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Technical Specification





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Foreword

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

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1 Scope

The present document defines for User Equipment (UE) those special functions and their activation/deactivation methods that are required in the UE for conformance testing purposes when the UE is connected to the 5G System (5GS) via its radio interface(s).

The document also describes the operation of these special functions when the 5GS capable UEs are connected via a non-5GS system e.g. E-UTRA FDD or TDD system.

Depending on the 5GS system's architecture some relevant for the UE for conformance testing special functions may be defined in TS 36.509 [6].

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* unless the context in which the reference is made suggests a different Release is relevant (information on the applicable release in a particular context can be found in e.g. test case title, description or applicability, message description or content).

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

[2] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment ".

[3] 3GPP TS 38.523-1: "5GS; User Equipment (UE) conformance specification; Part 1: Protocol ".

[4] 3GPP TS 38.523-3: "5GS; User Equipment (UE) conformance specification; Part 3: Protocol Test Suites "

[5] 3GPP TS 38.522: "NR; User Equipment (UE) conformance specification; Applicability of RF and RRM test cases".

[6] 3GPP TS 36.509: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Special conformance testing functions for User Equipment (UE)".

[7] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General Aspects".

[8] 3GPP TS 34.109: "Terminal logical test interface; Special conformance testing functions".

[9] 3GPP TS 44.014: "Individual equipment type requirements and interworking; Special conformance testing functions".

[10] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (EUTRA) Radio Resource Control (RRC) Protocol Specification".

[11] 3GPP TS 38.331: "NR Radio Resource Control (RRC) protocol specification".

[12] 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone".

[13] 3GPP TS 38.521-2: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone".

[14] 3GPP TS 38.521-3: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[15] 3GPP TS 38.521-4: "NR; User Equipment conformance specification; Radio transmission and reception; Part 4: Performance".

[16] 3GPP TS 38.533: NR; "User Equipment (UE) conformance specification; Radio resource management".

[17] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[18] 3GPP TS 36.323: "Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) specification".

[19] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[20] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[21] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[22] 3GPP TS 38.215: "NR; Physical Layer Measurements".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

Frequency Range 2 (FR2): The frequency ranges in which NR can operate being in the range of 24250 MHz - 52600 MHz.

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 5G System simulator

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

NOTE: In other Special conformance testing functions for User Equipment (UE) 3GPP specifications e.g. 36.509 [6], the term Test Control (TC) is used for describing the same UE entity. The different names do not preclude the implementation of a single entity to handle all the functionality in a UE supporting different 3GPP technologies.

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

3.2 Symbols

No specific symbols apply for the purposes of the present document.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

EMMI	Electrical Man Machine Interface
FFS	For further Study
FR2	Frequency Range 2
LB	Loop Back
MTC	Main Test Component
SS	System Simulator
TMC	Test Mode Control

4 UE special conformance test functions overview

4.1 Requirements for UE support of test functions

The UE special conformance test functions are required for the support of 5GS conformance testing. They form a part of the core requirements and thus have a direct impact on the design of the UE. The use of the word "mandatory" in the present specification shall be understood as a particular requirement being mandatory for performing UE conformance testing.

NOTE: While the importance of conformance testing should not be underestimated, and hence is highly recommended, the implementation of facilitation of it is left to the Device implementation.

4.2 UE special conformance test functions concept

The present specification defines the UE special conformance test functions including any relevant procedure and the Test Mode Control (TMC) message contents used for information exchange.

The conformance test methods applied in RF/RRM Conformance Test Specification TS 38.521-1 [12], TS 38.521-2 [13], TS 38.521-3 [14], TS 38.521-4 [15] and TS 38.533 [16], and, the conformance test models used in Protocol Conformance Test Specifications TS 38.523-1 [3] and TS 38.523-3 [4], as well as, common test environment definition and Generic procedures specified in TS 38.508-1 [2] utilise the UE special conformance test functions. Default TMC messages and information element contents utilised in all before mentioned test specifications are specified in TS 38.508-1 [2].

The UE special conformance test functions vary depending on the conformance testing functionality they are designed to support. The following broader groups of UE special conformance test functions can be identified:

- **Test Loop Functions**: Functions which require a loop to be established between the UE and the System Simulator (SS) to allow e.g. DL data packets sent by the SS to be looped back UL by the UE

- **General Test Functions**: Commands send by the SS e.g. to trigger a certain UE behaviour which may be a behaviour determined by 3GPP core spec requirements or such needed to facilitate conformance testing and not being part of any 3GPP core spec requirements, or, to provide to the UE information needed for the conformance testing.

NOTE 1: An example for behaviour needed to facilitate conformance testing and not representing behaviour determined by 3GPP core spec requirements is counting and reporting the number of received data packets thereby providing means to the SS to verify 3GPP core spec requirements.

The utilisation of any UE special conformance test functions shall be considered as putting the UE in a test mode. The duration of the test mode depends on the UE special conformance test function and in most of the cases will be

delimited by an activation and a deactivation command. However, in the case of general test functions used e.g. only to provide information relevant for the conformance testing the test mode can be considered as entered as soon as the information is received and exited as soon as the information has been acted upon.

As a common rule the UE special conformance test functions provide access to isolated functions of the UE via the radio interface without introducing new physical interfaces just for the reason of conformance testing. However, in certain cases the usage of AT Commands may be required which will require an external interface e.g. EMMI.

NOTE 2: It should be emphasised that the UE test functions only describe the functional behaviour of the UE with respect to its external interfaces; physical implementation of the UE test function is completely left open to the manufacturer.

Depending on the conformance testing functionality they are designed to support, the UE special conformance test functions may comprise:

- A single DL message (e.g. a test function intended to provide to the UE information needed for the conformance testing)

- A Request/Acknowledgement type of 2 messages exchange, an DL message followed by a UL message, (e.g. a test function intended to request the UE to execute an action which requires acknowledgment that request was received and acted upon)

Furthermore, depending on the conformance test scenarios

- An UE special conformance test function can be used in isolation.

NOTE 3: An example for this is the provision to the UE of location information which can then be used by the UE throughout its "normal" i.e. not test mode functions dependant behaviour.

- Two, or more, UE special conformance test functions may need to be executed in a particular sequence before the target UE behaviour can be assumed.

NOTE 4: An example for this are the Activate UE test mode and Close UE test loop functions. The former needs to be executed first, at a particular moment of time, in order a specific type of test bearer terminated in a particular UE protocol layer to be established. Followed by the latter, executed at different point of time, which will instruct the UE to start looping back the received packets.

- Two, or more, UE special conformance test functions may be executed simultaneously with no particular relation one to another allowing for different test mode functionality to take place at the same time.

NOTE 5: An example for this are the UE Beamlock test function and the test functions needed for test loop mode operation (see NOTE 4). The former may need to be active throughout the entire tests with the latter being active in parts of the test as appropriate. Both being active independently.

For the specification of UE special conformance test functions the present specification may refer to other specifications. In the case when text on the same matter exists in the present specification and in the referred specification, the text in the present specification takes precedence.

