

TS.11- Annex C

Detailed Test Procedures for a Single RAT / Multi RAT E‑UTRA User Equipment

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# Annex C: Detailed Test Procedures for a Single RAT / Multi RAT E‑UTRA User Equipment

This Annex contains the detailed procedures that are recommended to be used for Field and Lab Tests of a Single RAT / Multi RAT E-UTRA User Equipment.

To ensure that all features supported by the UE operating correctly on all supported frequency bands, an appropriate selection of frequency bands shall be used for the following test scenarios.

The 3GPP requirements for E-UTRA provide support for paired and unpaired spectrum, enabling a single radio-access technology that can support frequency-division duplex (FDD) as well as time-division duplex (TDD) operation.

It is expected that the lab test and field test scenarios specified in this document will be applicable for both FDD and TDD operation, unless a test case specifies TDD or FDD operation only.

# 30 System Access & Registration

## 30.1 Attach and Detach

### 30.1.1 Attach and Detach for EPS services

#### 30.1.1.1 EPS Attach / Detach

Description

The DUT shall successfully perform the “EPS Attach” , “Default EPS Bearer Context Activation” and “EPS Detach” procedures.

Related core specifications

3GPP TS 24.301 , section 5.5.2.2

Reason for test

To verify the DUT can successfully establish a Default EPS bearer with EPS Attach and successfully performs an EPS Detach procedure

Initial configuration

DUT is supporting PS mode 1 or PS mode 2 of operation.

DUT is powered off or in flight mode.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Power on / disable flight mode and confirm successful attach procedure. | DUT sends ATTACH REQUEST to the network with type EPS ATTACH (1).  Network sends ATTACH ACCEPT and ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST containing the APN and PDN type.  DUT sends ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT to the network. |
| 2 | Load a page on the embedded browser (or via a tethering connection if embedded browser is not supported). | Page is loaded successfully to confirm data connection. |
| 3 | Power off / enable flight mode. | DUT sends DETACH REQUEST to the network with type “EPS Detach (1)” and “Switch off (1)”. |

| **Step** | **Direction DUT – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| ATTACH | | | |
| 1 | 🡺 | ATTACH REQUEST  (PDN CONNECTIVITY REQUEST) | EPS attach (1) |
| 2 | 🡸 | ATTACH ACCEPT  (ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST) |  |
| 3 | 🡺 | ATTACH COMPLETE  (ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT) |  |
| DETACH | | | |
| 4 |  | DETACH REQUEST | EPS Detach (1) & Switch off (1) |

#### 30.1.1.2 Attach Reject, cause #7 “EPS Services not allowed”

Description

Check that UE correctly starts timer T3247 upon reception of non-integrity protected message and restart the registration procedure

Related core specifications

3GPP TS 24.301, clause 5.3.7b

Reason for test

To verify that the DUT behaves correctly after expiry of timer T3247.

Initial configuration

* DUT is powered off
* Network does not allow EPS services (e.g. this particular IMSI is not provisioned for EPS services)

|  |  |  |
| --- | --- | --- |
| - | **Test procedure** | Expected behaviour |
| 1 | Power on the DUT | The DUT attempts Attach procedure. |
| 2 | Network sends ATTACH REJECT with EMM cause #7, EPS services not allowed. The NAS message is not integrity protected | DUT shall start T3247 timer with a random value uniformly drawn from the range between 30 minutes and 60 minutes |
| 3 | Check whether the DUT tries to initiate registration procedure in 30-60 minutes range after DUT receives Attach Reject message. | DUT shall initiate registration procedure after T3247 expires. |

#### 30.1.1.3 Attach Reject, cause #14 “EPS Services not allowed in this PLMN”

##### 30.1.1.3.1 Attach Reject, cause #14 “EPS Services not allowed in this PLMN” – multiple PLMN environment

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

##### 30.1.1.3.2 Attach Reject, cause #14 “EPS Services not allowed in this PLMN” – single PLMN environment

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.1.1.4 Attach Reject, cause #25 “not authorised for this CSG”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.1.1.5 Attach Reject, cause #11 “PLMN not allowed”

Description

Check the DUT’s behaviour on the reject message with cause #11 ‘PLMN not allowed’

Related core specifications

3GPP TS 24.301, clause 5.5.1.2.5

Reason for test

To verify that the DUT behaves correctly on a reject message ‘‘PLMN not allowed’

Initial configuration

* The DUT is powered off
* The DUT is configured to automatic network selection mode
* PLMN1 is a E-UTRA radio access technology network, PLMN2 can be any RAT that is supported by the DUT
* The eSIM/USIM has a populated EPSLOCI field with PLMN1 as last visited PLMN
* The DUT’s “forbidden PLMN list” on the eSIM/USIM is empty
* Roaming is not allowed with PLMN1
* Roaming is allowed with PLMN2

Test procedure

1. Power on the DUT and verify that the DUT sends an ATTACH REQUEST to the EPS network PLMN1.
2. The EPS network PLMN1 shall respond to the DUT with an ATTACH REJECT with Reject Cause #11 ‘PLMN not allowed’.
3. Check that the DUT performs an automatic PLMN selection to another PLMN (e.g. PLMN2) without accessing the “forbidden PLMN”.
4. Perform a manual PLMN selection to PLMN1 and verify that the DUT attempts to select the “forbidden PLMN”.
5. Perform a manual PLMN selection to PLMN2 and verify that the DUT successfully selects the PLMN.
6. Send some data over the selected network (e.g. by using the ping command) to validate that the device is properly connected to the network.

Note: In case the PLMN2 RAT is not E-UTRA, a PDP context needs to be established.

1. Validate with a SIM card reader that the FPLMN field on the eSIM/USIM contains the forbidden PLMN.

Expected behaviour

1. The DUT performs an Attach procedure on PLMN1.
2. The DUT shall set the EPS update status to EU3 ROAMING NOT ALLOWED and shall delete any GUTI, last visited registered TAI and KSI. The DUT in S1 mode stores the PLMN identity in the “forbidden PLMN” list and enters state EMM-DEREGISTERED.PLMN-SEARCH.
3. The DUT performs an automatic PLMN selection without accessing the “forbidden PLMN”.
4. The DUT attempts to perform an ATTACH REQUEST on PLMN1, is rejected with Cause #11 and indicates an error message to the user
5. The DUT performs a successful ATTACH REQUEST on PLMN2.
6. The DUT establishes a service connection.
7. PLMN1 has been written to the FPLMN field on the eSIM/USIM.

#### 30.1.1.6 Attach Reject, cause #3 “Illegal UE” 5and cause #6 “Illegal ME”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.1.1.7 Attach Reject, cause #15 “No suitable cells in TA”

##### 30.1.1.7.1 Attach Reject, cause #15 “No suitable cells in TA”, E-UTRA only

Description

Check an E-UTRA only DUT’s behaviour on the reject message with cause 15 ‘No suitable cells in TA’ in an E-UTRA only environment. This test should be performed in an area where the PLMN has E-UTRA cells available. The test can be performed with a subscription which has not been provisioned for E-UTRA but has been provisioned for UTRA on that PLMN.

Related core specifications

3GPP TS 24.301, clause 5.5.1.2.2 and clause 5.5.1.2.5

Reason for test

To verify that the DUT behaves correctly on a reject message ‘‘No suitable cell in TA” from the E-UTRA cell. The DUT should obtain service on another TA of the same PLMN. If not available the DUT shall indicate the loss of service with an appropriate error message.

Initial configuration

* DUT is powered off
* DUT with USIM that contains IMSI1, GUTI1, TAI1, EPS update status “EU1:UPDATED”
* E-UTRA Cell(s) of PLMN1 available (all belonging to only one TA) and cell(s) of PLMN1 with another Radio Technology
* DUT with USIM that contains EPS LOCI field with PLMN1 as last visited PLMN
* DUT’s “forbidden PLMN list” is empty

Test procedure

1. Ensure only PLMN1 with TA1 and PLMN1 with another Radio Technology is available. Power on the DUT and verify that the DUT sends an ATTACH REQUEST to the EPS network PLMN1 and TA1.
2. The EPS network PLMN1 and TA1 shall respond to the DUT with an ATTACH REJECT with Reject Cause #15 ‘No suitable cells in TA’
3. Verify that the DUT does not send an ATTACH REQUEST to other cells of TA1.

Expected behaviour

1. The DUT performs an Attach procedure on PLMN1 and TA1.
2. The DUT shall set the EPS update status to EU3 ROAMING NOT ALLOWED and shall delete any GUTI, last visited registered TAI and KSI. In S1 mode, the DUT shall store the current TAI in the list of “forbidden tracking areas for roaming” and enter the state EMM-DEREGISTERED.LIMITED-SERVICE.
3. The DUT does not send another ATTACH REQUEST to the network PLMN1 and TA1.

##### 30.1.1.7.2 Attach Reject, cause #15 “No suitable cells in TA”, Multimode

Description

Check a multimode DUT’s behaviour on the reject message with cause 15 ‘No suitable cells in TA’ in a multimode environment. This test should be performed in an area where the PLMN has UMTS and E-UTRA cells available. The test can be performed with a subscription which has not been provisioned for E-UTRA but has been provisioned for UMTS on that PLMN.

Related core specifications

3GPP TS 24.301, clause 5.5.1.2.2 and clause 5.5.1.2.5

Reason for test

To verify that the DUT behaves correctly on a reject message ‘‘No suitable cell in TA” from the E-UTRA cell. The DUT does not lose service and should obtain service on another Radio Technology of the same PLMN.

Initial configuration

* DUT is powered off
* DUT with USIM that preferably contains IMSI1, GUTI1, TAI1, EPS update status “EU1:UPDATED”
* E-UTRA Cell(s) of PLMN1 available (all belonging to only one TA) and cell(s) of PLMN1 with another Radio Technology
* Cells of PLMN2 (VPLMN) available.
* DUT with USIM that contains EPS LOCI or PS LOCI field with PLMN1 as last visited PLMN
* DUT’s “forbidden PLMN list” is empty

Test procedure

1. Ensure only PLMN1 with TA1, PLMN1 with another Radio Technology and PLMN2 can be seen by the DUT. Power on the DUT and verify that the DUT sends an ATTACH REQUEST to the EPS network PLMN1 and TA1.
2. The EPS network PLMN1 and TA1 shall respond to the DUT with an ATTACH REJECT with Reject Cause #15 ‘No suitable cells in TA’
3. Verify that the DUT does not send an ATTACH REQUEST to other cells of TA1.
4. Verify that the DUT sends an ATTACH REQUEST to the cell with another Radio Technology of PLMN1
5. If the DUT is not capable to set-up a mobile terminated service, verify that the DUT is registered by setting up a mobile originated connection

Expected behaviour

1. The DUT performs an Attach procedure on PLMN1 and TA1.
2. The DUT shall set the EPS update status to EU3 ROAMING NOT ALLOWED and shall delete any GUTI, last visited registered TAI and KSI. In S1 mode, the DUT shall store the current TAI in the list of “forbidden tracking areas for roaming” and enter the state EMM-DEREGISTERED.LIMITED-SERVICE.
3. The DUT does not send another ATTACH REQUEST to the network PLMN1 and TA1.
4. The DUT performs an Attach procedure on a cell of PLMN1 with another Radio Technology.
5. The DUT establishes a service connection

#### 30.1.1.8 Void

#### 30.1.1.9 Attach Reject, cause #19 “ESM Failure”, PDN Connectivity Reject, ESM cause #111”Protocol Error, unspecified”

Description

Check the DUT’s behaviour on the reject message with cause #19 “ESM Failure”, with a PDN CONNECTIVITY REJECT message contained in the ESM message container information element.

Related core specifications

3GPP TS 24.301, sub clause 5.5.1.2.5, 5.5.1.2.6

Reason for test

To verify that the DUT behaves correctly on a reject message “ESM Failure”

Initial configuration

* DUT is powered off
* Network does not allow EPS services (e.g. this particular IMSI is not provisioned for EPS services)

Test procedure

1. Power on the DUT.
2. UE initiates Attach procedure by sending ATTACH REQUEST message.
3. EMM cause at the time of reception of the Attach Reject message is equal to   
   #19 ESM Failure. The ESM container information element contains a PDN CONNECTIVITY REJECT message, ESM cause is 111 Protocol Error, unspecified.
4. Check that the UE tries to perform additional attach procedure. Repeat steps 2 – 4 four more times.

Expected behaviour

1. –
2. The DUT attempts to perform Attach procedure.
3. –
4. DUT shall perform additional Attach procedure 4 times.

### 30.1.2 Combined Attach and Detach

#### 30.1.2.1 Combined Attach / Detach

Description

The DUT shall successfully perform the “Combined EPS/IMSI Attach”, “Default EPS Bearer Context Activation” and “Combined EPS/IMSI Detach” procedures.

Related core specifications

3GPP TS 24.301, clause 5.5.1.3 and section 5.5.2.2.

Reason for test

To verify the DUT can successfully establish a Default EPS bearer with Combined EPS/IMSI Attach and successfully perform a Combined EPS/IMSI Detach procedure.

Initial configuration

DUT is supporting CS/PS mode 1 or CS/PS mode 2 of operation.

DUT is supporting 4G and 3G/2G.

