#### 7.1.1.5 Discontinuous reception

##### 7.1.1.5.0 DRX Common Definitions

FirstSlot is the First DL Slot in the subframe, which is 0 for both FDD and TDD as per default configuration in 38.5081-1[4] TDD-UL-DL-Config Table 4.6.3-192

LastDLSlot is the Last DL Slot in a frame; for FDD (except for HD-FDD) numerology =0 it is slot 9, numerology=1 it is slot 19, numerology=2 it is slot 39. For TDD as per default configuration in 38.5081-1[4] TDD-UL-DL-Config Table 4.6.3-192, for numerology =0, it is slot 7, numerology=1 it is slot 16, numerology=3 it is slot 77. For HD-FDD as per default configuration in TS 38.508-1[4] Table 4.6.3-162, for numerology=0, it is slot 8.

LastULSlot is the Last UL Slot in a frame; for FDD/TDD numerology =0 it is slot 9, numerology=1 it is slot 18(Second Last as 2 Consecutive UL Slots), numerology=3 it is slot 79; the PDCCH for UL grant is sent K2= 4 Slot earlier.

##### 7.1.1.5.1 DRX operation / Short cycle not configured / Parameters configured by RRC

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Long DRX cycle is configured and [(SFN \* 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset* }

**then** { UE starts the OnDurationTimer and monitors the PDCCH for OnDurationTimer PDCCH-Occasions }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Long DRX cycle is configured and a new DL transmission is indicated on the PDCCH during Active Time }

**then** { UE starts or restarts the Drx-InactivityTimer and monitors the PDCCH for Drx-InactivityTimer PDCCH occasions starting from the next PDCCH occasion of the PDCCH occasion where the DL new transmission was indicated }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Long DRX cycle is configured and if a HARQ RTT Timer expires in this PDCCH Occasion and the data in the soft buffer of the corresponding HARQ process was not successfully decoded }

**then** { UE starts the drx-RetransmissionTimer-DL for the corresponding HARQ process and monitors the PDCCH for drx-RetransmissionTimer consecutive PDCCH Occasion }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Long DRX cycle is configured and an uplink grant for a pending HARQ retransmission can occur in this PDCCH occasion }

**then** { UE monitors the PDCCH in this PDCCH occasion }

}

7.1.1.5.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clause 5.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.7]

The MAC entity may be configured by RRC with a DRX functionality that controls the UE’s PDCCH monitoring activity for the MAC entity's C-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, and TPC-SRS-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other subclauses of this specification. When in RRC\_CONNECTED, if DRX is configured, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this subclause; otherwise the MAC entity shall monitor the PDCCH continuously.

RRC controls DRX operation by configuring the following timers:

- *drx-onDurationTimer*: the duration at the beginning of a DRX Cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates an new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycle* StartOffset: the Long DRX cycle and drx-StartOffset which defines the subframe where the Long and Short DRX Cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity.

When a DRX cycle is configured, the Active Time includes the time while:

- drx-onDurationTimer or drx-InactivityTimer or drx-RetransmissionTimerDL or drx-RetransmissionTimerUL or ra-ContentionResolutionTimer (as described in subclause 5.1.5) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in subclause 5.4.4); or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the random access preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in subclause 5.1.4).

When DRX is configured, the MAC entity shall:

1> if a MAC PDU is received in a configured downlink assignment:

2> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if a MAC PDU is transmitted in a configured uplink grant:

2> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

2> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

1> if a *drx-HARQ-RTT-TimerDL* expires:

2> if the data of the corresponding HARQ process was not successfully decoded:

3> start the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if an *drx-HARQ-RTT-TimerUL* expires:

2> start the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

1> if a DRX Command MAC CE or a Long DRX Command MAC CE is received:

2> stop *drx-onDurationTimer*;

2> stop *drx-InactivityTimer*.

1> if *drx-InactivityTimer* expires or a DRX Command MAC CE is received:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer in the first symbol after the expiry of drx-HARQ-RTT-TimerDL.*;

3> use the Short DRX Cycle.

2> else:

3> use the Long DRX cycle.

1> if *drx-ShortCycleTimer* expires:

2> use the Long DRX cycle.

1> if a Long DRX Command MAC CE is received:

2> stop *drx-ShortCycleTimer*;

2> use the Long DRX cycle.