5 UE special conformance test functions operation

5.1 General

For consistency with legacy terminology, the present specification uses the terms 'Activate UE test mode' and 'Deactivate UE test mode' for denoting the activation and the deactivation of 5GS test mode bearers procedures respectively. Consequently, 'Activate UE test mode' should not be understood as setting the UE in test mode in general rather, as setting the UE in a mode (i.e. establishing a special type of test bearers) which other special UE conformance testing functions require for proper operation. As this has been mentioned elsewhere in the present specification, not all special UE conformance testing functions require such a setting.

Similarly, the present specification may use the term 'UE test loop mode X operation", where X is a chose letter, for denoting operation which does not represent true looping back of data being received rather, it represents what can be

called as a "pseudo loop" i.e. providing back information about the received data e.g. the number of the received packets.

5.2 Activation and deactivation of 5GS test mode bearers (UE test mode procedures)

5.2.1 General

The SS performs, where applicable, activation and deactivation of the conformance test functions in the UE by sending Security Protected NAS Layer 3 messages.

The UE test mode procedures are intended for setting the UE into a test mode where the SS can set up test bearers terminated at a particular point in the 5GS protocol stack as specified in the functional block diagram of each UE test loop mode of operation. The following test bearers are defined in the present specification:

- data radio bearers (UE test loop mode A),
- EPS bearers or 5GS QoS flows (UE test loop mode B).

5.2.2 Activate UE test mode

Same as TS 36.509 [6], subclause 5.3.2 with the following exceptions:

- where E-UTRA is mentioned the same applies for NR;

  the NB-IoT mode is out of the scope of the present specification;

  where different UE test loop modes are mentioned only those applicable to 5GS should be taken into account (see subclause 5.3.4 for the applicable 5GS UE test loop modes).

5.2.3 Deactivate UE test mode

Same as TS 36.509 [6], subclause 5.3.3 with the following exceptions

- where E-UTRA is mentioned the same applies for NR;
- the NB-IoT mode is out of the scope of the present specification;
- where different UE test loop modes are mentioned only those applicable to 5GS should be taken into account (see subclause 5.3.4 for the applicable 5GS UE test loop modes).

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.

5.3 Test loop functions

5.3.1 General

Before a loop functionality can be exercised, the test loop needs to be closed; this is to be understood as the UE being instructed to start looping back received data packets. When looping back received data packets is not any longer required the loop should be re-opened; opening of a loop does not change the type of bearer being established by the UE test mode activation function (subclause 5.2.2).

To limit the number of special test functions, the concept of closing and opening a loop is also used as instruction to the UE to initiate/terminate other actions. An example of this is counting the received packets and reporting the number of received packets back to the SS; in the context of this utilisation closing a loop is to be understood as the UE being

instructed to start counting the packets, whereas opening a loop should be understood as stop counting the packets. Other utilisation of the closing/opening a "test loop" test functionality can be specified if appropriate.

The UE test loop functions for 5GS are intended for:

- NR receiver and transmitter testing to disable application data transfer in downlink and uplink during SS UE measurements.
- NR layer 2 (MAC, RLC, PDCP, SDAP) and data radio bearer testing to generate data transfer in downlink and uplink.
- 5GC and NR layer 3 testing to verify data transfer continuation over RRC and 5GC procedures.
- 5GC NAS user-plane testing to verify uplink QoS flow descriptions handling.

5.3.2 Close UE test loop

Same as TS 36.509 [6], subclause 5.4.2 with the following exceptions:

- where E-UTRA is mentioned the same applies for NR;
- the NB-IoT mode is out of the scope of the present specification
- where different UE test loop modes are mentioned only those applicable to 5GS should be taken into account (see subclause 5.3.4 for the applicable 5GS UE test loop modes).
- where EPS bearers are mentioned the same applies for 5GS QoS flows; and
- UE supported minimum buffer size for MR-DC and NR shall match the required total layer 2 buffer size as specified in TS 38.306 [20], clause 4.1.4.

5.3.3 Open UE test loop

Same as TS 36.509 [6], subclause 5.4.5 with the exceptions:

- where E-UTRA is mentioned the same applies for NR;
- the NB-IoT mode is out of the scope of the present specification;
- where different UE test loop modes are mentioned only those applicable to 5GS should be taken into account (see subclause 5.3.4 for the applicable 5GS UE test loop modes).

5.3.4 UE functionality when test loop is closed

5.3.4.1 UE test loop mode A operation

Editor’s note: Functional block diagrams for UE test loop mode A for NE-DC need to be added.

UE test loop mode A provides loopback of PDCP SDUs for bi-directional data radio bearers while UE is operating in NR. 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 QoS flow descriptions of the associated QoS Flow as specified in TS 24.501 [21].

Figures 5.3.4.1-1 and 5.3.4.1-2 show functional block diagrams of UE test loop function for the TMC entity and UE test loop mode A for the case when EN-DC or NGEN-DC with a MCG bearer and a SCG bearer is configured and for the case EN-DC or NGEN-DC with a MCG and a split bearer is configured.

Figures 5.3.4.1-3 shows functional block diagrams of UE test loop function for the TMC entity and UE test loop mode A for the case when standalone NR is configured.

NOTE 1: The number and the order of RB LB Entities in the functional block diagrams are provided for illustration only. No specific order or numbering is precluded.