DUT is powered off or in flight mode.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Power on / disable flight mode and confirm successful attach procedure. | DUT sends ATTACH REQUEST to the network with type COMBINED EPS/IMSI ATTACH (2).  Network sends ATTACH ACCEPT and ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST containing the APN and PDN type.  DUT sends ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT to the network. |
| 2 | Load a page on the embedded browser (or via a tethering connection if embedded browser is not supported). | Page is loaded successfully to confirm data connection. |
| 3 | Power off / enable flight mode. | DUT sends DETACH REQUEST to the network with type “Combined EPS/IMSI Detach (3)” and “Switch off (1)”. |

| **Step** | **Direction DUT – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| ATTACH | | | |
| 1 | 🡺 | ATTACH REQUEST  (PDN CONNECTIVITY REQUEST) | Combined EPS/IMSI attach (2) |
| 2 | 🡸 | ATTACH ACCEPT  (ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST) |  |
| 3 | 🡺 | ATTACH COMPLETE  (ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT) |  |
| DETACH | | | |
| 4 |  | DETACH REQUEST | Combined EPS/IMSI Detach (3) & Switch off (1) |

#### 30.1.2.2 Combined Attach – successful for EPS services only, cause #18 “CS Domain not available”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.1.2.3 Void

#### 30.1.2.4 Combined NW initiated detach – re-attach required

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.1.2.5 Combined Attach – successful for EPS services only, cause #16 “MSC temporarily not reachable”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.1.2.6 Combined Attach / Detach (SMS only)

Description

The DUT shall successfully perform the “Combined EPS/IMSI Attach”, “Default EPS Bearer Context Activation” and “Combined EPS/IMSI Detach” procedures with SMS only.

Related core specifications

3GPP TS 24.301, section 5.5.1.3.1

Reason for test

To verify the DUT can successfully establish a Default EPS bearer activation with Combined EPS/IMSI Attach and IE type “SMS only” and also successfully performs a Combined EPS/IMSI Detach procedure.

Initial configuration

DUT is supporting CS/PS mode 1 or CS/PS mode 2 of operation.

DUT is supporting 4G only (or can be set to 4G only via the user menu).

DUT is powered off or in flight mode.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Power on / disable flight mode and confirm successful attach procedure. | DUT sends ATTACH REQUEST to the network with type COMBINED EPS/IMSI ATTACH (2) and the Additional update type IE indicates “SMS only”.  Network sends ATTACH ACCEPT and ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST containing the APN and PDN type.  Within the ATTACH ACCEPT message, the Additional update result value IE indicates “SMS only”.  DUT sends ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT to the network. |
| 2 | Load a page on the embedded browser (or via a tethering connection if embedded browser is not supported). | Page is loaded successfully to confirm data connection. |
| 3 | Power off / enable flight mode. | DUT sends DETACH REQUEST to the network with type “Combined EPS/IMSI Detach (3)” and “Switch off (1)”. |

| **Step** | **Direction DUT – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| ATTACH | | | |
| 1 | 🡺 | ATTACH REQUEST  (PDN CONNECTIVITY REQUEST) | Combined EPS/IMSI attach (2) IE indicates SMS only. |
| 2 | 🡸 | ATTACH ACCEPT  (ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST) | IE indicates SMS only. |
| 3 | 🡺 | ATTACH COMPLETE  (ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT) |  |
| DETACH | | | |
| 4 |  | DETACH REQUEST | Combined EPS/IMSI Detach (3) & Switch off (1) |

## 30.2 Tracking Area Update

### 30.2.1 Normal Tracking Area Update

#### 30.2.1.1 Normal Tracking Area Update without ISR activation; Successful

Description

The DUT shall successfully perform a Tracking Area Update procedure after reselecting a cell in a new Tracking Area.

Related core specifications

3GPP TS 24.301, section 5.5.3.2

Reason for test

To verify that the DUT successfully performs a Tracking Area Update procedure, after reselecting a cell in a new Tracking Area.

Initial configuration

DUT is registered and in idle state.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Move the DUT to a cell in a new Tracking Area. | DUT sends a TRACKING AREA UPDATE REQUEST message to the network. If possible use a diagnostic tool to verify that the “EPS update type” parameter is set to ‘‘TA updating’’.  The network shall respond with TRACKING AREA UPDATE ACCEPT message to the DUT.  (If the TRACKING AREA UPDATE ACCEPT messsage contains a GUTI, the DUT shall send TRACKING AREA UPDATE COMPLETE to acknowledge the received GUTI. |
| 2 | Load a page on the embedded browser (or via a tethering connection if embedded browser is not supported). | Page is loaded successfully to confirm data connection. |

| **Step** | **Direction UE – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 |  | RRCConnectionRequest | RRC |
| 2 |  | RRCConnectionSetup | RRC |
| 3 |  | RRCConnectionSetupComplete(TRACKING AREA UPDATE REQUEST) | RRC(EMM) |
| 4 |  | AUTHENTICATION REQUEST | *EMM(Optional)* |
| 5 |  | AUTHENTICATION RESPONSE | *EMM(Optional)* |
| 6 |  | SECURITY MODE COMMAND | *EMM(Optional)* |
| 7 |  | SECURITY MODE COMPLETE | *EMM(Optional)* |
| 8 |  | TRACKING AREA UPDATE ACCEPT | EMM. |
| 9 |  | TRACKING AREA UPDATE COMPLETE | *EMM(Optional)* |
| 10 |  | RRCConnectionRelease | RRC |

#### 30.2.1.2 Normal Tracking Area Update with ISR activation; Successful

Description

The UE shall take in account “ISR Activated” IE in the Tracking Area Update procedure.

Related core specifications

3GPP TS 24.301, section 5.5.3.2; 3GPP TS 23.401, section 4.3.5.6; 3GPP TS 23.401, Annex J

Reason for test

To verify that UE is not performing RAU procedure in new RAT in case if previous TAU procedure has activated ISR function

Initial configuration

UE is registered and in idle state camped on GSM/WCDMA

Core Network is ISR capable

Test procedure

1. UE performs reselection from GSM/WCDMA RAT to E-UTRAN
2. UE detects it has entered a new TA that is not in the list of TAIs that the UE registered with the network.
3. The UE shall send a TRACKING AREA UPDATE REQUEST message to the network. Check that the “EPS update type” parameter is set to ‘‘TA updating’’.
4. The network shall respond with TRACKING AREA UPDATE ACCEPT message to the UE.
5. If the TRACKING AREA UPDATE ACCEPT message contains an indication that ISR is activated (EPS update result = “TA updated and ISR activated”), the UE shall regard a previously assigned P-TMSI and RAI as valid and registered with the network. If the TIN currently indicates “P-TMSI”, the UE shall set the TIN to “RAT-related TMSI”
6. Optionally, if the TRACKING AREA UPDATE ACCEPT message contained a GUTI, the UE shall return a TRACKING AREA UPDATE COMPLETE message to the MME to acknowledge the received GUTI.
7. Reselect to the RA/LA of the GSM/WCDMA RAT of Step 1

Expected behaviour

1. Once UE reselects to new RAT, it shall not perform any Routing Area Update procedure.

Example message flow:

| **Step** | **Direction UE – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 |  | RRCConnectionRequest | RRC |
| 2 |  | RRCConnectionSetup | RRC |
| 3 |  | RRCConnectionSetupComplete(TRACKING AREA UPDATE REQUEST) | RRC(EMM) |
| 4 |  | AUTHENTICATION REQUEST | *EMM(Optional)* |
| 5 |  | AUTHENTICATION RESPONSE | *EMM(Optional)* |
| 6 |  | SECURITY MODE COMMAND | *EMM(Optional)* |
| 7 |  | SECURITY MODE COMPLETE | *EMM(Optional)* |
| 8 |  | TRACKING AREA UPDATE ACCEPT | EPS Update result IE = “TA Updated and ISR Activated” |
| 9 |  | TRACKING AREA UPDATE COMPLETE | *EMM(Optional)* |
| 10 |  | RRCConnectionRelease | RRC |

#### 30.2.1.3 Tracking Area Update Reject, cause #15 “No suitable cells in TA”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.2.1.4 “Forbidden tracking areas for roaming” accommodates 40 or more TAIs

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.2.1.5 Tracking Area Update Reject, cause #17 “Network Failure”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 30.2.2 Periodic Tracking Area Update

#### 30.2.2.1 Periodic Tracking Area Update; Successful

Description

The UE shall successfully perform a Periodic Tracking Area Update procedure after the expiry of the T3412 timer.

Related core specifications

3GPP TS 24.301, section 5.5.3.2.

Reason for test

To verify that the UE successfully performs a Periodic Tracking Area Update procedure after the expiry of the T3412 timer.

Initial configuration

The UE is attached and in idle state, T3412 is reset.

Test procedure

1. Wait for the T3412 timer to expire, and if possible use a diagnostic tool to verify that the UE sends a TRACKING AREA UPDATE REQUEST message with EPS update type set to “periodic updating”.
2. Verify that the UE is registered to the Tracking Area correctly by setting up a mobile terminated connection after the Tracking Area Update procedure.
3. If the UE is not capable to set-up a mobile terminated service, verify that the UE is registered to the Tracking Area by setting up a mobile originated connection without establishing a redundant Tracking Area Update procedure.

Expected behaviour

1. The UE performs a Periodic Tracking Area Update procedure.
2. The UE establishes a mobile terminated service connection.
3. The UE establishes a mobile originated service connection.

Example Message Flow

| **Step** | **Direction UE – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 |  | *RRCConnectionRequest* | RRC |
| 2 |  | *RRCConnectionSetup* | RRC |
| 3 |  | *RRCConnectionSetupComplete*(TRACKING AREA UPDATE REQUEST) | RRC(EMM) |
| *(4)* | ** | *AUTHENTICATION REQUEST* | *EMM(Optional)* |
| *(5)* | ** | *AUTHENTICATION RESPONSE* | *EMM(Optional)* |
| *(6)* | ** | *SECURITY MODE COMMAND* | *EMM(Optional)* |
| *(7)* | ** | *SECURITY MODE COMPLETE* | *EMM(Optional)* |
| 8 |  | TRACKING AREA UPDATE ACCEPT | EMM |
| *(9)* | ** | *TRACKING AREA UPDATE COMPLETE* | *EMM(Optional)* |
| 10 |  | *RRCConnectionRelease* | RRC |

### 30.2.3 Combined Tracking Area Update

#### 30.2.3.1 Combined Tracking Area Update; Successful

Description

The DUT shall successfully perform the combined “Tracking Area Update” upon reselection to a cell in new Tracking Area

Related core specifications

3GPP TS 24.301, section 5.5.3.3

Reason for test

To verify that DUT successfully performs the combined “Tracking Area Update” upon reselection to a cell in new Tracking Area

Initial configuration

The DUT operates in CS/PS mode 1 of operation or CS/PS mode 2 of operation

The DUT is combined attached (EPS/IMSI) to the network and in idle mode.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Move the DUT to a cell in a new Tracking Area. | DUT sends a TRACKING AREA UPDATE REQUEST message to the network. If possible use a diagnostic tool to verify that the “EPS update type” parameter is set to ‘‘Combined TA updating’’.  The network shall respond with TRACKING AREA UPDATE ACCEPT message to the DUT.  (If the TRACKING AREA UPDATE ACCEPT messsage contains a GUTI, the DUT shall send TRACKING AREA UPDATE COMPLETE to acknowledge the received GUTI.)  (If the TRACKING AREA UPDATE ACCEPT message contains a TMSI, the DUT shall use this TMSI as new temporary identity. The DUT shall delete its old TMSI and shall store the new TMSI. In this case, a TRACKING AREA UPDATE COMPLETE message is returned to the network to confirm the received TMSI.) |
| 2 | Load a page on the embedded browser (or via a tethering connection if embedded browser is not supported). | Page is loaded successfully to confirm data connection. |

| **Step** | **Direction UE – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 |  | RRCConnectionRequest | RRC |
| 2 |  | RRCConnectionSetup | RRC |
| 3 |  | RRCConnectionSetupComplete(TRACKING AREA UPDATE REQUEST) | RRC(EMM) |
| 4 |  | AUTHENTICATION REQUEST | *EMM(Optional)* |
| 5 |  | AUTHENTICATION RESPONSE | *EMM(Optional)* |
| 6 |  | SECURITY MODE COMMAND | *EMM(Optional)* |
| 7 |  | SECURITY MODE COMPLETE | *EMM(Optional)* |
| 8 |  | TRACKING AREA UPDATE ACCEPT | EMM. |
| 9 |  | TRACKING AREA UPDATE COMPLETE | *EMM(Optional)* |
| 10 |  | RRCConnectionRelease | RRC |

#### 30.2.3.2 Combined Tracking Area Update; for EPS Services only, cause #18 “CS Domain not available”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

#### 30.2.3.3 Combined Tracking Area Update; for EPS Services only, cause #16 “MSC temporarily not reachable”

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

## 30.3 Void

PLMN selection test cases have been transitioned to Annex D, section 59

## 30.4 Security Features

### 30.4.1 Advertisement of mandatory integrity and ciphering algorithms

Description

To verify that MS includes mandatory integrity and ciphering algorithms in UE network capability IE.

Reason for test

Several ciphering algorithms are supported by mobile stations and networks today. This test verifies that DUT complies with the mandatory requirements from 33.401 by advertising support of:

Integrity algorithms:

* 128-EIA1 SNOW 3G based algorithm
* 128-EIA2 AES based algorithm

Ciphering algorithms:

* EEA0 Null ciphering algorithm
* 128-EEA1 SNOW 3G based algorithm
* 128-EEA2 AES based algorithm

Note: UEs shall implement EIA0 for integrity protection of NAS and RRC signalling but is only allowed for unauthenticated emergency calls and shall not be explicitly advertised.

Related 3GPP core specifications

3GPP TS 24.301, 3GPP TS 33.401, Chapter 5.1.3; Chapter 5.1.4

Initial configuration

DUT is Powered OFF (or Flight Mode enabled).

