SDF	Service Data Flow
SMR	Short Message Relay (entity)
SS	System Simulator
TC	Test Control
SC	Single-cell
PTM	point-to-multipoint
V2X	Vehicle-to-Everything

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 or AT commands. 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.

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

- UE test loop function;
- Electrical Man Machine Interface (EMMI).

The following Test Control (TC) procedures are used to control the UE test loop function:

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

4.2 Requirements for UE support of test functions

Whether or not a particular test function should be supported by the UE for facilitating the UE conformance testing is explicitly indicated throughout the present specification. The use of the word "mandatory" in the present specification shall be understood as a particular requirement being mandatory for performing UE conformance testing.

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 wherever possible new physical interfaces just for the reason of conformance testing.

NOTE 0: One exception from the rule above is the UE test loop mode E and UTC time reset when used for V2X out-of-coverage test scenarios which require an additional physical interface for the transmission of AT commands. This has been based on the assumption that V2X devices will normally provide such interface for other than testing purposes e.g. for device configuration.

NOTE 1: 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 TC message to the UE, see clause 6.

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

- UE test loop mode A;
- UE test loop mode B;
- UE test loop mode C;
- UE test loop mode D;
- UE test loop mode E;
- UE test loop mode F;
- UE test loop mode G;
- UE test loop mode H;
- UE test loop mode I.

UE test loop mode A provides loopback of PDCP SDUs for bi-directional data radio bearers while UE is operating in E-UTRA or NB-IoT 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 [36].

UE test loop mode B provides loopback of PDCP SDUs (E-UTRA and UTRA), SMDCP PDUs (GSM/GPRS) and RLP PDUs (CDMA2000) for bi-directional EPS bearers while UE is operated in E-UTRA, NB-IoT, UTRA, GSM/GPRS or CDMA2000 modes. When operating in E-UTRA, NB-IoT, UTRA or GSM/GPRS then the downlink PDCP SDUs or SMDCP PDUs 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 or SMDCP SDU [36]. When operating in CDMA2000 modes, the downlink RLP PDUs 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 RLP PDU content and of the TFT of the associated EPS bearer context.

NOTE 2: When multiple PDN connections are established (or multiple Primary PDP Contexts are active), it is assumed that different IP addresses are allocated to the UE by the SS on each PDN.

UE test loop mode C provides counting of successfully received MBMS Packets on a given MTCH while UE is operating in E-MBMS/E-UTRA mode. For E-MBMS then one or more MTCHs are multiplexed on a MCH. MBMS packets for a MTCH are delivered as one RLC SDU per MBMS packet segmented into one or more RLC UMD PDUs.

UE test loop mode D provides means for announcing or monitoring of ProSe Direct Discovery messages on SL-DCH, as specified by the test loop mode D setup IE in the CLOSE UE TEST LOOP message. In particular, for discovery monitor operation, UE test loop mode D provides counting of successfully received SL-DCH MAC SDUs while the UE is operating in ProSe Direct Discovery/E-UTRA mode. For discovery announce operation, UE test loop mode D provides trigger for transmission of ProSe Direct Discovery message on SL-DCH.

NOTE 3: UE test loop mode D is intended for RF/RRM testing purposes.

NOTE 4: ProSe Direct Discovery messages on the PC5 interface are delivered as one MAC SDU per ProSe Direct Discovery message.

UE test loop mode E provides means for either transmit or receive of ProSe Direct or V2X Communication packets, as specified by the test loop mode E setup IE in the CLOSE UE TEST LOOP message. In particular, for communication receive operation, UE test loop mode E provides counting of successfully received STCH PDCP SDUs, PSCCH PHY transport blocks and PSSCH PHY transport blocks while the UE is operating in ProSe Direct or V2X Communication/E-UTRA mode. For communication transmit operation, UE test loop mode E provides trigger for transmission of ProSe Direct or V2X Communication packets. For the V2X out-of-coverage scenarios this trigger utilises AT commands and requires an appropriate physical interface.

NOTE 5: Void

NOTE 6: The Application trigger required to force the UE to start or stop a particular ProSe Service is out of the scope of the test loop modes D and E.

UE test loop mode F provides counting of successfully received MBMS Packets on a given SC-MTCH while UE is operating in SC-PTM/E-UTRA mode. For SC-PTM one SC-MTCH is transmitted on a DL-SCH. MBMS packets for a SC-MTCH are delivered as one RLC SDU per MBMS packet segmented into one or more RLC UMD PDUs.

UE test loop mode G provides loopback of the User data container content of any received downlink ESM DATA TRANSPORT message in uplink. The received data can be configured to be either returned via the UE EMM entity (before the UE uplink rate control entity) or as a RLC SDU to the SRB RLC entity (SRB1bis for NB-IoT UE or to SRB2 for E-UTRA UE). UE test loop mode G may be configured to delay the uplink loopback of user data. UE test loop mode G may also be configured to repeat the received user data of the User data container in uplink to generate higher data rates in uplink.

UE test loop mode H provides loopback of the TP-User-Data field (including the SMS user data) of any received downlink TPDU (SMS-DELIVER) in uplink. The received data can be configured to be either returned via the UE SM-TL entity or as a RLC SDU to the SRB RLC entity (SRB1bis for NB-IoT UE or to SRB2 for E-UTRA UE). UE test loop mode H may be configured to delay the uplink loopback of SMS user data. UE test loop mode H may also be configured to repeat the received SMS user data in uplink to generate higher data rates in uplink.