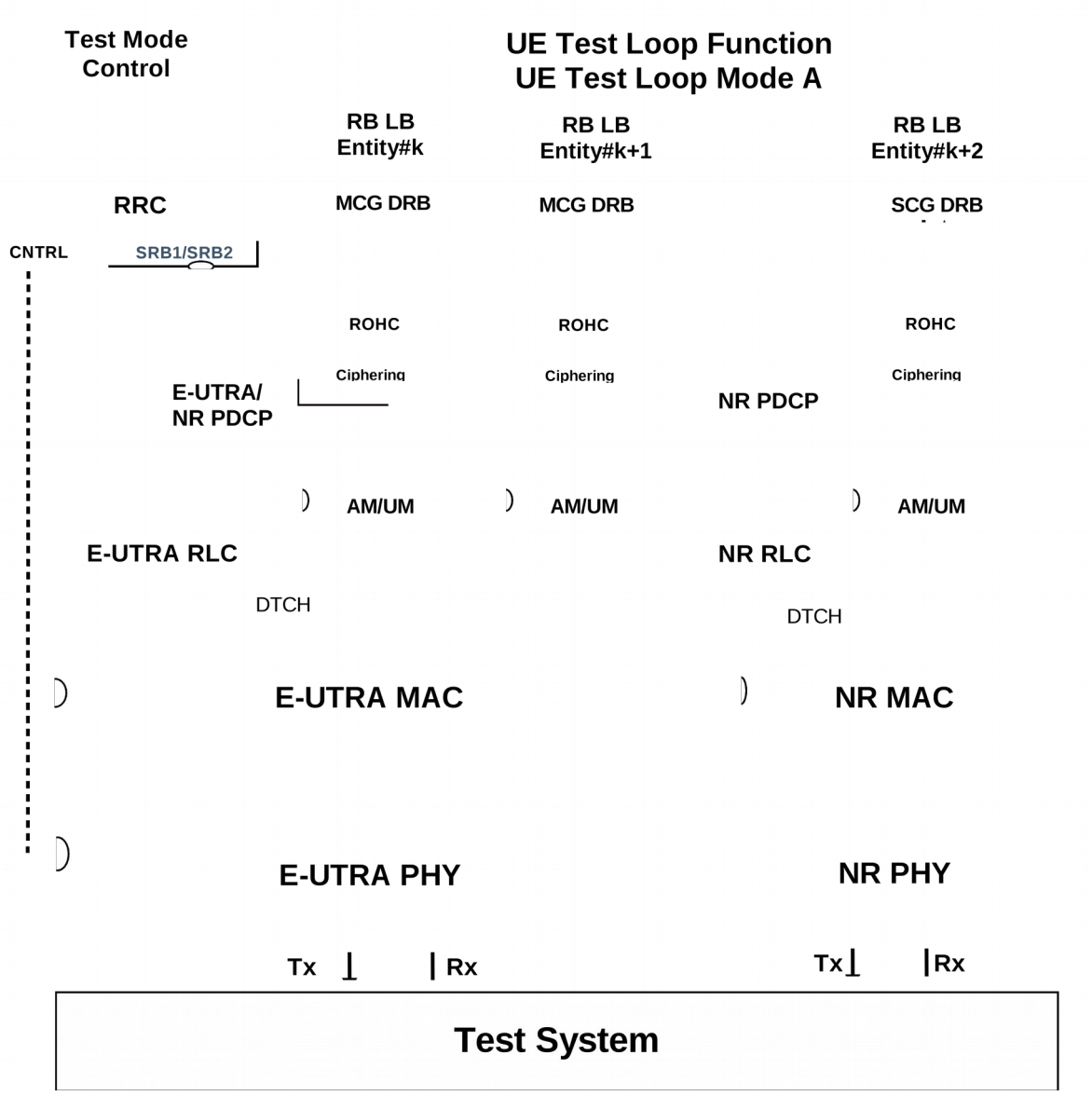


Figure 5.3.4.1-1: Model for Test Mode Control and UE Test Loop Mode A on UE side when EN-DC or NGEN-DC with MCG bearer and SCG bearer is configured

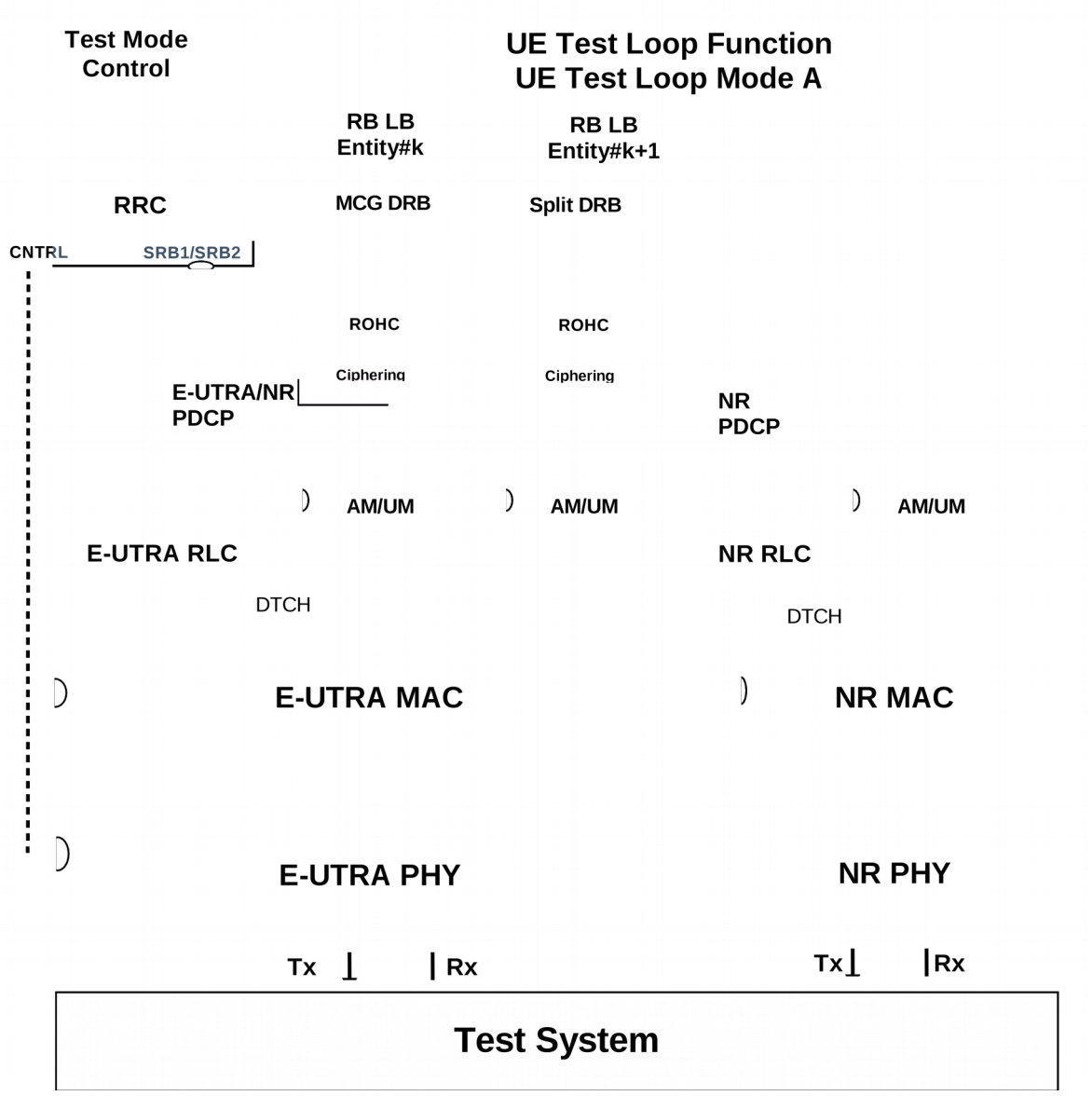


Figure 5.3.4.1-2: Model for Test Mode Control and UE Test Loop Mode A on UE side when EN-DC or NGEN-DC with MCG and split bearer configured