Test procedure

|  |  |  |
| --- | --- | --- |
| **-** | **Test procedure** | **Expected behaviour** |
| 1 | Power ON DUT (or disable Flight Mode). | DUT is successfully camping on the PLMN and starts regular registration procedure (attach for EPS services only or attach for both EPS and non-EPS services) |
|  | DUT sends an ATTACH REQUEST message to the network. | Within ATTACH REQUEST message, confirm the advertised integrity and ciphering algorithms included by the DUT in “UE Network capability IE”. Encoding example at the end.  The network shall respond to the DUT with an ATTACH ACCEPT message. |

Encoding example:

NAS EPS Mobility Management Message Type: Attach request (0x41)

...

UE network capability

Length: 7

1... .... = EEA0: Supported

.1.. .... = 128-EEA1: Supported

..1. .... = 128-EEA2: Supported

...0 .... = 128-EEA3: Not supported

.... 0... = EEA4: Not supported

.... .0.. = EEA5: Not supported

.... ..0. = EEA6: Not supported

.... ...0 = EEA7: Not supported

0... .... = EIA0: Not supported

.1.. .... = 128-EIA1: Supported

..1. .... = 128-EIA2: Supported

...1 .... = 128-EIA3: Supported

.... 0... = EIA4: Not supported

.... .0.. = EIA5: Not supported

.... ..0. = EIA6: Not supported

# 31 MOBILITY

## 31.1 Void

### 31.1.1 Void

### 31.1.2 Void

## 31.2 Void

### 31.2.1 Void

### 31.2.2 Void

## 31.3 Carrier Aggregation Mobility Test

### 31.3.1 Carrier Aggregation Mobility – Downlink

Description

The DUT shall perform Carrier Aggregation along the drive route as expected for the network under test.

Related core specifications

3GPP TS 36.331

Reason for test

To ensure the DUT can perform Carrier Aggregation under mobility conditions.

This test is applicable for devices supporting Carrier Aggregation regardless of the type of Carrier Aggregation (Contiguous, non-contiguous, inter band), technology (FDD, TDD) or number of components aggregated by the network.

Initial configuration

DUT and network under test are both supporting Carrier Aggregation in the downlink.

There must be an appropriate number of E-UTRA cells available on the same PLMN, supporting the Carrier Aggregation Bands and frequencies required to be tested.

The test route should be sufficient enough to adequately test the Carrier Aggregation scenarios supported by the network and DUT.

Test procedure

1. Start a Data session. I.e. activate tethering (USB/Wi-Fi) / DUN / internal FTP client.
2. Download a large incompressible file from an external server.

Confirm Carrier Aggregation status is ACTIVATED using a trace tool or internal measuring application to ensure successful addition of the Scell(s) to the Pcell.

Confirm Data download has started and the transfer is ongoing throughout the test.

1. Move along the test route ensuring the DUT moves between Pcells sharing the same eNodeB and Pcells not sharing the same eNodeB.

Ideally, as many of the below scenarios should be covered:

Scell(s) release by RRCConnectionReconfiguration (sCellToReleaseList):

1. Release to a reduced component Carrier Aggregation
2. Release to single carrier.

Scell(s) add by RRCConnectionReconfiguration (sCellToAddModList):

1. Adding to an active Carrier Aggregation.
2. Adding to a single carrier to activate Carrier Aggregation.

Scell(s) modify by RRCConnectionReconfiguration (sCellToReleaseList and sCellToAddModList):

1. Combination of release and adding to an already active Carrier Aggregation.

Note: The Carrier Aggregation information may be a standalone RRCConnectionReconfiguration message or it may be part of the intra-LTE handover RRCConnectionReconfiguration message.

1. Stop the data download.

Expected behaviour

1. Data connection is successfully established.
2. Carrier Aggregation status is ACTIVATED as implemented and allocated by the network.

Data download is ongoing successfully.

1. The DUT performs Carrier Aggregation as expected along the drive route. Each handover is successfully performed and data download continues as expected after each handover and cell change.
2. Data download is successfully stopped.

### 31.3.2 Carrier Aggregation Mobility – Uplink

Description

The DUT shall perform Carrier Aggregation along the drive route as expected for the network under test.

Related core specifications

3GPP TS 36.331

Reason for test

To ensure the DUT can perform Carrier Aggregation under mobility conditions.

This test is applicable for devices supporting Carrier Aggregation regardless of the type of Carrier Aggregation (Contiguous, non-contiguous, inter band), technology (FDD, TDD) or number of components aggregated by the network.

Initial configuration

DUT and network under test are both supporting Carrier Aggregation in the uplink.

There must be an appropriate number of E-UTRA cells available on the same PLMN, supporting the Carrier Aggregation Bands and frequencies required to be tested.

The test route should be sufficient enough to adequately test the Carrier Aggregation scenarios supported by the network and DUT.

Test procedure

1. Start a Data session. I.e. activate tethering (USB/Wi-Fi) / DUN / internal FTP client.
2. Upload a large incompressible file from an external server.

Confirm Carrier Aggregation status is ACTIVATED using a trace tool or internal measuring application to ensure successful addition of the Scell(s) to the Pcell.

Confirm Data upload has started and the transfer is ongoing throughout the test.

1. Move along the test route ensuring the DUT moves between Pcells sharing the same eNodeB and Pcells not sharing the same eNodeB.

Ideally, as many of the below scenarios should be covered:

Scell(s) release by RRCConnectionReconfiguration (sCellToReleaseList):

1. Release to a reduced component Carrier Aggregation
2. Release to single carrier.

Scell(s) add by RRCConnectionReconfiguration (sCellToAddModList):

1. Adding to an active Carrier Aggregation.
2. Adding to a single carrier to activate Carrier Aggregation.

Scell(s) modify by RRCConnectionReconfiguration (sCellToReleaseList and sCellToAddModList):

1. Combination of release and adding to an already active Carrier Aggregation.

Note: The Carrier Aggregation information may be a standalone RRCConnectionReconfiguration message or it may be part of the intra-LTE handover RRCConnectionReconfiguration message.

1. Stop the data upload.

Expected behaviour

1. Data connection is successfully established.
2. Carrier Aggregation status is ACTIVATED as implemented and allocated by the network.

Data upload is ongoing successfully.

1. The DUT performs Carrier Aggregation as expected along the drive route. Each handover is successfully performed and data upload continues as expected after each handover and cell change.
2. Data upload is successfully stopped.

### 31.3.3 Carrier Aggregation Mobility – Downlink & Uplink

Description

The DUT shall perform Carrier Aggregation along the drive route as expected for the network under test.

Related core specifications

3GPP TS 36.331

Reason for test

To ensure the DUT can perform Carrier Aggregation under mobility conditions.

This test is applicable for devices supporting Carrier Aggregation regardless of the type of Carrier Aggregation (Contiguous, non-contiguous, inter band), technology (FDD, TDD) or number of components aggregated by the network.

Initial configuration

DUT and network under test are both supporting Carrier Aggregation in the downlink and uplink.

There must be an appropriate number of E-UTRA cells available on the same PLMN, supporting the Carrier Aggregation Bands and frequencies required to be tested.

The test route should be sufficient enough to adequately test the Carrier Aggregation scenarios supported by the network and DUT.

Test procedure

1. Start a Data session. I.e. activate tethering (USB/Wi-Fi) / DUN / internal FTP client.
2. Download a large incompressible file from an external server.

Confirm Carrier Aggregation status is ACTIVATED using a trace tool or internal measuring application to ensure successful addition of the Scell(s) to the Pcell.

Confirm Data download has started and the transfer is ongoing throughout the test.

1. Simultaneously upload a large incompressible file to an external server.
2. Move along the test route ensuring the DUT moves between Pcells sharing the same eNodeB and Pcells not sharing the same eNodeB.

Ideally, as many of the below scenarios should be covered:

Scell(s) release by RRCConnectionReconfiguration (sCellToReleaseList):

1. Release to a reduced component Carrier Aggregation
2. Release to single carrier.

Scell(s) add by RRCConnectionReconfiguration (sCellToAddModList):

1. Adding to an active Carrier Aggregation.
2. Adding to a single carrier to activate Carrier Aggregation.

Scell(s) modify by RRCConnectionReconfiguration (sCellToReleaseList and sCellToAddModList):

1. Combination of release and adding to an already active Carrier Aggregation.

Note: The Carrier Aggregation information may be a standalone RRCConnectionReconfiguration message or it may be part of the intra-LTE handover RRCConnectionReconfiguration message.

1. Stop the data download & upload.

Expected behaviour

1. Data connection is successfully established.
2. Carrier Aggregation status is ACTIVATED as implemented and allocated by the network.

Data download is ongoing successfully.

1. Data upload is ongoing successfully.
2. The DUT performs Carrier Aggregation as expected along the drive route. Each handover is successfully performed and data download & upload continues as expected after each handover and cell change.
3. Data download and upload are successfully stopped.

## 31.4 Void

### 31.4.1 Void

### 31.4.2 Void

### 31.4.3 Void

## 31.5 Mobility Management

Description

The DUT should perform reselections and handovers without losing service.

Related core specifications

3GPP TS36.304

Reason for test

To ensure that the DUT performs reselections, handovers and release redirect correctly without losing service.

Initial configuration

There must be an appropriate number of E-UTRA, UTRAN and GERAN cells available on the same

PLMN.



The above table shows the combinations of test cases that can be performed with each scenario.

Please see the test scenario and apply the required test procedure (below) as per the requirement in the table.

**Test Scenario**

Use an internal test monitor or protocol tool to confirm the scenario has been successfully performed.

**Scenario A: Intra-Band (Long Route / Multi Cell) (4G -> 4G)**

Test route should contain a substantial number of different Cell ID’s.

The test route should contain as many of the scenarios as possible:

Cells within the same Tracking Area.

Cells in different Tracking Areas.

Cells using the same frequency.

Cells using different frequencies within the same band.

Cells sharing the same eNodeB.

Cells not sharing the same eNodeB.

Cells using a different MME.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Move DUT along the route, ensuring as many scenarios as possible are covered.  Check the Cell ID details as the DUT moves through the route. | The scenarios are successfully performed and DUT stays in service the whole time. |

**Scenario B: Inter-Band (4G(Band A) -> 4G(Band B))**

The test route should contain the following scenario:

* Cells operating on different frequency bands (Band A -> Band B).

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is at start location. | DUT is in a 4G cell (Band A). |
| 2 | Move DUT along the route.  Check the Cell ID details as the DUT moves through the route. | DUT is in a 4G cell (Band B). |

**Scenario C: Inter-RAT (4G -> 3G)**

The test route should contain the following scenario:

4G cells and 3G cells.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is at start location. | DUT is in a 4G cell. |
| 2 | Move DUT along the route.  Check the Cell ID details as the DUT moves through the route. | Reselection, Cell Change Order, Redirect or Handover is successfully performed as per the network and DUT implementation.  DUT is in a 3G cell. |

**Scenario D: Inter-RAT (4G -> 2G)**

The test route should contain the following scenario:

4G cells and 2G cells.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is at start location. | DUT is in a 4G cell. |
| 2 | Move DUT along the route.  Check the Cell ID details as the DUT moves through the route. | Reselection, Cell Change Order, Redirect or Handover is successfully performed as per the network and DUT implementation.  DUT is in a 2G cell. |

**Scenario E: Inter-Technology (4G(FDD) -> 4G(TDD))**

The test route should contain the following scenario:

4G cells suppoting FDD and 4G cells supporting TDD.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is at start location. | DUT is in a 4G cell supporting FDD. |
| 2 | Move DUT along the route.  Check the Cell ID details as the DUT moves through the route. | DUT is in a 4G cell supporting TDD. |

**Scenario F: Inter-Technology (4G(TDD) -> 4G(FDD))**

The test route should contain the following scenario:

4G cells suppoting TDD and 4G cells supporting FDD.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is at start location. | DUT is in a 4G cell supporting TDD. |
| 2 | Move DUT along the route.  Check the Cell ID details as the DUT moves through the route. | DUT is in a 4G cell supporting FDD. |

Test Procedure

### 31.5.1 PDN Activated (IDLE)

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is configured so that data is enabled (PDN connection is possible in E-UTRA and PDP context will be established in UTRAN/GERAN) | Data connection is available according to the RAT connection. |
| 2 | DUT is in Idle state. | No data transfer is on-going. |
| 3 | Perform the instruction of the desired scenario. | |
| 4 | Page (SMS) the DUT after the scenario. | DUT can be successfully paged (SMS). |

### 31.5.2 PDN Activated – Data Transfer (CONNECTED)

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT is configured so that data is enabled (PDN connection is possible in E-UTRA and PDP context will be established in UTRAN/GERAN) | Data connection is available according to the RAT connection. |
| 2 | Ensure a data transfer is ongoing. This can be via a tethered connection, DUN, an internal application on DUT or via continuous PINGs. | DUT is actively transferring data. |
| 3 | Follow the instruction of the desired scenario. | |
| 4 | Check data transfer continues after the scenario. | DUT is actively transferring data. |

### 31.5.3 PDN Activated – VoLTE (CONNECTED)

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | DUT registers for VxLTE | VxLTE registration is successful. |
| 2 | Set up MO VxLTE call to Client 1 in a static location. | Voice call set up successfully. |
| 3 | Follow the instruction of the desired scenario. | |
| 4 | Check the voice call is still active after the scenario. | Voice call is on-going. |

# 32 PS Data

Note 1: It is required USB 2.0 or higher as modem connection between DUT and PC in order to ensure the throughput expected.

Note 2: It is required Wi-Fi connection as per 802.11n standard in order to ensure the throughput expected.

## 32.1 EPS Session Management Procedures

### 32.1.1 PDN Connectivity Request -ESM Information transfer flag=TRUE

Description

In case if UE wants to include the APN name in PDN Connectivity request and/or usage of default APN requires PAP/CHAP – UE shall include ESM Information transfer flag = TRUE

Related core specifications

3GPP TS 24.301, clause 6.5.1.2

Reason for test

To verify that UE is correctly setting ESM Information transfer flag and additional information like APN name and PAP/CHAP information is exchanged using ESM INFORMATION procedure

Initial configuration

UE is powered off

APN name is explicitly configured on UE side

Usage of APN requires PAP/CHAP Authentication

PAP/CHAP Username/password is configured on UE side.