1> if the Short DRX Cycle is used, and [(SFN x 10) + subframe number] modulo (*drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*); or

1> if the Long DRX Cycle is used, and [(SFN x 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> if *drx-SlotOffset* is configured:

3> start *drx-onDurationTimer* after *drx-SlotOffset from the beginning of the subframe*.

2> else:

3> start *drx-onDurationTimer*.

1> if the MAC entity is in Active Time:

2> monitor the PDCCH;

2> if the PDCCH indicates a DL transmission or if a DL assignment has been configured:

3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process immediately after the corresponding PUCCH transmission;

3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

2> if the PDCCH indicates a UL transmission or if a UL grant has been configured:

3> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process immediately after the first repetition of the corresponding PUSCH transmission;

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

2> if the PDCCH indicates a new transmission (DL or UL):

3> start or restart *drx-InactivityTimer*.

1> else (i.e. not part of the Active Time):

2> not report CQI/PMI/RI on PUCCH.

7.1.1.5.1.3 Test description

7.1.1.5.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.5.1.3.2 Test procedure sequence

Table 7.1.1.5.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits RRCReconfiguration to configure specific DRX parameters. (Note 6) | <-- | - | - | - |
| 2 | The UE transmits RRCReconfigurationComplete. (Note 7) | --> | - | - | - |
| 3 | In the first PDCCH occasion when the *Drx-onDurationTimer* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 4 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 3? | --> | HARQ ACK | 1 | P |
| 5 | At least drx-InactivityTimer PDCCH occasions after the transmission of the MAC PDU in Step 3 has been indicated (This means the next DRX cycle or later after Step 2) in the last PDCCH occasion while the *drx-onDurationTimer* is still running, the SS indicates the transmission a DL MAC PDU on the PDDCH. (Note 4). | <-- | MAC PDU | - | - |
| 6 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 5? | --> | HARQ ACK | 1 | P |
| 7 | drx-InactivityTimer PDCCH-occasions after the transmission of the MAC PDU transmitted in step 5 was indicated on the PDCCH, the SS indicates the transmission of a DL MAC PDU on the PDCCH. (Note 4) | <-- | MAC PDU | - | - |
| 8 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 7? | --> | HARQ ACK | 2 | P |
| 9 | At least drx-InactivityTimer PDCCH occasions after the transmission of the MAC PDU in Step 7 has been indicated (This means the next DRX cycle or later after Step 5) and in the last PDCCH occasion before the *Drx-onDurationTimer* expires, the SS indicates the transmission of a DL MAC PDU on the PDDCH. The DL MAC PDU transmitted is invalid. (Note 1, Note 4) | <-- | Invalid MAC PDU | - | - |
| 10 | Check: Does the UE transmit a HARQ NACK for the DL MAC PDU in Step 9? | --> | HARQ NACK | 1 | P |
| 11 | In the first PDCCH occasion when the Drx-RetransmissionTimerDL for the MAC PDU in Step 9 is started (i.e. after expiry of *drx-HARQ-RTT-TimerDL after step 9)*, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 12 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 11? | --> | HARQ ACK | 3 | P |
| 13 | At least drx-InactivityTimer PDCCH occasions after the transmission of the DL MAC PDU in Step 11 has been indicated (This means the next DRX cycle or later after Step 11) and last PDCCH occasion before the *Drx-onDurationTimer* expires, the SS indicates the transmission of DL MAC PDU on the PDCCH. The DL MAC PDU transmitted is invalid. (Note 1, Note 4) | <-- | Invalid MAC PDU | - | - |
| 14 | Check: Does the UE transmit a HARQ NACK for the DL MAC PDU in Step 13? | --> | HARQ NACK | 1 | P |
| 15 | In the last PDCCH occasion when the drx-RetransmissionTimerDL for MAC PDU in Step 13 is still running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 16 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 15? | --> | HARQ ACK | 3 | P |
| 17 | The SS is configured for Uplink Grant Allocation Type [0]. At least drx-InactivityTimer PDCCH subframes after the transmission of the DL MAC PDU in Step 15 has been indicated in the last PDCCH occasion when the onDuratiopnTimer is still running (This means the next DRX cycle or later after Step 9), the SS indicates an UL grant to the UE on the PDCCH. (Note 4) | <-- | UL grant on PDCCH | - | - |
| 18 | Check: Does the UE transmit a Buffer Status Report on the UL indicating an empty buffer? | --> | Buffer Status Report MAC control element | 1 | P |
| 19 | In the last PDCCH occasion when the drx-RetransmissionTimer-UL for MAC PDU from Step 17 is still running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 20 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 19? | --> | HARQ ACK | 4 | P |
| Note 1: Invalid MAC PDU is a MAC PDU that fails the CRC check.  Note 2: All the DL MAC PDU are transmitted with the NDI set on the PDCCH.  Note 3: Timer tolerances for the MAC DRX related timers measured in PDCCH occasions is 0. These timers are: drx-InactivityTimer, drx-RetransmissionTimerDL, drx-RetransmissionTimerUL, drx-HARQ-RTT-TimerDL and drx-HARQ-RTT-TimerUL.  Note 4: The drx-InactivityTimer is started in the next PDCCH occasion of the PDCCH occasion where DL new transmission is indicated.  Note 5: The timer values expressed in number of slots.  Note 6: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 7: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete.* | | | | | |