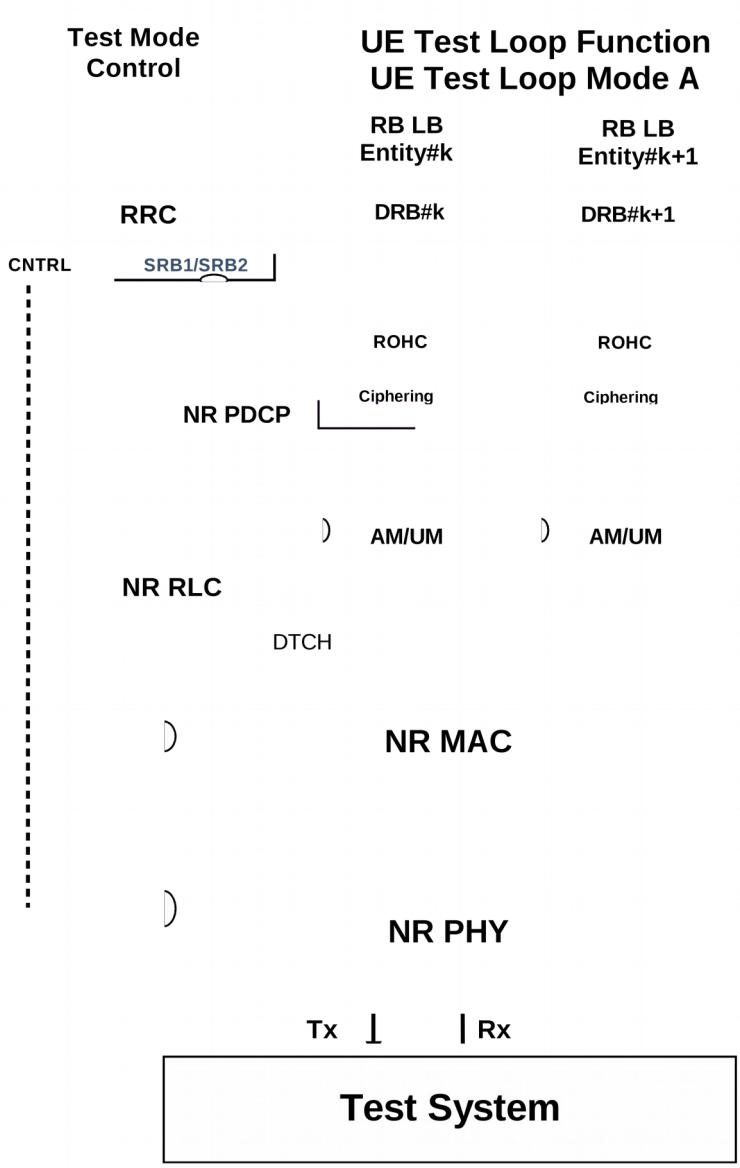


Figure 5.3.4.1-3: Model for Test Mode Control and UE Test Loop Mode A on UE side when standalone NR is configured

UE test loop mode A is mandatory to all 5GS UEs.

Prior to closing the UE test loop mode A, thereby requesting the UE to start looping back the received data packets, at least one 5GS test mode bi-directional data radio bearer shall have been established between SS and UE. This implies that before the procedure for establishing the bi-directional data radio bearer takes place the SS needs to activate the UE test mode as specified in subclause 5.2.2.

The 5GS UE test loop mode A operation is the same as the one described in TS 36.509 [6], subclause 5.4.3 with the exception where E-UTRA is mentioned the same applies for NR, and, the understanding that the NB-IoT mode is out of the scope of the present specification.

5.3.4.2 UE test loop mode B operation

Editor's note: Functional block diagrams for UE test loop mode B for NE-DC need to be added.

5.3.4.2.1 General

UE test loop mode B is mandatory to all 5GS UEs supporting one or more PDU session establishments.

5.3.4.2.2 UE test loop mode B operation for EN-DC and NGEN-DC

UE test loop mode B provides loopback of PDCP SDUs for bi-directional EPS bearers while UE is operated in NR or E-UTRA modes. When operating in NR or E-UTRA, the downlink PDCP SDUs or SNDCP 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 QoS Flow with a QoS flow descriptions matching the TCP/UDP/IP protocol information within the PDCP SDU or SNDCP SDU as specified in TS 24.501 [21].

NOTE 1: 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.

Figures 5.3.4.2.2-1 and 5.3.4.2.2-2 show functional block diagrams of UE test loop function for the TMC entity and UE test loop mode B for the case when EN-DC or NGEN-DC with a MCG bearer and a SCG bearer is configured and for the case EN-DC or NGEN-DC with a MCG and a split bearer is configured.

NOTE 2: The number and the order of RB LB Entities in the UE Test Loop Function in the functional block diagrams are provided for illustration only. No specific order or numbering is precluded.

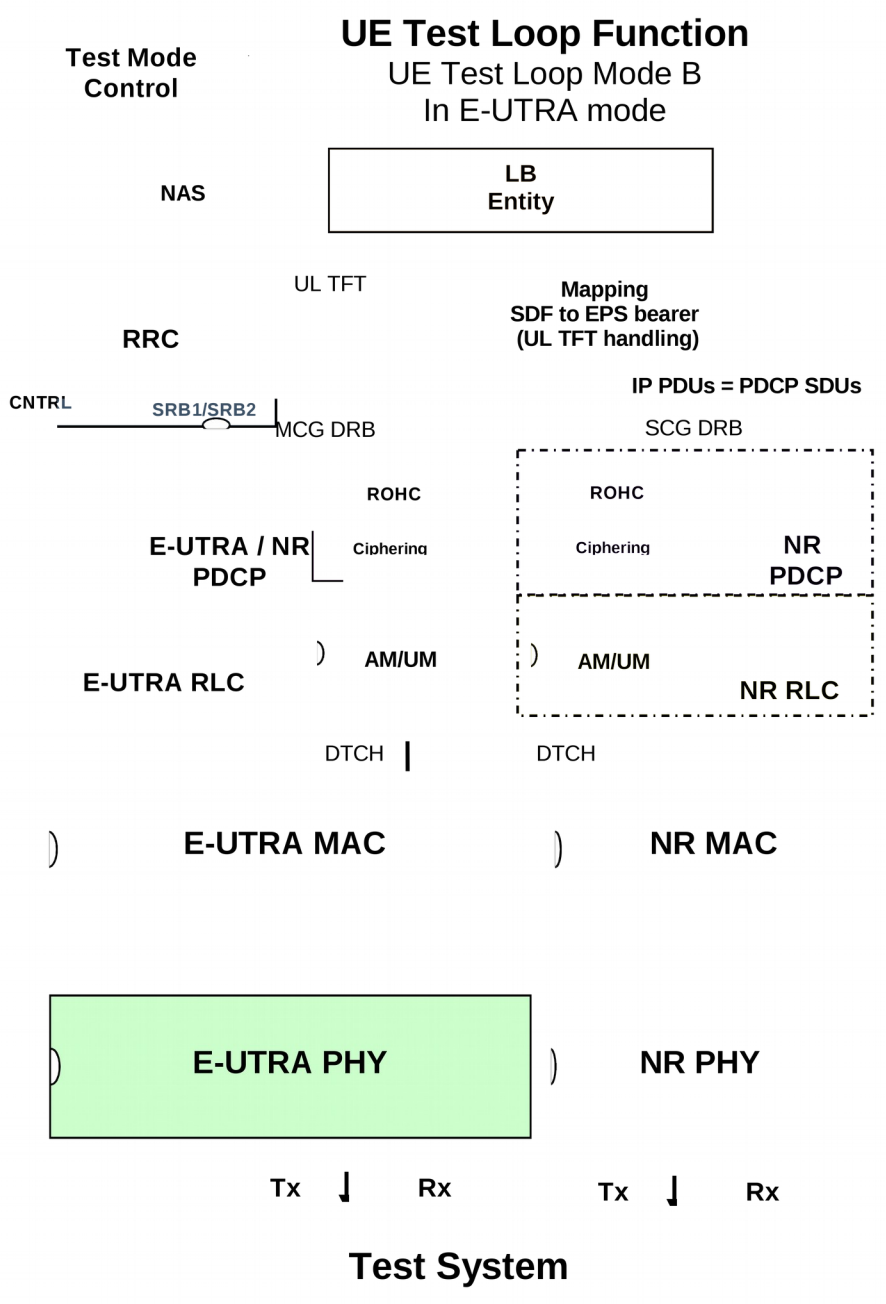


Figure 5.3.4.2.2-1: Model for Test Mode Control and UE Test Loop Mode B on UE side when EN-DC or NGEN-DC with MCG bearer and SCG bearer is configured