Test procedure

1. Power on the UE.
2. Verify that PDN Connectivity is functional to the network where this APN gives access to (e.g. loading a designated HTML page, which is only accessible via this network).

Expected behaviour

1. If possible use a diagnostic tool to verify that the UE sends ESM Information Transfer flag = TRUE in “PDN CONNECTIVITY REQUEST”.

The network shall respond to the UE with a ESM INFORMATION REQUEST message

After UE replies with ESM INFORMATION RESPONSE containing APN IE and PCO (Protocol Configuration Options), the network shall respond to the UE with an “RRCConnectionReconfiguration” message that contains the “EPS Radio Bearer Identity” and the APN for a default bearer.

1. The PDN connectivity is functional to the network.

Example message flow:

| **Step** | **Direction UE – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 |  | RRCConnectionRequest | RRC |
| 2 |  | RRCConnectionSetup | RRC |
| 3 |  | RRCConnectionSetupComplete(ATTACH REQUEST(PDN CONNECTIVITY REQUEST)) | RRC(EMM(ESM))  **ESM Information transfer flag=TRUE** |
| 4 |  | AUTHENTICATION REQUEST | EMM(Optional) |
| 5 |  | AUTHENTICATION RESPONSE | EMM(Optional) |
| 6 |  | SECURITY MODE COMMAND | EMM(Optional) |
| 7 |  | SECURITY MODE COMPLETE | EMM(Optional) |
| 8 |  | ESM INFORMATION REQUEST | ESM |
| 9 |  | ESM INFORMATION RESPONSE | ESM |
| 10 |  | UECapabilityEnquiry | RRC |
| 11 |  | UECapabilityInformation | RRC |
| 12 |  | SecurityModeCommand | RRC |
| 13 |  | SecurityModeComplete | RRC |
| 14 |  | RRCConnectionReconfiguration(ATTACH ACCEPT(ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST)), | RRC(EMM(ESM)) |
| 15 |  | RRCConnectionReconfigurationComplete | RRC |
| 16 |  | ULInformationTransfer(ATTACH COMPLETE (ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT)) | RRC (EMM(ESM)) |
| 17 |  | FIRST UPLINK DATA |  |
| 18 |  | FIRST DOWNLINK DATA |  |

### 32.1.2 Multiple PDN Connection Activation / Deactivation – User initiated

Description

Verify that the DUT can successfully activate/deactivate a second PDN Connection.

Related core specifications

3GPP TS 24.301, section 6.5.1, 3GPP TS 23.401, section 5.10

Reason for test

To ensure the DUT is able to have multiple PDN connections correctly established.

Initial configuration

Mobile data is enabled on DUT.

Setup an APN profile for default PDN connection using APN1.

Setup an APN profile for a Mobile hotspot (Tethering / DUN) connection using APN2.

DUT is Attached for EPS services: Default PDN connection and Bearer Context is active with APN1.

Test procedure

1. Open the embedded browser application and load a webpage.
2. Activate a second PDN connection with APN2, by means of a Mobile hotspot.
3. Using an external device such as a PC, connect to the hotspot. Open the browser on PC and load a webpage.
4. Open the embedded browser application and load a webpage.
5. Deactivate Mobile hotspot.
6. Open the browser on PC and load a webpage.
7. Open the embedded browser application and load a webpage.

Note: If DUT is not supporting the setup of a separate APN for the Mobile hotspot (Tethering/DUN) connection, the use of a different application provoking the establishment of a second PDN context is acceptable.

Expected behaviour

1. Webpage is loaded successfully.
2. The Mobile hotspot connection is established successfully.

DUT sends a PDN CONNECTIVITY REQUEST message to the network using APN2.

Network sends ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST containing APN2.

DUT sends ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT to the network.

| **Step** | **Direction DUT – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 | 🡺 | PDN CONNECTIVITY REQUEST |  |
| 2 | 🡸 | ACTIVATE DEFAULT EPS BEARER CONTEXT REQUEST |  |
| 3 | 🡺 | ACTIVATE DEFAULT EPS BEARER CONTEXT ACCEPT |  |

1. Webpage is loaded successfully.
2. Webpage is loaded successfully.
3. The Mobile hotspot connection is deactivated successfully.

DUT sends a PDN DISCONNECT REQUEST message to the network.

Network sends DEACTIVATE EPS BEARER CONTEXT REQUEST.

DUT sends DEACTIVATE EPS BEARER CONTEXT ACCEPT to the network.

| **Step** | **Direction DUT – NW** | **Message** | **Comments** |
| --- | --- | --- | --- |
| 1 | 🡺 | PDN DISCONNECT REQUEST |  |
| 2 | 🡸 | DEACTIVATE EPS BEARER CONTEXT REQUEST |  |
| 3 | 🡺 | DEACTIVATE EPS BEARER CONTEXT ACCEPT |  |

1. Webpage is not loaded.
2. Webpage is loaded successfully.

### 32.1.3 Void

### 32.1.4 Multiple PDN Connections - PDN Connectivity Reject, Missing or unknown APN

Description

When a missing or unknown APN is used, the DUT should handle the PDN CONNECTIVITY REJECT correctly.

Related core specifications

3GPP TS 24.301, section 6.5.1.4

Reason for test

To ensure that the DUT is not able to achieve PDN connectivity with an unknown APN.

Initial configuration

Setup APN profiles accordingly:

APN1: Default APN correctly input for network under test.

APN2: DUN APN set as “Unknown”

DUT is online with an established “Default EPS Bearer Context Activation” using APN1.

|  |  |  |
| --- | --- | --- |
| - | **Test procedure** | Expected behaviour |
| 1 | Initiate a secondary PDN connectivity request with APN2. For example, enable Mobile hotspot. | At DUT, check NAS protocol messages:  - DUT sends PDN CONNECTIVITY REQUEST to the network.  - Network sends PDN CONNECTIVITY REJECT with cause #27 “Missing or unknown APN”.  Check within the PDN CONNECTIVITY REJECT message if T3396 timer is included.  **Timer included:**  T3396 timer included (and not deactivated or zero):  - DUT shall start back-off timer according to the value in T3396 and make a further PDN CONNECTIVITY REQUEST only when the timer has expired.  T3396 timer included (set to deactivated):  - DUT shall not make any further PDN CONNECTIVITY REQUESTs until it is restarted or the SIM is removed.  T3396 timer included (set to zero):  - DUT may send a "PDN CONNECTIVITY REQUEST" message to the same APN (depending on device implementation).  **T3396 Timer NOT included: Release 10/11**  T3396 timer not included: Rejected with any cause:  - DUT may send a "PDN CONNECTIVITY REQUEST" message to the same APN (depending on device implementation).  **T3396 Timer NOT included: Release 12 and abo**ve:  T3396 timer not included: Rejected with #8, #27, #32 or #33.  - DUT shall start back-off timer with a default value of 12 minutes and make a further PDN CONNECTIVITY REQUEST message to the same APN only when the timer has expired.  T3396 timer not included: Rejected with any other cause:  - DUT may send a "PDN CONNECTIVITY REQUEST" message to the same APN (depending on device implementation).  N.B Some operators request the manufacturer to implement a specific timer value for their network rather than inclduing a timer in the reject cause message. Please check with the network under test if no timer is included in the reject cause message. |

### 32.1.5 Dedicated Bearer Activation – UE requested bearer resource allocation

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

## 32.2 Basic Traffic Cases

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 32.2.2 Browser Capability – Browse Through HTML Page

Description

The DUT shall be able to Browse through HTML pages with an embedded browser application.

Related 3GPP core specifications

3GPP TS 36.331

Reason for test

To ensure the DUT is able to browse through HTML pages using an embedded browser application with a reasonable performance.

Initial configuration

The DUT is attached to the network and has an always-on IP connectivity after establishing a default EPS bearer during Network Attachment.

Test procedure

1. Open the embedded browser application and load a feature rich web page containing pictures, text and CSS formatting.
2. Refresh the page once it’s loaded completely.
3. Load a different feature rich web page containing pictures, text and CSS formatting.
4. Refresh the page once it’s loaded completely.
5. Load a third feature rich web page containing pictures, text and CSS formatting.
6. Refresh the page once it’s loaded completely.

Expected behaviour

1. The page is loaded within a reasonable time and displayed/rendered appropriately.
2. The page is loaded within a reasonable time and displayed/rendered appropriately.
3. The page is loaded within a reasonable time and displayed/rendered appropriately.
4. The page is loaded within a reasonable time and displayed/rendered appropriately.
5. The page is loaded within a reasonable time and displayed/rendered appropriately.
6. The page is loaded within a reasonable time and displayed/rendered appropriately.

### 32.2.3 FTP Downlink

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 32.2.4 FTP Uplink

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 32.2.5 Simultaneous FTP downlink and FTP Uplink

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 32.2.6 Channel Type Switching – Resume data in IDLE

Description

This test describes the test method for testing channel type switching from RRC-CONNECTED to RRC-IDLE and back to RRC-CONNECTED.

Related 3GPP core specifications

3GPP TS 24.301 – Section 5.3

Reason for test

To ensure the DUT is able to perform channel state transition process and resume sending data when in RRC channel state IDLE.

Initial configuration

DUT is in Idle Mode.

Mobile data is enabled.

RRC state transition In-activity timer for network under test are preferably known (X seconds).

Test procedure

1. Open the embedded browser application and load a webpage.
2. Confirm with a trace tool / test monitor that DUT is in RRC state CONNECTED.
3. Ensure there is no further data traffic and wait for in-activity timer to expire.
4. Confirm with a trace tool / test monitor that DUT switches to RRC state IDLE.
5. While DUT is in IDLE, reload the webpage.
6. Confirm with a trace tool / test monitor that DUT is back in RRC state CONNECTED.

Expected behaviour

1. Webpage is loaded successfully.
2. DUT is in CONNECTED state.
3. No further data packets are sent or received.
4. DUT is in IDLE state.
5. Webpage is loaded successfully.
6. DUT is in CONNECTED state.

### 32.2.7 Data Usage with Roaming Data Off

Description

The DUT shall not send any traffic on the Internet PDN when Data Roaming is disabled on the device, unless the data service in question is marked as PS Data Off Exempt in the device configuration.

Related 3GPP core specifications

3GPP TS 22.011, Rel-14 Section 10

Reason for test

To verify that no unexpected data is sent while roaming where Data Roaming is disabled on the device.

Unexpected data traffic is any data usage which is not associated with a PS Data Off Exempt service or application, which often includes XCAP and BIP

Initial configuration

Roaming is enabled, but Data Roaming is disabled on the DUT

DUT is in Flight Mode

Visited PLMN allows CS and PS services

|  |  |  |
| --- | --- | --- |
| - | **Test procedure** | Expected behaviour |
| 1 | Disable Flight mode | - Device will camp on roaming PLMN for CS & PS services and will establish an internet PDN  - No unexpected traffic will be seen on Internet PDN |
| 2 | Attempt to browser web | - Device will be unable to browse web. Optionally a popup or other error may be displayed to user.  - No unexpected traffic will be seen on Internet PDN |
| 3 | Leave phone connected for 15-20 minutes | - No unexpected traffic will be seen on Internet PDN |
| 4 | Place an MO voice call from phone. Once call is connected, disconnect it immediately. | - Call will be successfully completed on VoLTE or CSFB  - No unexpected traffic will be seen on Internet PDN |
| 5 | Leave phone connected for an additional 5-10 minutes. | - No unexpected traffic will be seen on Internet PDN |
| 6 | Enable Flight mode | - Device will enter Flight mode |

## 32.3 PS performances

### 32.3.1 PS performances (good coverage – relative measurement)

It is essential for the tester to build up a knowledge base of the maximum throughput achievable in the test location and for the device capability. This can be done using different Reference devices with similar capabilities to the DUT. Once a maximum achievable throughput is known for the location then this can be used as a base figure to validate the test result. Please note, that with networks continuously improving, this maximum achievable figure shall be monitored regularly and updated with the latest known maximum achievable throughput. The model name(s) used to build up the knowledge base shall be noted in the test result.

Note: There are several ways to check the throughput:

- DUT tethered to a laptop (USB/Wi-Fi). A speedtest tool on the laptop can then be used to measure the throughput.

- A speedtest tool directly on the DUT can be used to measure the throughput.

- For modules or devices without a UI, a DUN connection to a laptop can be used along with a speedtest tool on the laptop to measure the throughput.

- Other valid methods are available such as an FTP client.

32.3.1.1 Stationary Data Performance – Relative Downlink Throughput

Description

Measure the average downlink throughput for a E-UTRA Radio Access Bearer.

Related 3GPP core specifications

3GPP TS 36.331

Reason for test

Obtain a measure of average downlink throughput for an E-UTRA Radio Access Bearer.

Initial configuration

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid contention with other devices, etc.).

Knowledge base of the maximum throughput achievable in the test location and for the device capability is available.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Prepare the DUT and Reference-1 with the method of measuring the throughput. | DUT and Reference-1 are setup with the appropriate tool/method. |
| 2 | Perform 1 x Downlink throughput measurement on DUT using the appropriate method. | Measurement is taken and recorded. |
| 3 | Perform 1 x Downlink throughput measurement on the Reference-1 using the appropriate method. | Measurement is taken and recorded. |
| 4 | Repeat and perform at least 5 Downlink throughput measurements on DUT and Reference-1 in alternating sequence.  Ensure DUT and Reference-1 are in IDLE before performing the next throughput measurement. | Measurements are taken and recorded on DUT and Reference-1 |
| 5 | Calculate average Downlink throughput for DUT and reference-1 |  |
| 6 | Evaluate the data performance by comparing the DUT’s average throughput with the reference-1 average throughput and with the known maximum throughput for the test location and device capability from the knowledge base. | Ensure that the DUT’s data performance is no more than 10% worse than the reference-1 device and that the DUT’s performance is no more than 20% worse than the known maximum throughput from the knowledge base. |

#### 32.3.1.2 Stationary Data Performance – Relative Uplink Throughput

Description

Measure the average uplink throughput for an E-UTRA Radio Access Bearer.