7.1.1.5.1.3.3 Specific message contents

Table 7.1.1.5.1.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.5.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  | NR |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.5.1.3.3-2: *CellGroupConfig* (Table 7.1.1.5.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer | ms20 |  |  |
| drx-InactivityTimer | ms10 |  |  |
| drx-HARQ-RTT-TimerDL | 56 | Number of slots=4 due to number of symbol per slot=14 | =0,1,2,3,4 ( 2 with normal CP) |
|  | 48 | Number of slots=4 due to number of symbol per slot=12 | = 2 with external CP |
| drx-HARQ-RTT-TimerUL | 56 | Number of slots=4 due to number of symbol per slot=14 | =0,1,2,3,4 ( 2 with normal CP) |
|  | 48 | Number of slots=4 due to number of symbol per slot=12 | = 2 with external CP |
| drx-RetransmissionTimerDL | sl8 |  |  |
| drx-RetransmissionTimerUL | sl8 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms640 | 7 |  |  |
| } |  |  |  |
| shortDRX | Not present |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.5.2 DRX operation / Short cycle not configured / Long DRX command MAC control element reception

7.1.1.5.2.1 Test Purpose (TP)

(1)

**with** { UE in CONNECTED mode }

**ensure that** {

**when** { long DRX cycle is configured and a DRX Command MAC control element is received }

**then** { UE successfully decodes the MAC control PDU }

}

(2)

**with** { UE in CONNECTED mode }

**ensure that** {

**when** { long DRX cycle is configured and the HARQ RTT Timer is running and a DRX Command MAC control element is received }

**then** { UE continues running the HARQ RTT timer }

}

(3)

**with** { UE in CONNECTED mode }

**ensure that** {

**when** { long DRX cycle is configured and the drx-RetransmissionTimer is running and a DRX Command MAC control element is received }

**then** { UE continues running the drx-RetransmissionTimer and monitors the PDCCH }

}

7.1.1.5.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clause 5.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.7]

The MAC entity may be configured by RRC with a DRX functionality that controls the UE’s PDCCH monitoring. Activity for the MAC entity's C-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, and TPC-SRS-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other subclauses of this specification. When in RRC\_CONNECTED, if DRX is configured, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this subclause; otherwise the MAC entity shall monitor the PDCCH continuously.

RRC controls DRX operation by configuring the following timers:

- *drx-onDurationTimer*: the duration at the beginning of a DRX Cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycle* StartOffset: the Long DRX cycle and drx-StartOffset which defines the subframe where the Long and Short DRX Cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity.

When a DRX cycle is configured, the Active Time includes the time while:

- drx-onDurationTimer or drx-InactivityTimer or drx-RetransmissionTimerDL or drx-RetransmissionTimerUL or ra-ContentionResolutionTimer (as described in subclause 5.1.5) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in subclause 5.4.4); or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the random access preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in subclause 5.1.4).