NOTE 7: UE test loop mode G and H are intended for control plane data testing for UEs supporting EPS services with Control Plane CIoT EPS optimization.

NOTE 8: The delay timer for UE test loop mode G and H is triggered by the first reception of user data after the reception of a CLOSE UE TEST LOOP TC message. While the delay timer is running only the user data received in the latest ESM DATA TRANSPORT or SMS message is buffered.

NOTE 9: The repetition of uplink transmission of uplink messages carrying data can be configured as 0 (no data returned), 1 (the same content and size of user data as received in downlink is returned) or value $N > 1$ (user data corresponding to N times repetition of the received user data is returned in uplink).

UE test loop mode I provides loopback of the IP PDUs received in User data container content of downlink ESM DATA TRANSPORT message in uplink via the UE uplink TFT handler and the UE EMM entity (before the UE uplink rate control entity).

NOTE 10: UE test loop mode I is intended for control plane data testing for UEs supporting EPS services with Control Plane CIoT EPS optimization.

UE test loop mode A is mandatory to all E-UTRA UEs and all NB-IoT UEs supporting user plane data transfer.

UE test loop mode B for operation in E-UTRA mode is mandatory to all E-UTRA UEs and all NB-IoT UEs supporting user plane data transfer.

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.

UE test loop mode C is mandatory for E-UTRA UEs supporting E-MBMS.

UE test loop mode D is mandatory for E-UTRA UEs supporting ProSe Direct Discovery.

UE test loop mode E is mandatory for E-UTRA UEs supporting ProSe Direct or V2X Communication.

UE test loop mode F is mandatory for E-UTRA UEs supporting SC-PTM.

UE test loop mode G is mandatory for UEs supporting Control Plane CIoT EPS optimization and control plane data transfer using the ESM DATA TRANSFER procedure.

UE test loop mode H is mandatory for UEs supporting Control Plane CIoT EPS optimization and control plane data transfer using SMS.

UE test loop mode I is mandatory for UEs supporting Control Plane CIoT EPS optimization and control plane data transfer using the ESM DATA TRANSFER procedure.

Support of UPDATE UE LOCATION INFORMATION is optional for all E-UTRA UEs with the exception of E-UTRA UEs supporting ProSe Direct Communication for which it is mandatory.

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 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 TC entity and UE test loop mode A. The loopback of PDCP SDUs for UE test loop mode A is specified in sub clause 5.4.3.

Figure 5.1-2 shows a functional block diagram of UE test loop function for 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 5.4.4.2 and 5.4.4.3.

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 5.4.4.4 and 5.4.4.5.

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 5.4.4.6 and 5.4.4.7.

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 5.4.4.8 and 5.4.4.9.

Figure 5.1-6 shows a functional block diagram of UE test loop function for TC entity and UE test loop mode C. The MBMS Packet Counter function for UE test loop mode C is specified in sub clause 5.4.4.a. The MBMS Packet Counter function is limited to count successfully received MBMS packets on one MTCH configured by the SS when UE test loop mode C is activated.

Figure 5.1-7 and Figure 5.1-8 show a functional block diagram of the UE test loop mode for TC entity and UE test loop mode D. The ProSe Direct Discovery Packet Counter function for UE test loop mode D is specified in clause 5.4.4b. The ProSe Direct Discovery packet counter function is limited to count successfully received SL-DCH MAC SDUs when UE test loop mode D is activated.

Figure 5.1-9 and Figure 5.1-10 show a functional block diagram of the UE test loop mode for TC entity and UE test loop mode E for UE supporting ProSe Direct, or, V2X when UE is in in-coverage state. Figure 5.1-9a and Figure 5.1-10a show a functional block diagram of the UE test loop mode for TC entity and UE test loop mode E for UE supporting V2X when UE is in out-of-coverage state; the Electrical Man Machine Interface (EMMI) required for facilitating the AT commands transmission is specified in clause 8. The ProSe Direct or V2X Communication Packet Counter function for UE test loop mode E is specified in clause 5.4.4c. The ProSe Direct or V2X Communication packet counter function is limited to count successfully received STCH PDCP SDUs, PSCCH PHY Transport blocks and PSSCH PHY Transport blocks when the UE test loop mode E is activated.

Figure 5.1-11 shows a functional block diagram of UE test loop function for TC entity and UE test loop mode F. The SC-PTM Packet Counter function for UE test loop mode F is specified in sub clause 5.4.4.d. The SC-PTM Packet Counter function is limited to count successfully received MBMS packets on one SC-MTCH configured by the SS when UE test loop mode F is activated.

Figure 5.1-12 shows a functional block diagram of UE test loop function for TC entity and UE test loop mode G when User data container content received in a downlink ESM DATA TRANSFER message is configured to be returned in uplink via the EMM entity. Figure 5.1-13 shows a functional block diagram of UE test loop function for TC entity and UE test loop mode G when User data container content received in a downlink ESM DATA TRANSFER message is configured to be returned in uplink in a RLC SDU via the SRB1bis/SRB2 RLC AM entity. The UE test loop mode G mode of operation is specified in sub clause 5.4.4e.

Figure 5.1-14 shows a functional block diagram of UE test loop function for TC entity and UE test loop mode H when TP-User-Data (SMS user data) received in a downlink TPDU (SMS-DELIVER) is configured to be returned in uplink via the SM-TL entity (in a TPDU (SMS-SUBMIT)).