Related 3GPP core specifications

3GPP TS 36.331

Reason for test

Obtain a measure of average uplink throughput for a E-UTRA Radio Access Bearer.

Initial configuration

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid contention with other devices, etc.).

Knowledge base of the maximum throughput achievable in the test location and for the device capability is available.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Prepare the DUT and Reference-1 with the method of measuring the throughput. | DUT and Reference-1 are setup with the appropriate tool/method. |
| 2 | Perform 1 x Uplink throughput measurement on DUT using the appropriate method. | Measurement is taken and recorded. |
| 3 | Perform 1 x Uplink throughput measurement on the Reference-1 using the appropriate method. | Measurement is taken and recorded. |
| 4 | Repeat and perform at least 5 Uplink throughput measurements on DUT and Reference-1 in alternating sequence.  Ensure DUT and Reference-1 are in IDLE before performing the next throughput measurement. | Measurements are taken and recorded on DUT and Reference-1 |
| 5 | Calculate average Uplink throughput for DUT and reference-1 |  |
| 6 | Evaluate the data performance by comparing the DUT’s average throughput with the reference-1 average throughput and with the known maximum throughput for the test location and device capability from the knowledge base. | Ensure that the DUT’s data performance is no more than 10% worse than the reference-1 device and that the DUT’s performance is no more than 20% worse than the known maximum throughput from the knowledge base. |

#### 32.3.1.3 Stationary Data Performance – Relative Downlink and Uplink Throughput

Description

Measure the average simultaneous uplink and downlink throughput for a E-UTRA Radio Access Bearer.

Related 3GPP core specifications

3GPP TS 36.331

Reason for test

Obtain a measure of average simultaneous uplink and downlink throughput for a EUTRA Radio Access Bearer.

Initial configuration

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid contention with other devices, etc.).

Reference device(s) used to validate the result with similar capabilities is/are available. The model name(s) shall be noted in the test result.

The UDP server should be configured to meet the following requirements:

* UDP blast duration shall be selected to meet the minimum test time using a sufficient rate to prevent physical layer DTX based upon the UE Category

The following settings are to be used:

* The UDP MTU size is set to a value comprised between 1280 and 1500 bytes as recommended by the manufacturer.
* The UDP transfers are always carried out in Binary mode.
* The contents of the files to be transferred over UDP are chosen in such a way that they are statistically random, with least compressibility.
* No application-level compression protocols are used to compress the UDP files.
* Either IPv4 or IPv6 can be used, but only results obtained with the same IP address type can be compared, since the IP address type will affect the measured throughput.
* UDP bidirectional duration shall be set to the duration of the test with a sufficient blast rate to prevent physical layer DTX on either the UL or DL

The UDP application used on the tethered PC for tethered testing should meet the following requirements:

* The tethered UDP application should allow the user to transfer files of any format supported by the tethered PC, in binary mode, in both the Downlink and the Uplink

The UDP application used for embedded testing should meet the following requirements:

* The embedded UDP application should allow the user to transfer files of formats supported by the UE, in binary mode, both in the Downlink and the Uplink.

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Activate tethering (USB/Wi-Fi) / DUN / client connection at DUT. | Data connection is successfully established. |
| 2 | Start bi-directional UDP throughput | Download and upload is ongoing |
| 3 | Measure the average downlink and uplink throughput using a suitable application over a 10 minutes period. | Measurement is taken and recorded. |
| 4 | Evaluate the data performance by comparing the DUT’s throughput measurements with the throughput measurements of (a) reference device(s) with similar capabilities. | Ensure the DUT’s data performance is comparable to the reference data performance (no more than 10% worse). |

### 32.3.2 PS performances (good coverage – absolute measurement)

NOTE: These tests needs to be conducted under lab conditions (optimum RF signal, no contention with other Ues, sufficient bandwidth of eNodeB).

#### 32.3.2.1 Throughput Measure – Downlink FTP

Description

This test verifies that the UE can successfully complete an FTP (or TFTP) download during an active E-UTRA data call with sufficient Data Throughput.

Related core specifications

3GPP TS 36.211, 3GPP TS 36.212, 3GPP TS 36.213, 3GPP TS 36.321

Reason for test

To ensure the UE is able to perform an FTP/TFTP download in a good coverage area with sufficient Data Throughput.

Initial configuration

Check the Lab Environment with a Reference Device (recommended by an Operator) to ensure that the Minimum Realistic Throughput Values can be achieved.

Connect the DUT to a PC and use it as a modem. Ensure that the Connection Manager from the device supplier is used. Where possible, the DUT shall be connected via USB.

The UE is attached to the network and has an always-on IP connection over a default EPS bearer to the P-GW that is connected to the internet.

Test procedure

1. Set up an FTP/TFTP session to a controlled FTP site using a suitable application.
2. Initiate the download of an uncompressible file sufficient for at least 60 seconds of data transfer, from the remote host to the UE. If possible utilize a server with minimal latency to the P-GW.
3. Measure the average throughput using the application. If possible, use a diagnostic tool to record the resource block allocations and modulation scheme used.
4. Repeat steps 3-4, fourteen more times, for a total of 15 transfers. Ensure that the time between runs does not cause the expiry of any inactivity timers, thus keeping the data session active.

Expected behaviour

The UE shall download the test file with a minimal average throughput as specified in the following table.

| **Downlink** | **Bandwidth** | **Advertised Throughput FDD (ref. 3GPP 36.306)** | **Advertised Throughput TDD (ref. 3GPP 36.306, 36.213)** | **Minimum Throughput** |
| --- | --- | --- | --- | --- |
| Cat 5 | 5 MHz | [TBD] | [TBD] | [TBD] |
| Cat 4 | 5 MHz | [TBD] | [TBD] | [TBD] |
| Cat 3 | 5 MHz | 35 Mbit/s | [TBD] | [TBD] |
| Cat 2 | 5 MHz | 25 Mbit/s | [TBD] | [TBD] |
| Cat 1 | 5 MHz | 10 Mbit/s | 6 Mbit/s | [TBD] |
| Cat 1bis | 5 MHz | 10 Mbit/s | 6 Mbit/s | [TBD] |
| Cat 5 | 10 MHz | [TBD] | [TBD] | [TBD] |
| Cat 4 | 10 MHz | [TBD] | [TBD] | [TBD] |
| Cat 3 | 10 MHz | 71 Mbit/s | [TBD] | [TBD] |
| Cat 2 | 10 MHz | 50 Mbit/s | [TBD] | [TBD] |
| Cat 1 | 10 MHz | 10 Mbit/s | 6 Mbit/s | [TBD] |
| Cat 1bis | 10 MHz | 10 Mbit/s | 6 Mbit/s | [TBD] |
| Cat 5 | 20 MHz | 299 Mbit/s | 179 Mbit/s | [TBD] |
| Cat 4 | 20 MHz | 150 Mbit/s | 90Mbit/s | [TBD] |
| Cat 3 | 20 MHz | 102 Mbit/s | 61Mbit/s | [TBD] |
| Cat 2 | 20 MHz | 51 Mbit/s | 30Mbit/s | [TBD] |
| Cat 1 | 20 MHz | 10 Mbit/s | 6Mbit/s | [TBD] |
| Cat 1bis | 20 MHz | 10 Mbit/s | 6 Mbit/s | [TBD] |
| Cat 13 | 40MHz | 390Mbit/s | 234Mbit/s | [TBD] |
| Cat 7 | 40MHz | 300Mbit/s | 180Mbit/s | [TBD] |
| Cat 6 | 40MHz | 300Mbit/s | 180Mbit/s | [TBD] |
| Cat 12 | 60MHz | 586Mbit/s | 351Mbit/s | [TBD] |
| Cat 11 | 60MHz | 586Mbit/s | 351Mbit/s | [TBD] |
| Cat 10 | 60MHz | 450Mbit/s | 270Mbit/s | [TBD] |
| Cat 9 | 60MHz | 450Mbit/s | 270Mbit/s | [TBD] |
| Cat 12 | 80MHz | 600Mbit/s | 360Mbit/s | [TBD] |
| Cat 11 | 80MHz | 600Mbit/s | 360Mbit/s | [TBD] |

Note: The advertised throughput of TDD is given with Uplink-downlink Configuration 2 and no data transmission during DwPTS.

#### 32.3.2.2 Throughput Measure – Uplink FTP

Description

This test verifies that the UE can successfully complete an FTP (or TFTP) upload during an active E-UTRA data call.

Related core specifications

3GPP TS 36.211, 3GPP TS 36.212, 3GPP TS 36.213, 3GPP TS 36.321

Reason for test

To ensure the UE is able to perform an FTP upload in a good coverage area.

Initial configuration

The UE is attached to the network and has an always-on IP connection over a default EPS bearer to the P-GW that is connected to the internet.

Test procedure

1. Setup an FTP/TFTP session to a controlled FTP site using a suitable application.
2. Initiate the upload of an uncompressible file sufficient for at least 60 seconds of data transfer, from the UE to the remote host. If possible utilize a server with minimal latency to the P-GW.
3. Measure the average throughput using the application. If possible, use a diagnostic tool to record the resource block allocations and modulation scheme used.
4. Repeat steps 3-4, fourteen more times, for a total of 15 transfers. Ensure that the time between runs does not cause the expiry of any inactivity timers, thus keeping the data session active.

Expected behaviour

The UE shall upload the test file with a minimal average throughput to be determined by the carrier.

| **Uplink** | **Bandwidth** | **Advertised Throughput FDD (ref. 3GPP 36.306)** | **Advertised Throughput TDD (ref. 3GPP 36.306, 36.213)** | **Minimum Throughput** |
| --- | --- | --- | --- | --- |
| Cat 9 | 5 MHz | 12 Mbit/s | 2.5Mbit/s | [TBD] |
| Cat 6 | 5 MHz | 12 Mbit/s | 2.5Mbit/s | [TBD] |
| Cat 5 | 5 MHz | [TBD] | [TBD] | [TBD] |
| Cat 4 | 5 MHz | [TBD] | [TBD] | [TBD] |
| Cat 3 | 5 MHz | 17 Mbit/s | [TBD] | [TBD] |
| Cat 2 | 5 MHz | 12 Mbit/s | [TBD] | [TBD] |
| Cat 1 | 5 MHz | 5 Mbit/s | 1 Mbit/s | [TBD] |
| Cat 1bis | 5 MHz | 5 Mbit/s | 1 Mbit/s | [TBD] |
| Cat 9 | 10MHz | 25Mbit/s | 5Mbit/s | [TBD] |
| Cat 6 | 10MHz | 25Mbit/s | 5Mbit/s | [TBD] |
| Cat 5 | 10 MHz | [TBD] | [TBD] | [TBD] |
| Cat 4 | 10 MHz | [TBD] | [TBD] | [TBD] |
| Cat 3 | 10 MHz | 36 Mbit/s | [TBD] | [TBD] |
| Cat 2 | 10 MHz | 25 Mbit/s | [TBD] | [TBD] |
| Cat 1 | 10 MHz | 5 Mbit/s | 1 Mbit/s | [TBD] |
| Cat 1bis | 10 MHz | 5 Mbit/s | 1 Mbit/s | [TBD] |
| Cat 9 | 20MHz | 50Mbit/s | 10Mbit/s | [TBD] |
| Cat 6 | 20MHz | 50Mbit/s | 10Mbit/s | [TBD] |
| Cat 5 | 20 MHz | 75 Mbit/s | 15 Mbit/s | [TBD] |
| Cat 4 | 20 MHz | 51 Mbit/s | 10Mbit/s | [TBD] |
| Cat 3 | 20 MHz | 51 Mbit/s | 10Mbit/s | [TBD] |
| Cat 2 | 20 MHz | 25 Mbit/s | 5Mbit/s | [TBD] |
| Cat 1 | 20 MHz | 5 Mbit/s | 1Mbit/s | [TBD] |
| Cat 1bis | 20 MHz | 5 Mbit/s | 1 Mbit/s | [TBD] |
| Cat 13 | 40MHz | 150Mbit/s | 30Mbit/s | [TBD] |
| Cat 10 | 40MHz | 100Mbit/s | 20Mbit/s | [TBD] |
| Cat 7 | 40MHz | 100Mbit/s | 20Mbit/s | [TBD] |

Note: The advertised throughput of TDD is given with Uplink-downlink Configuration 2 and no data transmission during UpwPTS.

## 32.4 UE Transmit Anntena Selection Stationary Data Performance – Relative Downlink Throughput

In a TD-LTE network supporting TM8, if UE Transmit Antenna Selection is enabled on the device, network can acquire CSI from both transmit antennas of the device and improve downlink data performance for 2 layer transmission.

Note: This test case can only be executed by TD-LTE device under a TD-LTE network supporting TM8

Description

To measure the average downlink throughput under a TD-LTE network supporting TM8 using UE Transmit Antenna Selection as configured by the DUT.

Related 3GPP core specifications

3GPP TS 36.331, TS 36.213

Reason for test

To guarantee downlink data perfomence for DUT using UE Transmit Antenna Selection under a TD-LTE network supporting TM8.

Initial configuration

DUT is configured with UE Transmit Antenna Selection.