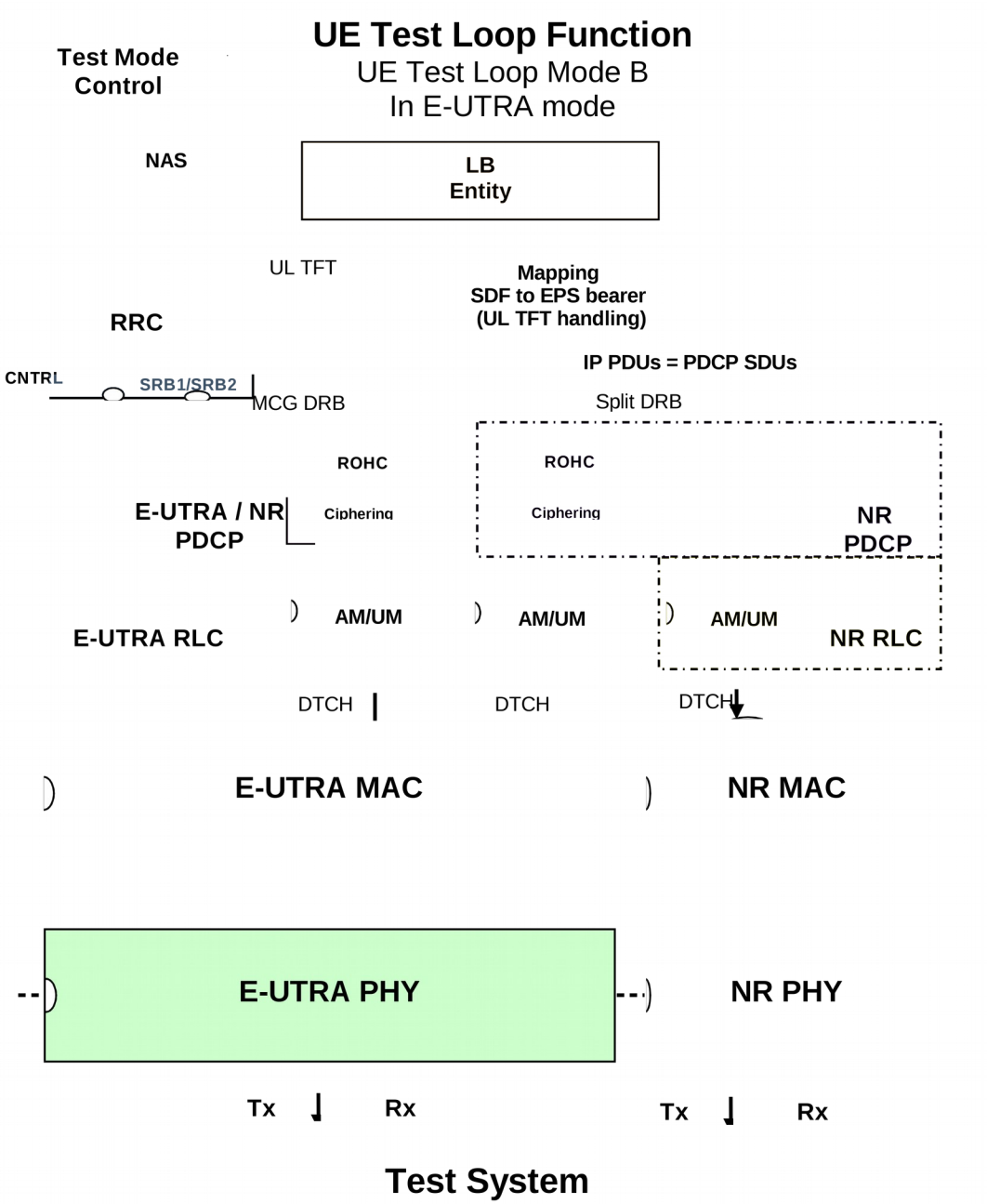


Figure 5.3.4.2.2-2: Model for Test Mode Control and UE Test Loop Mode B on UE side when EN-DC or NGEN-DC with MCG and split bearer configured

5.3.4.2.3 UE test loop mode B operation for Standalone NR

UE test loop mode B provides loopback of SDAP SDUs for bi-directional QoS Flows while UE is operated in standalone NR mode. Prior to closing the UE test loop mode B, thereby requesting the UE to start looping back the received data packets, at least one 5GS test mode bi-directional QoS Flow shall have been established between SS and UE. This implies that before the procedure for establishing the bi-directional QoS Flows takes place the SS needs to activate the UE test mode as specified in subclause 5.2.2

The downlink SDAP SDUs or IP PDU's received by the UE on all bi-directional QoS Flows are returned by the UE without any modification of the IP header to the UL QoS flow descriptions handling SAP for transmission in uplink.

NOTE 1: When multiple PDU sessions are established, it is assumed that different IP addresses are allocated to the UE by the SS on each PDU session.

Figure 5.3.4.2.3-1 shows functional block diagrams of UE test loop function for the TMC entity and UE test loop mode B for the case when standalone NR is configured.

NOTE 2: The number and the order of QoS Flow LB Entities in the UE Test Loop Function in the functional block diagrams are provided for illustration only. No specific order or numbering is precluded.

The 5GS UE test loop mode B operation is the same as the one described in TS 36.509 [6], subclause 5.4.4 with the exception where E-UTRA is mentioned the same applies for NR, and, where PDCP SDU is mentioned the same applies for SDAP SDU.