Reference 1 with similar capabilities to the DUT is available (It is recommended to use the same type device as DUT). UE Transmit Antenna Selection is disabled on Reference 1.

DUT, Reference 1 are successfully registered in an E-UTRA cell supporting TDD and TM8.

Test should happen in a static test location without a good network coverage (e.g. -105dBm - -120dbm) and 0 < SNR < 10 dB.

This test requires logging tools.

|  |  |  |
| --- | --- | --- |
| **-** | **Test procedure** | **Expected behaviour** |
| 1 | Set up a tethering (USB/Wi-Fi)/ DUN/ internal FTP client connection on DUT and Reference 1. Or use embedded application. | Data connection is successfully established on DUT.  Note: Using logging tool to verify DCI Format indicate the use of TM8 for data transmission, otherwise the test should not be performed |
| 2 | Perform at least 5 throughput measurements using the appropriate method on DUT and Reference 1. | 5 Measurements on DUT and Reference 1 are taken and recorded. |
| 3 | Evaluate the data performance by comparing the average results of 5 measurements. | The data throughput of DUT enabling UE Transmit Antenna Selection is at least 10% more than the data throughput of Reference 1 disabling UE Transmit Antenna Selection |

# 33 VOID

NOTE: This section formerly contained ‘UICC/USIM Aspects’. It is now combined with ‘UICC/USIM Aspects and SIM/USIM Interworking’ and moved to Annex D, section 57.

# 34 E-UTRA Voice

## 34.1 CS Fallback – Voice

### 34.1.1 MO Voice Call with CS Fallback – DUT in IDLE state – Successful (UTRAN)

Description

The DUT shall successfully perform a MO Voice Call with CS fallback to UTRAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

Reason for test

To verify that the DUT successfully performs CS fallback for an MO Voice call.

Initial configuration

E-UTRAN and UTRAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to UTRAN
* CS fallback to UTRAN with System Info (RIM)
* CS fallback to UTRAN with measurements
* CS fallback to UTRAN with handover

DUT is either configured to E-UTRA / UTRAN only or the test is carried out in automatic mode in an area where GERAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”.

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT, make MO voice call to Client 1.
2. Answer call on Client 1.
3. At DUT, end A voice call to Client 1.

Expected behaviour

1. DUT performs CS fallback to UTRAN.

DUT is alerting.

Client 1 indicates an incoming call.

1. 2-way audio A connection is established.
2. Voice call is ended between DUT and Client 1.

### 34.1.2 MO Voice Call with CS Fallback – DUT in IDLE state – Successful (GERAN)

Description

The DUT shall successfully perform a MO Voice Call with CS fallback to GERAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

Reason for test

To verify that the DUT successfully performs CS fallback for an MO Voice call.

Initial configuration

E-UTRAN and GERAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to GERAN
* CS fallback to GERAN with System Info (RIM)
* CS fallback to GERAN with measurements
* CS fallback to GERAN with handover

DUT is either configured to E-UTRA / GERAN only or the test is carried out in automatic mode in an area where UTRAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT, make MO voice call to Client 1.
2. Answer call on Client 1.
3. At DUT, end voice call to Client 1.

Expected behaviour

1. DUT performs CS fallback to GERAN.

DUT is alerting.

Client 1 indicates an incoming call.

1. 2-way audio connection is established.
2. Voice call is ended between DUT and Client 1.

### 34.1.3 MO Voice Call with CS Fallback – DUT in IDLE state – NW Rejected

Description

The DUT shall behave correctly when a MO Voice Call with CS fallback to UTRAN is rejected by the network.

Related core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify that the DUT behaves correctly when a MO Voice Call with CS fallback to UTRAN is rejected by the network.

Initial configuration

E-UTRAN and GERAN or UTRAN cells are available.

DUT is configured to automatic network mode.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT, make MO voice call to Client 1.

Expected behaviour

1. DUT sends EXTENDED SERVICE REQUEST message with Service type set to “mobile originating CS fallback or 1xCS fallback”.

The network responds with a SERVICE REJECT message with EMM cause set to “CS domain temporarily not available”.

Voice call to Client 1 is not established.

### 34.1.4 MT Voice Call with CS Fallback – DUT in IDLE state – Successful (UTRAN)

Description

The DUT shall successfully receive a MT Voice Call with CS fallback to UTRAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify that the DUT successfully performs CS fallback for an MT Voice call.

Initial configuration

E-UTRAN and UTRAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to UTRAN
* CS fallback to UTRAN with System Info (RIM)
* CS fallback to UTRAN with measurements
* CS fallback to UTRAN with handover

DUT is either configured to E-UTRA / UTRAN only or the test is carried out in automatic mode in an area where GERAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT, receive MT A voice call from Client 1.
2. Answer call on DUT.
3. At Client 1, end voice call to DUT.

Expected behaviour

1. DUT performs CS fallback to UTRAN.

DUT is alerting and indicates an incoming call.

1. 2-way audio connection is established.
2. Voice call is ended between DUT and Client 1.

### 34.1.5 MT Voice Call with CS Fallback – DUT in IDLE state – Successful (GERAN)

Description

The DUT shall successfully receive a MT Voice Call with CS fallback to GERAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify that the DUT successfully performs CS fallback for an MT Voice call.

Initial configuration

E-UTRAN and GERAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to GERAN
* CS fallback to GERAN with System Info (RIM)
* CS fallback to GERAN with measurements
* CS fallback to GERAN with handover

DUT is either configured to E-UTRA / GERAN only or the test is carried out in automatic mode in an area where UTRAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT, receive MT voice call from Client 1.
2. Answer call on DUT.
3. At Client 1, end A voice call to DUT.

Expected behaviour

1. DUT performs CS fallback to GERAN.

DUT is alerting and indicates an incoming call.

1. 2-way audio connection is established.
2. Voice call is ended between DUT and Client 1.

### 34.1.6 MT Voice Call with CS Fallback – DUT in CONNECTED state – Successful (UTRAN)

Description

The DUT shall successfully receive a MT Voice Call with CS fallback to UTRAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify that the DUT successfully performs CS fallback for a MT Voice call while in CONNECTED state.

Initial configuration

E-UTRAN and UTRAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to UTRAN
* CS fallback to UTRAN with System Info (RIM)
* CS fallback to UTRAN with measurements
* CS fallback to UTRAN with handover

DUT is either configured to E-UTRA / UTRAN only or the test is carried out in automatic mode in an area where GERAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT start a data transfer session. This can be via tethering (USB/Wi-Fi) / DUN / internal FTP client connection.
2. At DUT, receive MT voice call from Client 1.
3. Answer call on DUT.
4. At Client 1, end voice call to DUT.

Expected behaviour

1. DUT is moved to CONNECTED state and data transfer is started.
2. DUT performs CS fallback to UTRAN.

DUT is alerting and indicates an incoming call.

The active data transfer continues.

1. 2-way audio connection is established.
2. Voice call is ended between DUT and Client 1.

### 34.1.7 MT Voice Call with CS Fallback – DUT in CONNECTED state – Successful (GERAN)

Description

The DUT shall successfully receive a MT Voice Call with CS fallback to GERANRelated core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify that the DUT successfully performs CS fallback for an MT Voice call.

Initial configuration

E-UTRAN and GERAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to GERAN
* CS fallback to GERAN with System Info (RIM)
* CS fallback to GERAN with measurements
* CS fallback to GERAN with handover

DUT is either configured to E-UTRA / GERAN only or the test is carried out in automatic mode in an area where UTRAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT start a data transfer. This can be via tethering (USB/Wi-Fi) / DUN / internal FTP client connection.
2. At DUT, receive MT voice call from Client 1.
3. Answer call on DUT.
4. At Client 1, end voice call to DUT.

Expected behaviour

1. DUT is moved to CONNECTED state and data transfer is started.
2. DUT performs CS fallback to GERAN.

DUT is alerting and indicates an incoming call.

If DTM is supported by DUT/Network, the active data transfer continues.

If DTM is not supported by DUT/Network, the data transfer is paused.

1. 2-way audio connection is established.
2. Voice call is ended between DUT and Client 1.

### 34.1.8 MT Voice Call with CS Fallback – DUT in CONNECTED state – Call Rejected (UTRAN)

Description

The DUT shall successfully reject a MT Voice Call after CS fallback to UTRAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify the DUT can successfully reject a MT Voice Call after CS fallback.

Initial configuration

E-UTRAN and UTRAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to UTRAN
* CS fallback to UTRAN with System Info (RIM)
* CS fallback to UTRAN with measurements
* CS fallback to UTRAN with handover

DUT is either configured to E-UTRA / UTRAN only or the test is carried out in automatic mode in an area where GERAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT start a data transfer. This can be via tethering (USB/Wi-Fi) / DUN / internal FTP client connection.
2. At DUT, receive MT voice call from Client 1.
3. Reject call on DUT.

Expected behaviour

1. DUT is moved to CONNECTED state and data transfer is started.
2. DUT performs CS fallback to UTRAN.

DUT is alerting and indicates an incoming call.

The active data transfer continues.

1. DUT stops alerting. Call setup is terminated.

If a handover from UTRAN to E-UTRA is supported by DUT/Network then this shall take place and the active data transfer continues in E-UTRA.

If a handover from UTRAN to E-UTRA is not supported by DUT/Network then the active data transfer shall continue in UTRAN until the transfer is stopped.

### 34.1.9 MT Voice Call with CS Fallback – DUT in CONNECTED state – Call Rejected (GERAN)

Description

The DUT shall successfully reject a MT Voice Call after CS fallback to GERAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

3GPP TS 24.301 (v8.2.1)

Reason for test

To verify the DUT can successfully reject a MT Voice Call after CS fallback.

Initial configuration

E-UTRAN and GERAN cells are available.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to GERAN
* CS fallback to GERAN with System Info (RIM)
* CS fallback to GERAN with measurements
* CS fallback to GERAN with handover

DUT is either configured to E-UTRA / GERAN only or the test is carried out in automatic mode in an area where UTRAN cells are not available.

DUT is successfully registered in an E-UTRA cell and in IDLE.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. At DUT start a data transfer. This can be via tethering (USB/Wi-Fi) / DUN / internal FTP client connection.
2. At DUT, receive MT voice call from Client 1.
3. Reject call on DUT.

Expected behaviour

1. DUT is moved to CONNECTED state and data transfer is started.
2. DUT performs CS fallback to GERAN.

DUT is alerting and indicates an incoming call.

If DTM is supported by DUT/Network, the active data transfer continues.

If DTM is not supported by DUT/Network, the data transfer is paused.

1. DUT stops alerting. Call setup is terminated.

If DTM is not supported by DUT/Network, the data transfer now resumes.

If a handover from GERAN to E-UTRA is supported by DUT/Network then this shall take place and the active data transfer continues in E-UTRA.

If a handover from GERAN to E-UTRA is not supported by DUT/Network then the active data transfer shall continue in GERAN until the transfer is stopped.

## 34.2 CS Fallback – Emergency Call

### 34.2.1 Emergency Call with CS Fallback – Successful

Description

The DUT shall successfully perform an Emergency Call with CS fallback to GERAN or UTRAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

Reason for test

To verify that the DUT successfully performs CS fallback for an Emergency call.

Initial configuration

E-UTRAN and GERAN or UTRAN cells are available.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary”, “CS voice only” or “IMS PS voice preferred, CS voice for Emergency calls only”.

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

DUT is configured to automatic network mode.

DUT is successfully registered in an E-UTRA cell and in IDLE.

Test procedure

1. Make an Emergency Call to 112 or 911.
2. At DUT, end voice call to Emergency Services.

Expected behaviour

1. DUT performs CS fallback to GERAN or UTRAN.

DUT UI indicates to the user an Emergency call is being initiated.

DUT is alerting and 2-way audio connection is established with the Emergency Services.

1. Voice call is ended to the Emergency Services.

## 34.3 CS Fallback – Supplementary Service

### 34.3.1 Supplementary Service with CS Fallback – Successful

Description

The DUT shall successfully perform a Supplementary Service operation with CS fallback to GERAN or UTRAN.

Related core specifications

3GPP TS 23.272 (v9.2.0)

Reason for test

To verify that the DUT successfully performs supplementary services with CS fallback.

Initial configuration

E-UTRAN and GERAN or UTRAN cells are available.

If the DUT is supporting voice over IMS, it is either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT is set to operate in CS/PS mode 1 or CS/PS mode 2.

DUT is configured to automatic network mode.

DUT is successfully registered in an E-UTRA cell and in IDLE.

Test procedure

1. At DUT, perform a supplementary service such as CF, CW or CB activation, interrogation, erasure.

Expected behaviour

1. DUT performs CS fallback to GERAN or UTRAN.

DUT UI indicates the Supplementary Service command was successful.

# 34.3.2 Void35 SMS over E-UTRA

## 35.1 SMS & MMS over SGs

### 35.1.1 MO SMS and MO MMS over SGs

Description

DUT shall send an MO SMS and MMS over SGs when camped on an E-UTRA network.

Related 3GPP core specifications

3GPP TS 23.272

Reason for test

To ensure the DUT correctly sends an MO SMS and MMS over SGs when camping to an E-UTRA network.

Initial configuration

Ensure network supports SMS and MMS over SGs.

Ensure network and device are not configured to send/receive SMS and MMS over IMS.

DUT is set to E-UTRA only mode.