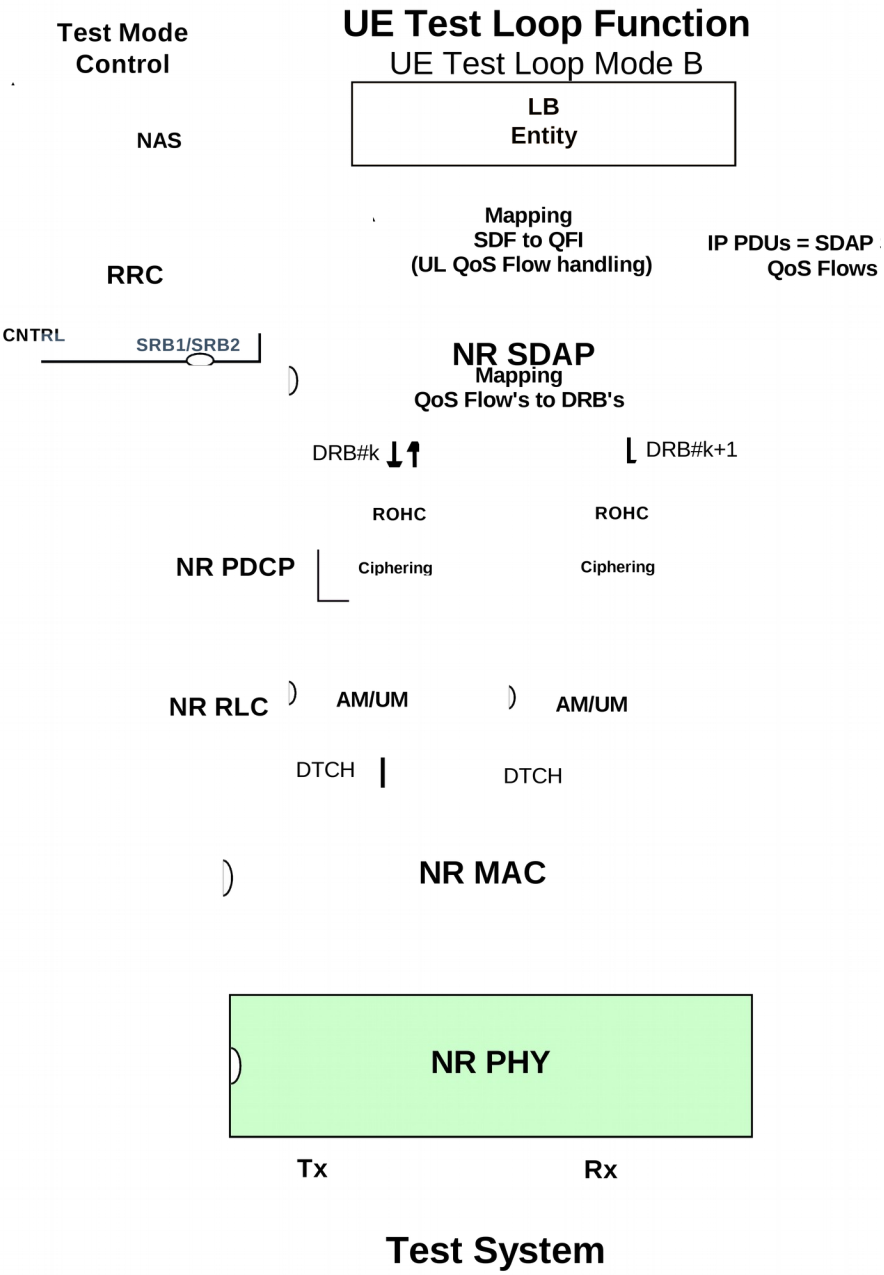


Figure 5.3.4.2.3-1: Model for Test Mode Control and UE Test Loop Mode B on UE side when standalone NR is configured

5.4 UE Beamlock test Function (UBF)

5.4.1 General

The UE Beamlock test function is intended for making the UE to lock the UE antenna pattern once it has formed a beam towards the base station (SS) direction following the cell identification procedure in preparation for subsequent test procedures.

The Beamlock test function is mandatory for applicable UEs operating in Frequency Range 2 (FR2).

The SS uses the UE Beamlock test mode activation procedure to command the UE to lock the UE antenna pattern. The Beamlock activation procedure can apply to UE transmitter and UE receiver beams either simultaneously or independently.

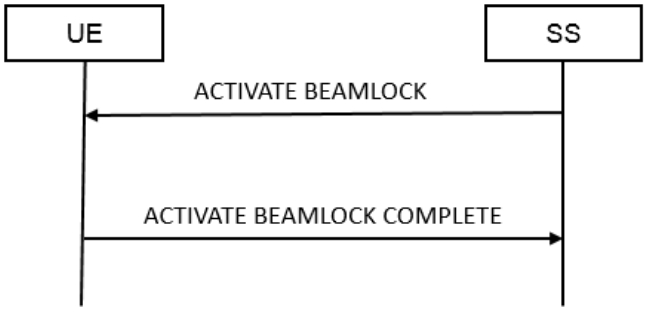


Figure 5.4.1-1: UE Beamlock test mode activation procedure

The SS uses the UE Beamlock test mode deactivation procedure to command the UE to re-tracking the beam towards the base station direction. The Beamlock deactivation procedure can apply to UE transmitter and UE receiver beams either simultaneously or independently.

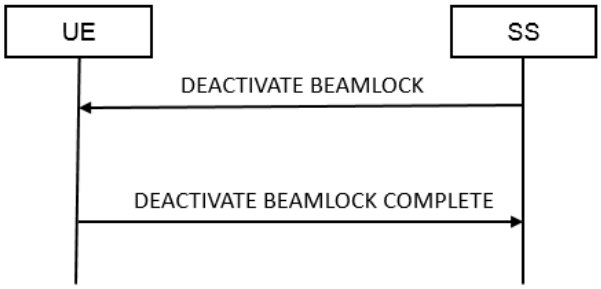


Figure 5.4.1-2: UE Beamlock test mode deactivation procedure

5.4.2 Activate Beamlock procedure

5.4.2.1 Initiation

The SS requests the UE to activate beamlock by transmitting an ACTIVATE BEAMLOCK message.

5.4.2.2 Reception of ACTIVATE BEAMLOCK message by UE

When UE receives ACTIVATE BEAMLOCK message then the UE shall:

1> if the UE is operating in FR2 AND is in RRC_CONNECTED state:

2> if UE Beamlock test Function = 01

3> Lock the UE antenna pattern with Tx only

2> else if UE Beamlock test Function = 10

3> Lock the UE antenna pattern with Rx only

2> else if UE Beamlock test Function = 11

3> Lock the UE antenna pattern with both TxRx

2> Transmit ACTIVATE BEAMLOCK COMPLETE message

1> else:

2> the UE behaviour is unspecified.

5.4.3 Deactivate Beamlock procedure

5.4.3.1 Initiation

The SS requests the UE to deactivate beamlock by transmitting a DEACTIVATE BEAMLOCK message. The SS should do this when the UE is in RRC_CONNECTED state.

5.4.3.2 Reception of DEACTIVATE BEAMLOCK message by UE

When UE receives DEACTIVATE BEAMLOCK message then the UE shall:

1> if the UE is operating in FR2 AND is in RRC_CONNECTED state AND the UE Beamlock test function is active:

2> unlock the beam and transmit DEACTIVATE BEAMLOCK COMPLETE message;

1> else:

2> the UE behaviour is unspecified.

5.4.3.3 Release of antenna beamlock by UE

The UE shall release the beamlock on its own:

1> if the UE is operating in FR2 AND the UE Beamlock test Function is active AND the UE moves out of RRC_CONNECTED state

2> transmit DEACTIVATE BEAMLOCK COMPLETE message;

1> else:

2> not applicable.

5.5 UE SS-RSRPB per receiver branch reporting

5.5.1 General

In 38.215 [22], section 5.1.18 defines SS-RSRPB as below, with its applicability only to FR2 and in RRC_CONNECTED Mode.

Definition	SS reference signal received power per branch (SS-RSRPB) is defined as the linear average over the power contributions (in [W]) of the resource elements that carry secondary synchronization signals (SS). The measurement time resource(s) for SS-RSRPB are confined within SS/PBCH Block Measurement Time Configuration (SMTC) window duration. For SS-RSRPB determination demodulation reference signals for physical broadcast channel (PBCH) and, if indicated by higher layers, CSI reference signals in addition to secondary synchronization signals may be used. SS-RSRPB using demodulation reference signal for PBCH or CSI reference signal shall be measured by linear averaging over the power contributions of the resource elements that carry corresponding reference signals taking into account power scaling for the reference signals as defined in 3GPP TS 38.213 [5]. SS-RSRPB shall be measured only among the reference signals corresponding to SS/PBCH blocks with the same SS/PBCH block index and the same physical-layer cell identity. If higher-layers indicate certain SS/PBCH blocks for performing SS-RSRPB measurements, then SS-RSRPB is measured only from the indicated set of SS/PBCH block(s). For frequency range 1, SS-RSRPB is not defined. For frequency range 2, SS-RSRPB shall be measured for each receiver branch based on the combined signal from antenna elements corresponding to the receiver branch.
Applicable for	RRC_CONNECTED intra-frequency

The SS uses the SS-RSRPB reporting procedure to command the UE to report SS-RSRP per UE receiver branch. The report from the UE shall be a vector of values, where the number of the reported values equals the number of receiver branches on the UE.