Scenario A:SMS

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Using the DUT messaging application, create a new SMS and enter the MSISDN of Client 1 as the recipient | The Messaging application is opened and the MSISDN of Client 1 is entered |
| 2 | Enter some text | The message is prepared |
| 3 | Send the SMS to Client 1 | SMS is successfully sent from DUT and received on Client 1. Ensure DUT stays in E-UTRA service the whole time |
| 4 | Open the SMS at Client 1 and check the content | The message content is identical to the message prepared on DUT |

Scenario B: MMS

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Using the DUT messaging application, create a new MMS and enter the MSISDN of Client 1 as the recipient | The Messaging application is opened and the MSISDN of Client 1 is entered |
| 2 | Enter some text and attach an image. | The MMS message is prepared |
| 3 | Send the MMS to Client 1 | MMS is successfully sent from DUT and received on Client 1. Ensure DUT stays in E-UTRA service the whole time. |
| 4 | Open the MMS at Client 1 and check the content | The message content is identical to the message prepared on DUT. |

### 35.1.2 MT SMS and MT MMS over SGs

Description

DUT shall receive an MT SMS and MMS over SGs when camped to an E-UTRA network.

Related 3GPP core specifications

3GPP TS 23.272

Reason for test

To ensure the DUT correctly receives an MT SMS and MMS over SGs when camping to an E-UTRA network.

Initial configuration

Ensure network supports SMS and MMS over SGs.

Ensure network and device are not configured to send/receive SMS and MMS over IMS.

DUT is set to E-UTRA only mode.

Scenario A: SMS

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | At Client 1, create a new SMS and enter the MSISDN of DUT as the recipient | The Messaging application is opened and the MSISDN of DUT is entered |
| 2 | Enter some text | The message is prepared |
| 3 | Send the SMS to DUT | SMS is successfully sent from Client 1 and received on DUT. Ensure DUT stays in E-UTRA service the whole time |
| 4 | Open the SMS at DUT and check the content | The message content is identical to the message prepared on Client 1 |

Scenario B: MMS

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | At Client 1, create a new MMS and enter the MSISDN of DUT as the recipient | The Messaging application is opened and the MSISDN of DUT is entered |
| 2 | Enter some text and attach an image. | The MMS message is prepared |
| 3 | Send the MMS to DUT | MMS is successfully sent from Client 1 and received on DUT. Ensure DUT stays in E-UTRA service the whole time. |
| 4 | Open the MMS at DUT and check the content | The message content is identical to the message prepared on Client 1. |

# 36 Data Retry

## 36.1 RRC Errors

### 36.1.1 RRCConectionReject Message: initial attach

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.1.2 Idle Mobile Originated SMS over SGs when on E-UTRA

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

## 36.2 EMM (EPS Mobility Management) Common Procedures

### 36.2.1 UE Fails to Authenticate the Network: Invalid MAC Code

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.2.2 UE Fails to Authenticate the Network: Invalid Value for Separation Bit

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.2.3 UE Fails to Authenticate the Network: Invalid Value for SQN Field

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.2.4 Network Fails to Authenticate the UE: Network Sends “Authentication Reject” Message

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.2.5 UE Sends “Security Mode Reject” Message: Initial Attach

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

## 36.3 EPS Session Management

### 36.3.1 Network Fails to Assign an Ipv6 Address for the Internet PDN

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.3.2 Network Fails to Refresh the Ipv6 Address for the Internet PDN

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.3.3 UE Receives PDN Connectivity Reject Message from the Network for the Internet PDN

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

### 36.3.4 UE Receives Bearer Resource Allocation Reject Message from the Network: Codes 30-34

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

## 36.4 Network Initiated ESM Procedures

### 36.4.1 UE Receives Deactivate EPS Bearer Context Request Message from the Network: 1 PDN Connection Open

Test case has been archived. Please refer to TS.11 v22.0 for the full test procedure. A copy of which can be requested by emailing terminals@gsma.com

# 37 Carrier Aggregation

The tester shall perform Carrier Aggregation using a configuration supported by the DUT and network under test.

For example: (This is purely an example and not based on a particular network or device).

Network supporting the following bands:

* FDD 3
* FDD 7
* FDD 1
* TDD 40

Network supporting the following Carrier Aggregation types:

* FDD 3 Intra-band contiguous
* TDD 40 Intra-band non-contiguous
* FDD 1 + FDD 3 + FDD 7
* FDD 3 + FDD 7
* FDD 1 + FDD 3 + FDD 7 + TDD 40

DUT supporting the following bands:

* FDD 1
* FDD 3
* FDD 7
* FDD 20
* TDD 38
* TDD 40

DUT supporting the following Carrier Aggregation types:

* FDD 3 Intra-band contiguous
* FDD 38 Intra-band non-contiguous
* TDD 40 Intra-band non-contiguous
* FDD 1 + FDD 3
* FDD 1 + FDD 20
* FDD 3 + FDD 20
* FDD 3 + FDD 7
* FDD 1 + FDD 3 + FDD 7
* FDD 1 + FDD 3 + FDD 20 + FDD 7

So in this example, the following Carrier Aggregations are available to test:

* FDD 3 Intra-band contiguous
* TDD 40 Intra-band non-contiguous
* FDD 3 + FDD 7
* FDD 1 + FDD 3 + FDD 7

Note: Definitions of Carrier Aggregation abbreviations are available in the Glossary.

## 37.1 Carrier Aggregation Stationary Data Performance

### 37.1.1 Carrier Aggregation Stationary Data Performance – Relative Downlink Throughput

Description

To measure the average downlink throughput under static conditions using Carrier Aggregation as allocated by the network.

Related core specifications

3GPP TS 36.331

Reason for test

To obtain a measure of average downlink throughput for an E-UTRA Radio Access Bearer using Carrier Aggregation as implemented in the network under test.

This test is applicable for devices supporting Carrier Aggregation regardless of the type of Carrier Aggregation (Contiguous, non-contiguous, inter band), technology (FDD, TDD) or number of components aggregated by the network.

Initial configuration

DUT and network under test are both supporting Carrier Aggregation in the downlink.

There must be an appropriate number of E-UTRA cells available on the same PLMN, supporting the Carrier Aggregation Bands and frequencies required to be tested.

Reference device(s) used to validate the result with similar Carrier Aggregation capabilities is/are available. The model name(s) shall be noted in the test result.

Ensure optimal testing conditions (low user traffic hours to avoid conflict with other devices for Radio resources and a stable RF environment).

Test procedure

1. Start a Data session. I.e. activate tethering (USB/Wi-Fi) / DUN / internal FTP client.
2. Download a large incompressible file from an external server.

Confirm Carrier Aggregation status is ACTIVATED using a trace tool or internal measuring application to ensure successful addition of the Scell(s) to the Pcell.

Confirm Data download has started and the transfer is ongoing throughout the test.

Make a note of the Carrier Aggregation configuration being tested. E.g. CA\_1A\_3A\_7A or CA\_40C

1. Measure the average downlink throughput for a sufficient amount of time to evaluate the throughput using a suitable application.
2. Stop the data download.
3. Repeat steps 1 to 4 until you have a total of 5 measurements.
4. Evaluate the data performance by comparing the DUT’s throughput measurements with the throughput measurements of a reference device(s) with similar Carrier Aggregation capabilities.

Expected behaviour

1. Data connection is successfully established.
2. Carrier Aggregation status is ACTIVATED as implemented and allocated by the network.

Data download is ongoing successfully.

The Carrier Aggregation configuration tested is noted in the test plan.

1. The average throughput measurement is taken and recorded.
2. Data download is successfully stopped.
3. Further measurements are taken and recorded until a total of 5 are performed.
4. The DUT’s data performance is comparable to the reference data performance (no more than 10% worse).

### 37.1.2 Carrier Aggregation Stationary Data Performance – Relative Uplink Throughput

Description

To measure the average uplink throughput under static conditions using Carrier Aggregation as allocated by the network.

Related core specifications

3GPP TS 36.331

Reason for test

To obtain a measure of average uplink throughput for an E-UTRA Radio Access Bearer using Carrier Aggregation as implemented in the network under test.

This test is applicable for devices supporting Carrier Aggregation regardless of the type of Carrier Aggregation (Contiguous, non-contiguous, inter band), technology (FDD, TDD) or number of components aggregated by the network.

Initial configuration

DUT and network under test are both supporting Carrier Aggregation in the uplink.

There must be an appropriate number of E-UTRA cells available on the same PLMN, supporting the Carrier Aggregation Bands and frequencies required to be tested.

Reference device(s) used to validate the result with similar Carrier Aggregation capabilities is/are available. The model name(s) shall be noted in the test result.

Ensure optimal testing conditions (low user traffic hours to avoid conflict with other devices for Radio resources and a stable RF environment).

Test procedure

1. Start a Data session. I.e. activate tethering (USB/Wi-Fi) / DUN / internal FTP client.
2. Upload a large incompressible file to an external server.

Confirm Carrier Aggregation status is ACTIVATED using a trace tool or internal measuring application to ensure successful addition of the Scell(s) to the Pcell.

Confirm Data upload has started and the transfer is ongoing throughout the test.

Make a note of the Carrier Aggregation configuration being tested. E.g. CA\_1A\_3A\_7A or CA\_40C

1. Measure the average uplink throughput for a sufficient amount of time to evaluate the throughput using a suitable application.
2. Stop the data upload.
3. Repeat steps 1 to 4 until you have a total of 5 measurements.
4. Evaluate the data performance by comparing the DUT’s throughput measurements with the throughput measurements of a reference device(s) with similar Carrier Aggregation capabilities.

Expected behaviour

1. Data connection is successfully established.
2. Carrier Aggregation status is ACTIVATED as implemented and allocated by the network.

Data upload is ongoing successfully.

The Carrier Aggregation configuration tested is noted in the test plan.

1. The average throughput measurement is taken and recorded.
2. Data upload is successfully stopped.
3. Further measurements are taken and recorded until a total of 5 are performed.
4. The DUT’s data performance is comparable to the reference data performance (no more than 10% worse).

### 37.1.3 Carrier Aggregation Stationary Data Performance – Relative Downlink & Uplink Throughput

Description

To measure the average downlink & uplink throughput under static conditions using Carrier Aggregation as allocated by the network.

Related core specifications

3GPP TS 36.331

Reason for test

To obtain a measure of average downlink & uplink throughput for an E-UTRA Radio Access Bearer using Carrier Aggregation as implemented in the network under test.

This test is applicable for devices supporting Carrier Aggregation regardless of the type of Carrier Aggregation (Contiguous, non-contiguous, inter band), technology (FDD, TDD) or number of components aggregated by the network.

Initial configuration

DUT and network under test are both supporting Carrier Aggregation in the downlink and uplink.

There must be an appropriate number of E-UTRA cells available on the same PLMN, supporting the Carrier Aggregation Bands and frequencies required to be tested.

Reference device(s) used to validate the result with similar Carrier Aggregation capabilities is/are available. The model name(s) shall be noted in the test result.

Ensure optimal testing conditions (low user traffic hours to avoid conflict with other devices for Radio resources and a stable RF environment).

Test procedure

1. Start a Data session. I.e. activate tethering (USB/Wi-Fi) / DUN / internal FTP client.
2. Download a large incompressible file from an external server.

Confirm Carrier Aggregation status is ACTIVATED using a trace tool or internal measuring application to ensure successful addition of the Scell(s) to the Pcell.

Confirm Data download has started and the transfer is ongoing throughout the test.

Make a note of the Carrier Aggregation configuration being tested. E.g. CA\_1A\_3A\_7A or CA\_40C

1. Simultaneously upload a large incompressible file to an external server.
2. Measure the average downlink and uplink throughput for a sufficient amount of time to evaluate the throughput using a suitable application.
3. Stop the data download and upload.
4. Repeat steps 1 to 5 until you have a total of 5 measurements.
5. Evaluate the data performance by comparing the DUT’s throughput measurements with the throughput measurements of a reference device(s) with similar Carrier Aggregation capabilities.

Expected behaviour

1. Data connection is successfully established.
2. Carrier Aggregation status is ACTIVATED as implemented and allocated by the network.

Data download is ongoing successfully.

The Carrier Aggregation configuration tested is noted in the test plan.

1. Data upload is ongoing successfully.
2. The average throughput measurement is taken and recorded.
3. Data download and upload are successfully stopped.
4. Further measurements are taken and recorded until a total of 5 are performed.
5. The DUT’s data performance is comparable to the reference data performance (no more than 10% worse).

## 37.2 Void

Moved to Annex L

### 37.2.1 Void

### 37.2.2 Void

### 37.2.3 Void

## 37.3 Void

Moved to Annex L

### 37.3.1 Void

### 37.3.2 Void

### 37.3.3 Void

# 38 UE Performance in HST Scenario

Initial configuration (Overview)

The test shall be conducted along an agreed high-speed train (HST) line where mobile speed of trains should be above 250 km/h. (Related core specifications: 3GPP TR25.913, clause 7.3 Mobility and 3GPP TS36.101, clause B.3 High speed train scenario) The velocity can be got by GPS software etc.

## 38.1 System Access & Registration in HST Scenario

### 38.1.1 Combined Attach

Description

The DUT shall successfully perform the combined “EPS Attach” and “Default EPS Bearer Context Activation” procedures.

Related core specifications

3GPP TS 24.301, clause 5.5.1.3

Reason for test

To verify that the DUT can successfully perform the combined attach procedure in High Speed Train Scenario.

Initial configuration

E-UTRAN and UTRAN (or GERAN) cells are available (Cells on the train are not included) in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

The DUT and Reference 1 are on the high speed train

**Scenario A: DUT is powered off**

**Scenario B: Flight mode enabled**

The DUT operates in CS/PS mode 1 of operation or CS/PS mode 2 of operation

Test procedure

**Scenario A: Power ON**

1. Power on DUT and Reference 1.
2. Open embedded Browser and load a content rich page on DUT and Reference 1
3. Power off DUT and Reference 1. Repeat steps 1 and 2 for 9 more times.

**Scenario B: Flight Mode OFF**

1. Disable Flight Mode on DUT and Reference 1.
2. Open Internal Browser and load a content rich page on DUT and Reference 1.
3. Enable Flight Mode on DUT and Reference 1. Repeat steps 1 and 2 for 9 more times.