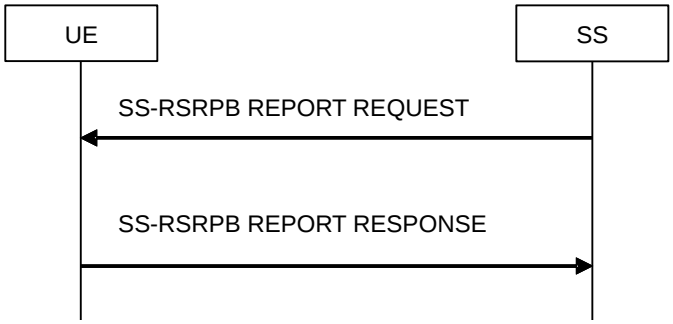


Figure 5.5.1-1: UE SS-RSRPB reporting procedure

5.5.2 Initiation

The SS requests the UE to start reporting SS-RSRP per receiver branch by transmitting a SS-RSRPB REPORT REQUEST message. And the UE responds back reporting SS-RSRP per receiver branch via SS-RSRPB REPORT RESPONSE.

5.5.3 Reception of SS-RSRPB REPORT REQUEST message by UE

When the UE receives SS-RSRPB REPORT REQUEST message then the UE shall:

1> if the UE is operating in FR2 AND in RRC_CONNECTED state:

2> if the MeasObjectId signalled by the IE SS-RSRPB Measurement Config is configured to the UE by RRC Signalling and PeriodicalReportConfig is defined for this MeasObject

3> Reply with the SS-RSRPB REPORT RESPONSE using the Measurement configuration as in the Measurement Object identified in the SS-RSRPB Measurement Config with the same reportInterval, reportAmount, Filter Coefficient

4> Report the SS-RSRPB measurement for the serving PCI and best SSB-ID configured in the MeasObject

5> FFS to have multiple cells and/or SSB-ID

2> else:

3> use default filtercoefficient of fc4, default reportInterval of 640ms, and default reportAmount of r16

1> else:

2> the UE behaviour is unspecified.

The SS-RSRPB Report Request & SS-RSRPB Report Response Message Octets are defined below in Section 6.5.

5.6 UE Positioning test mode procedures

5.6.1 Reset UE Positioning Stored Information

5.6.1.1 General

Same as TS 36.509 [6], subclause 5.5.1.1.

5.6.1.2 Initiation

Same as TS 36.509 [6], subclause 5.5.1.2.

5.6.1.3 Reception of RESET UE POSITIONING STORED INFORMATION message by UE

Same as TS 36.509 [6], subclause 5.5.1.3 with the following exception:

- where OTDOA is mentioned this applies to OTDOA using LTE cells.

5.6.2 Update UE Location Information

FFS.

5.6.3 UTC time reset

FFS.

6 Test Mode Control message definitions

6.1 General

Clause 6 describes only TMC protocol messages.

When UE under test is operated in EN-DC or NGEN-DC the TMC messages are sent using the E-UTRA RRC *DLInformationTransfer* and *ULInformationTransfer* procedures, see TS 36.331 [10], subclauses 5.6.1 and 5.6.2.

When UE under test is operated in NR or NE-DC the TMC messages are sent using the NR RRC *DLInformationTransfer* and *ULInformationTransfer* procedures, see TS 38.331 [11], subclauses 5.7.1 and 5.7.2.

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 [7], clause 11.

NOTE 3: 5GS use the same protocol discriminator value ("1111") as E-UTRA, UTRA and GSM/GPRS as specified in TS 24.007 [7], subclause 11.2.3.1.1. 5GS test control messages the message type value series 1010xxxx is reserved, where x represents 0 or 1. The message type values 0000xxxx to 1001xxxx are reserved to E-UTRA, UTRA and GSM/GPRS as specified in TS 36.509 [6], TS 34.109 [8] and TS 44.014 [9]. For 5GS test control messages that are common with E-UTRA control messages in TS 36.509 [6] the 5GS test control messages use the same message type values as used for the E-UTRA test control messages in TS 36.509 [6].

All the TMC messages are integrity protected and ciphered according to TS 24.301 [17] subclause 4.4.

6.2 Test mode messages

6.2.1 ACTIVATE TEST MODE

Same as TS 36.509 [6], subclause 6.5.

6.2.2 ACTIVATE TEST MODE COMPLETE

Same as TS 36.509 [6], subclause 6.6.

6.2.3 DEACTIVATE TEST MODE

Same as TS 36.509 [6], subclause 6.7.

6.2.4 DEACTIVATE TEST MODE COMPLETE

Same as TS 36.509 [6], subclause 6.8.

6.3 Test loop messages

6.3.1 CLOSE UE TEST LOOP

Same as TS 36.509 [6], subclause 6.1 with the following exception:

- The supported test modes for 5GS are limited to those specified in subclause 5.3.4.
- 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		Q5	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.
Q5 = 0 for E-UTRA Data Radio Bearers and Q5 = 1 for NR Data Radio Bearers

Q4..Q0 = Data Radio Bearer identity number, 1..32 (binary coded value of ‘DRB-Identity’ -1, Q4 is most significant bit and Q0 least significant bit), where Data Radio Bearer identity identifies the radio bearer, see TS 36.331 [10] for E-UTRA Data Radio Bearers and TS 38.331 [11] for NR Data Radio Bearers.

NOTE 1: The UL PDCP SDU size is limited to 12160 bits (1520 octets).

NOTE 2: 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.

NOTE 3: The UL PDCP SDU size shall be byte aligned (i.e. multiple of 8 bits) according to TS 36.323 [18] clause 6.2.1 for E-UTRA Data Radio Bearers and TS 38.323 [19] clause 6.2.1 for NR Data Radio Bearers.

6.3.2 CLOSE UE TEST LOOP COMPLETE

Same as TS 36.509 [6], subclause 6.2.

6.3.3 OPEN UE TEST LOOP

Same as TS 36.509 [6], subclause 6.3.

6.3.4 OPEN UE TEST LOOP COMPLETE

Same as TS 36.509 [6], subclause 6.4.

6.3.5 RESET UE POSITIONING STORED INFORMATION

Same as TS 36.509 [6], subclause 6.9 with the following exception:

- where OTDOA is mentioned this applies to OTDOA using LTE cells.

6.3.6 UPDATE UE LOCATION INFORMATION

FFS.

6.4 Beamlock messages

6.4.1 ACTIVATE BEAMLOCK

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 Beamlock test Function		M	V	1

where message type is:

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

where UE Beamlock test Function is:

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

where X1,X2 = 01 for activate beamlock of Tx only, 10 for activate beamlock of Rx only and 11 for activate beamlock of both TxRx.