Expected behaviour

1. Verify that the DUT sends a combined ATTACH REQUEST to the network.

Check that in the ATTACH REQUEST message, the “EPS attach type” parameter holds the “combined EPS/IMSI attach” value.

## 38.2 PS Data and Mobility in HST Scenario

### 38.2.1 Reselection – Idle Mode (Data enabled)

Description

The DUT should perform reselections without losing service.

Related core specifications

3GPP TS36.304

Reason for test

To ensure that the DUT performs reselections correctly without losing service.

Initial configuration

There must be an appropriate number of E-UTRA cells available (Cells on the train are not included) on the same PLMN in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

The DUT, Reference 1 are on the high speed train and successfully registered in E-UTRAN cell for IMS service.

Test procedure

1. Browse Web pages on DUT and Reference 1 using the embedded browser (or via a tethering connection if embedded browser is not supported).
2. Block all data traffic on DUT and Reference 1.
3. Enable data and load web pages on the DUT and Reference 1 using embedded browser (or via a tethering connection if embedded browser is not supported) after each reselection.
4. Repeat steps 2-3 for 9 more times.

Expected behaviour

1. Web pages are loaded successfully to confirm data connection.
2. Data transfer has stopped and DUT and Reference 1 are in Idle Mode.
3. DUT and Reference 1 perform reselections as expected and remain in service at all times.
4. Confirm DUT’s reselection success ratio is comparable to the success ratio of Reference 1 (within 10%).

### 38.2.2 PS Data (FTP Downlink) and Handover

Description

The DUT should perform handovers without losing service. To measure the average relative downlink throughput during mobility tests on an E-UTRA Radio Access Bearer.

Related core specifications

3GPP TS 36.331

3GPP TS 36.304

Reason for test

To ensure that the DUT performs handovers correctly without losing service and obtain a measure of average downlink throughput for an E-UTRA Radio Access Bearer.

Initial configuration

There must be an appropriate number of E-UTRA cells available (Cells on the train are not included) on the same PLMN in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

The DUT, Reference 1 are on the high speed train and successfully registered in E-UTRAN cell for IMS service.

A file that takes longer time than 10 minutes to download is available.

Test procedure

1. Set up an FTP session to a controlled FTP site using a suitable application on DUT and Reference 1.
2. Download a large incompressible file on both DUT and Reference 1 for 10 minutes.

Expected behaviour

1. –
2. DUT and Reference 1 perform handover as expected and remain in service at all times. Ensure the DUT has comparable data performance to the Reference 1 (within 10%).

## 38.3 E-UTRA Voice in HST Scenario

### 38.3.1 MO Voice Call with CS Fallback – DUT in IDLE state – Successful (UTRAN)

Description

The DUT shall successfully perform a MO Voice Call with CS fallback to UTRAN.

Related core specifications

3GPP TS 23.272

Reason for test

To verify that the DUT successfully performs CS fallback for an MO Voice call.

Initial configuration

E-UTRAN and UTRAN cells are available (Cells on the train are not included) in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

The DUT, Reference 1 are on the high speed train. Client 1 and Client 2 are in a static test environment.

The DUT, Reference 1 and clients are successfully registered in E-UTRAN cell.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to UTRAN
* CS fallback to UTRAN with System Info (RIM)
* CS fallback to UTRAN with measurements
* CS fallback to UTRAN with handover

DUT and Reference 1 are either configured to E-UTRA / UTRAN only or the test is carried out in automatic mode in an area where GERAN cells are not available.

If the DUT and Reference 1 are supporting voice over IMS, they are either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”.

DUT and Reference 1 are set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. DUT makes a MO voice call to Client 1. Consecutively, Reference 1 makes a MO voice call to Client 2.
2. Answer call on Client 1 and Client 2.
3. End both voice calls.
4. Repeat steps 1 – 3 for 9 more times.

Expected behaviour

1. DUT and Reference 1 perform CS fallback to UTRAN, then alerting tone is heard on DUT and Reference 1.
2. Both MO voice calls are successfully established.
3. Calls are ended.
4. Confirm DUT’s CSFB call success ratio is comparable to the success ratio of Reference 1 (within 10%).

### 38.3.2 MO Voice Call with CS Fallback – DUT in IDLE state – Successful (GERAN)

Description

The DUT shall successfully perform a MO Voice Call with CS fallback to GERAN.

Related core specifications

3GPP TS 23.272

Reason for test

To verify that the DUT successfully performs CS fallback for an MO Voice call.

Initial configuration

E-UTRAN and GERAN cells are available (Cells on the train are not included) in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

The DUT, Reference 1 are on the high speed train. Client 1 and Client 2 are in a static test environment.

The DUT, Reference 1 and clients are successfully registered in E-UTRAN cell.

The network shall support one or more of the following CS fallback types:

* Blind CS fallback to GERAN
* CS fallback to GERAN with System Info (RIM)
* CS fallback to GERAN with measurements
* CS fallback to GERAN with handover

DUT and Reference 1 are either configured to E-UTRA / GERAN only or the test is carried out in automatic mode in an area where UTRAN cells are not available.

If the DUT and Reference 1 are supporting voice over IMS, they are either configured to “CS voice preferred, IMS PS voice secondary” or “CS voice only”

DUT and Reference 1 are set to operate in CS/PS mode 1 or CS/PS mode 2.

Test procedure

1. DUT makes a MO voice call to Client 1. Consecutively, Reference 1 makes a MO voice call to Client 2.
2. Answer call on Client 1 and Client 2
3. End both voice calls.
4. Repeat steps 1 – 3 for 9 more times.

Expected behaviour

1. DUT and Reference 1 performs CS fallback to GERAN, then alerting tone is heard on DUT and Reference 1..
2. Both MO voice calls are successfully established.
3. End both voice calls.
4. Confirm DUT’s CSFB call success ratio is comparable to the success ratio of Reference 1 (within 10%).

### 38.3.3 MO Voice Call with VoLTE – DUT in IDLE state – Successful

**Description**

The DUT shall successfully perform Voice over LTE (VoLTE) calls in HST Scenario

**Related core specifications**

3GPP TS 36.331

**Reason for test**

To verify that the DUT can successfully perform Voice call over LTE (VoLTE) calls in HST Scenario.

**Initial configuration**

E-UTRAN cells are available (Cells on the train are not included) in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

Reference 1 is available.

The DUT, Reference 1 are on the high speed train. Client 1 and Client 2 are in a static test environment.

The DUT, Reference 1 and clients are successfully registered in E-UTRAN cell for IMS service.

**Test procedure**

1. DUT makes a MO VoLTE call to Client 1. Consecutively, Reference 1 makes a MO VoLTE call to Client 2.
2. Answer call on Client 1 and Client 2.
3. End both VoLTE calls.
4. Repeat steps 1-3 for 19 more times.

**Expected behaviour**

1. Alerting tone is heard on DUT and Reference 1.
2. Both MO VoLTE calls are successfully established.
3. Calls are ended.
4. Confirm DUT’s VoLTE call success ratio is comparable to the success ratio of Reference 1 (within 10%).

### 38.3.4 Service continuity of VoLTE call and Handover

Description

The DUT in an ongoing VoLTE call should perform handovers without losing service.

Related core specifications

3GPP TS 36.331

3GPP TS 36.304

Reason for test

To ensure the DUT can perform handovers correctly without losing service in HST Scenario.

Initial configuration

There must be an appropriate number of E-UTRA cells available (Cells on the train are not included) on the same PLMN in High Speed Train test route.

Ensure optimal testing conditions (optimum RF signal, low traffic hours to avoid interference with other devices, etc.).

Reference 1 is available.

The DUT, Reference 1 are on the high speed train, Client 1 and Client 2 are in a static test environment.

The DUT, reference 1 and clients are successfully registered in E-UTRAN cell for IMS service.

Test procedure

1. DUT, Reference 1 are powered on and camping to the appropriate RAT.
2. DUT makes a MO VoLTE call to Client 1. Consecutively, Reference 1 makes a MO VoLTE call to Client 2.
3. Continue the VoLTE calls for 10 minutes.
4. End both VoLTE calls.

Expected behaviour

1. DUT and Reference 1 are camping to the appropriate RAT.
2. Both MO VoLTE calls are successfully established.
3. VoLTE calls are stable. The DUT’s VoLTE call has comparable performance with Reference 1’s.
4. Calls are ended.

# 39 Single User Multiple-Input-Multiple-Output

### 39.1 Stationary Data Performance

### 39.1.1 Downlink Throughput with Four-Layer Spatial Multiplexing (Relative Measurement)

Description

To measure the average downlink throughput under static conditions using Downlink Four-Layer Spatial Multiplexing.

Related core specifications

3GPP TS 36.211, 3GPP TS 36.212, 3GPP TS 36.213, 3GPP TS 36.331

Reason for test

To obtain a measure of average downlink throughput for an E-UTRA Radio Access Bearer using Downlink four-layer spatial multiplexing as implemented in the network under test.

This test is applicable for devices supporting Downlink four-layer spatial multiplexing regardless of the type of transmission mode (TM3, TM4, TM9) or frequency.

Initial configuration

DUT and network under test are both supporting downlink four-layer spatial multiplexing.

Reference-1 used to validate the result with similar MIMO capabilities is available.

DUT and Reference-1 are successfully registered in E-UTRAN cell

Ensure optimal testing conditions (low user traffic hours to avoid interference with other devices for Radio resources and a suitable RF environment for high spectral efficiency facilitating four-layer spatial multiplexing).

|  |  |  |
| --- | --- | --- |
| - | Test procedure | Expected behaviour |
| 1 | Set up a tethering (USB/Wi-Fi)/ DUN/ internal FTP client connection on DUT. Or use embedded application. | Data connection is successfully established. |
| 2 | Download a large incompressible file from an external server.  Confirm that downlink four-layer spatial multiplexing is scheduled; using trace tool or internal measuring application.  Confirm Data download has started and the transfer is ongoing throughout the test.  Make a note of the configuration being tested. E.g. B41 TM9 four-layer spatial multiplexing. | Downlink four-layer spatial multiplexing is scheduled by the network.  Data download is ongoing successfully. |
| 3 | Measure the average downlink throughput for a sufficient amount of time to evaluate the throughput using a suitable application. | The average throughput measurement is taken and recorded. |
| 4 | Stop the data download. | Data download is successfully stopped. |
| 5 | Repeat steps 1 to 4 for 5 times on DUT and Reference-1. | Calculate an average throughput of 5 times on DUT and Reference-1. |
| 6 | Evaluate the data performance by comparing the DUT’s throughput measurements with the throughput measurements of Reference-1. | The DUT’s data performance is comparable to the Reference-1’s data performance (no more than 10% worse). |

## 39-1 Minimization of Drive Test

### 39-1.1 Immediate Minimization of Drive Test

Description

DUT shall provide detailed location information when it is available if DUT is configured with immediate MDT.

Related 3GPP core specifications

3GPP TS 36.331, 3GPP TS 37.320

Reason for test

To ensure the DUT correctly send detailed location information when it is available if E-UTRA network has configured DUT with immediate MDT.

Initial configuration

DUT and network support immediate MDT.

GNSS is enabled on DUT.

|  |  |  |
| --- | --- | --- |
| - | **Test procedure** | Expected behaviour |
| 1 | Power on DUT. | DUT is powered on and camping on the E-UTRA network. |
| 2 | Set up a Tethering connection on DUT. Download a file from an external server to make sure DUT is in connected mode. | DUT is successfully tethered and downloading data. |
| 3 | Confirm that immediate MDT is configured with the measurement configuration; using a trace tool or internal measuring application if available. | Network sends RRCConnectionReconfigura-tion with “includeLocationInfo-r10” IE set to be True.  Immediate MDT is successfully configured. |
| 4 | Move the DUT to trigger the report of the measurement results. | Location information is reported to the E-UTRA network with the measurement results. |

### 39-1.2 Logged Minimization of Drive Test

Description

DUT shall provide detailed location information after entering RRC-CONNECTED mode if DUT is configured with logged MDT.

Related 3GPP core specifications

3GPP TS 36.331, 3GPP TS 37.320

Reason for test

To ensure the DUT log the measurement results and detailed location information periodically in RRC-IDLE mode if E-UTRA network configure DUT with logged MDT.

To ensure the DUT send the logged information to the E-UTRA network when DUT enter RRC-CONNECTED mode.

Initial configuration

DUT and network support logged MDT.

GNSS is enabled on DUT.

|  |  |  |
| --- | --- | --- |
| - | **Test procedure** | Expected behaviour |
| 1 | Power on DUT. | DUT is powered on and camping on the E-UTRA network. |
| 2 | Browse Web pages on DUT using the embedded browser (or via a tethering connection if embedded browser is not supported). | Web pages are loaded successfully to confirm data connection. |
| 3 | Disable the data connection on DUT to make the DUT in RRC-IDLE mode for 1 minute (longer than the configured report interval). | Data transfer has stopped and DUT is in RRC-IDLE Mode. |
| 4 | Confirm that logged MDT is configured before the DUT enters idle mode; using a trace tool or internal measuring application if available | Network sends RRCConnectionReconfigura-tion with “loggedMeasurementConfiguration-r10” IE.  DUT is configured with logged MDT |
| 5 | Load web pages on the DUT using embedded browser (or via a tethering connection if embedded browser is not supported). | DUT sends “rrcConnetionSetupComplete” with “logMeasAvailable-r10” IE set to be true.  Network sends “ueInformationRequest-r9” with “logMeasReportReq-r10” IE set to be true.  DUT sends “ueInformationResponse” with “logMeasReport-r10” IE which contains the periodically logged measurement results and detailed location information.  Web pages are loaded successfully. |

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