NOTE: X1,X2 = 00 is not used

6.4.2 ACTIVATE BEAMLOCK 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	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	1	0	0	0	0	1	octet 1

6.4.3 DEACTIVATE BEAMLOCK

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	1	0	0	0	1	0	octet 1

6.4.4 DEACTIVATE BEAMLOCK 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	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	1	0	0	0	1	1	octet 1

6.5 UE SS-RSRP per receiver branch reporting messages

6.5.1 SS-RSRPB REPORT REQUEST

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

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [5], subclause 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
SS-RSRPB Measurement Config		M	V	1

where message type is:

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

where SS-RSRPB Measurement Config is:

8	7	6	5	4	3	2	1	bit no.
X8	X7	X6	X5	X4	X3	X2	X1	octet 1

This maps to the MeasObjectId as configured by the RRC Reconfig Message.

6.5.2 SS-RSRPB REPORT RESPONSE

This message is only sent in the direction UE to SS representing the measured SS-RSRPB. To report SS-RSRPB (0 to 127). per measured SSB, UE will send 3 Octets, the First Octet reporting the Measured SSB ID (values 0 to 63 consuming 6 bits X1 to X6 of Octet 1), Second Octet reporting SS-RSRPB for Branch#0 and third Octet reporting SS-RSRPB for Branch#1.

Information Element	Reference	Presence	Format	Length
Protocol discriminator	TS 24.007 [5], subclause 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
SS-RSRPB report response param		M	V	1

where message type is:

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

where SS-RSRPB report response param is:

8	7	6	5	4	3	2	1	bit no.
Reserved		X6	X5	X4	X3	X2	X1	octet 1
16	15	14	13	12	11	10	9	bit no.
X16	X15	X14	X13	X12	X11	X10	X9	octet 2
24	23	22	21	20	19	18	17	bit no.
X24	X23	X22	X21	X20	X19	X18	X17	octet 3
16	15	14	13	12	11	10	9	bit no.
X16	X15	X14	X13	X12	X11	X10	X9	octet 2
24	23	22	21	20	19	18	17	bit no.
X24	X23	X22	X21	X20	X19	X18	X17	octet 3

where X1 to X24 spanning over three octets will have the following definition:

Definition	8	7	6	5	4	3	2	1	bit no.
SSB ID	Reserved		X6	X5	X4	X3	X2	X1	octet 1
RSRPB Branch #0	X16	X15	X14	X13	X12	X11	X10	X9	octet 2
RSRPB Branch #1	X24	X23	X22	X21	X20	X19	X18	X17	octet 3

7 Variables, constants and timers

7.1 State variables

Same as [9] TS 36.509, subclause 7.1.

7.2 Constants

Same as [9] TS 36.509, subclause 7.2.

7.3 Timers

Same as [9] TS 36.509, subclause 7.3.

7.4 Configurable parameters

Same as [9] TS 36.509, subclause 7.4.

8 Electrical Man Machine Interface (EMMI)

The EMMI is used for automation of conformance testing. The commands used on the EMMI by the System Simulator, shall be limited to those specified in TS 38.523-3 [3]. An illustration is given in figure 8-1 as an example.

At the System Simulator side, the logical EMMI using mandatory AT commands shall interface with the Main Test Component (MTC) of TTCN test cases which hosts the Upper Tester. The physical EMMI interface towards the UE may be for example a standard USB interface. Other interfaces of proprietary or standardized type shall not be precluded.

At the UE side an adapter needs to be provided by the UE manufacturer for converting the commands into the UE manufacturer specific interface and format.

The use of EMMI is optional for the UE.

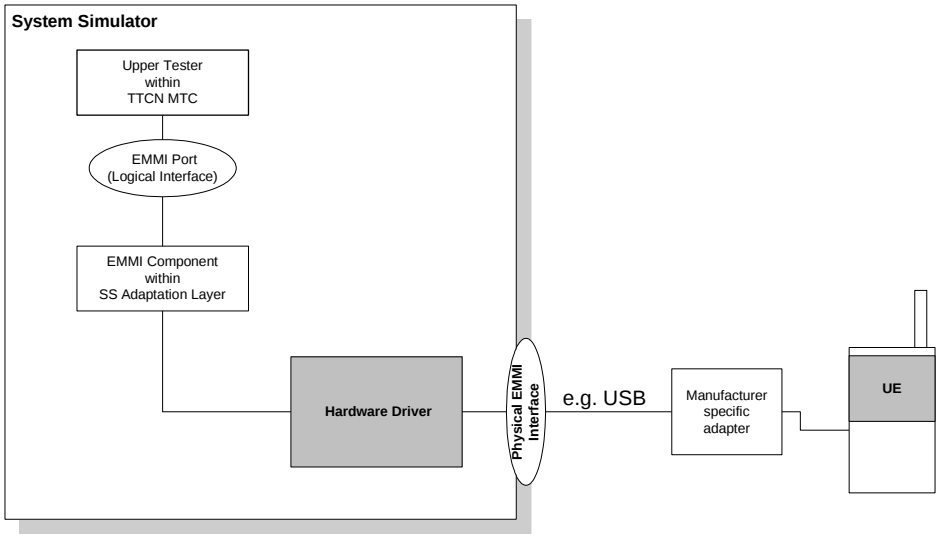


Figure 8-1: An example of EMMI and its use for automation of signalling testing

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-08	RAN5#76	R5-174100	-	-	-	Introduction of TS 38.509.	0.0.1
2017-12	RAN5#77	R5-176853	-	-	-	Adding technical content: UE beamlock special conformance testing function	0.1.0
2018-03	RAN5#78	R5-181211	-	-	-	Text proposal to add UE test loop mode A and B for 5GS (TP 38.509)	0.2.0
2018-04	RAN5#78	R5-182071	-	-	-	Text proposal to add UE functional block diagram for UE test loop modes A and B	0.3.0
2018-04	RAN5#78	R5-182070	-	-	-	Update of 38.509 general sections	0.3.0
2018-04	RAN5#78	R5-182037	-	-	-	Text Proposal on SS-RSRPB UE reporting	0.3.0
2018-05	RAN5#79	R5-182423	-	-	-	Editorial updates to 38.509	1.0.0
2018-05	RAN5#79	R5-182354	-	-	-	Text proposal to add message type ID for UBF and SS-RSRP messages’	1.0.0
2018-05	RAN5#79	R5-183081	-	-	-	Text proposal to UE test loop modes A and B	1.0.0
2018-06	RAN#80	RP-181209	-	-	-	put under revision control as v13.0.0 with small editorial changes	15.0.0
2018-09	RAN#81	R5-185057	0001	1	F	Editorial updates to 38.509	15.1.0
2018-09	RAN#81	R5-185523	0003	1	F	FR2_UE_BeamlockMode_IE_38.509	15.1.0
2018-12	RAN#82	R5-186863	0007	-	F	Update of Test Control UE Beamlock Function messages	15.2.0
2018-12	RAN#82	R5-187113	0009	-	F	Correction of 5GC terminology	15.2.0
2018-12	RAN#82	R5-187684	0008	1	F	Addition of Test Loop for SDAP testing	15.2.0
2018-12	RAN#82	R5-187891	0011	1	F	FR2 UE RSRPB Function 38.509	15.2.0
2019-03	RAN#83	R5-191128	0013	-	F	Addition of information for RESET UE POSITIONING STORED INFORMATION message	15.3.0
2019-03	RAN#83	R5-191196	0014	-	F	Resolving FFS's	15.3.0