When DRX is configured, the MAC entity shall:

1> if a MAC PDU is received in a configured downlink assignment:

2> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if a MAC PDU is transmitted in a configured uplink grant:

2> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

2> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

1> if a *drx-HARQ-RTT-TimerDL* expires:

2> if the data of the corresponding HARQ process was not successfully decoded:

3> start the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if an *drx-HARQ-RTT-TimerUL* expires:

2> start the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

1> if a DRX Command MAC CE or a Long DRX Command MAC CE is received:

2> stop *drx-onDurationTimer*;

2> stop *drx-InactivityTimer*.

1> if *drx-InactivityTimer* expires or a DRX Command MAC CE is received:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer in the first symbol after the expiry of drx-HARQ-RTT-TimerDL.*;

3> use the Short DRX Cycle.

2> else:

3> use the Long DRX cycle.

1> if *drx-ShortCycleTimer* expires:

2> use the Long DRX cycle.

1> if a Long DRX Command MAC CE is received:

2> stop *drx-ShortCycleTimer*;

2> use the Long DRX cycle.

1> if the Short DRX Cycle is used, and [(SFN x 10) + subframe number] modulo (*drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*); or

1> if the Long DRX Cycle is used, and [(SFN x 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> if *drx-SlotOffset* is configured:

3> start *drx-onDurationTimer* after *drx-SlotOffset from the beginning of the subframe*.

2> else:

3> start *drx-onDurationTimer*.

1> if the MAC entity is in Active Time:

2> monitor the PDCCH;

2> if the PDCCH indicates a DL transmission or if a DL assignment has been configured:

3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process immediately after the corresponding PUCCH transmission;

3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

2> if the PDCCH indicates a UL transmission or if a UL grant has been configured:

3> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process immediately after the first repetition of the corresponding PUSCH transmission;

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

2> if the PDCCH indicates a new transmission (DL or UL):

3> start or restart *drx-InactivityTimer*.

1> else (i.e. not part of the Active Time):

2> not report CQI/PMI/RI on PUCCH.

7.1.1.5.2.3 Test description

7.1.1.5.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.5.2.3.2 Test procedure sequence

For FDD, *NormalSLT*(current SFN,current sub-frame, current slot,y)=y; For TDD, *NormalSLT*(current SFN, current slot,y) counts the minimum number of normal slots needed to cover y number of PDCCH-occasions(slots) until next PDCCH-occasion(slot) available, starting from current slot on current SFN.

Table 7.1.1.5.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits RRCReconfiguration to configure specific DRX parameters. (Note 5) | <-- | - | - | - |
| 2 | The UE transmits RRCReconfigurationComplete. (Note 6) | --> | - | - | - |
| 3 | In a PDCCH occasion which is X PDCCH sub frames before the PDCCH occasion in which the onDurationTimer expires, with X < drx-onDurationTimer, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits an MAC PDU. | <-- | MAC PDU | - | - |
| 4 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 3? | --> | HARQ ACK | 1 | P |
| 5 | In a PDCCH occasion before the *drx-onDurationTimer* expires, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU with DRX MAC Control element.  UE successfully decodes the MAC PDU and starts the long DRX cycle. | <-- | MAC PDU(DRX MAC Control element) | - | - |
| 6 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 6A | In a PDCCH occasion before the Long DRX cycle ends, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU | <-- | MAC PDU |  |  |
| 6B | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | F |
| 7 | On the next or later DRX cycle than the one used for Step 3 and on a PDCCH occasion which is X PDCCH sub frames before the PDCCH occasion in which the *onDurationTimer* expires, with X < drx-onDurationTimer,the SS indicates the transmission of a DL MAC PDU. The SS transmits an invalid MAC PDU. (Note 1) | <-- | MAC PDU | - | - |
| 8 | Check: Does the UE transmit a HARQ NACK? | --> | HARQ NACK | - | P |
| 8A | In a PDCCH occasion before the *Drx-HARQ-RTT-TimerDL* for the MAC PDU indicated in Step 7 expires, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU with DRX MAC Control element. | <-- | MAC PDU(DRX MAC Control element) | - | - |
| 8B | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 2,3 | P |
| 9 | In a PDCCH occasion when the *drx-RetransmissionTimer* for the MAC PDU indicated in Step 7 is still running,, the SS indicates the transmission of a DL MAC PDU. The SS transmits a DL MAC PDU with DRX MAC Control element. | <-- | MAC PDU(DRX MAC Control element) | - | - |
| 10 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 2,3 | P |
| 11 | In the last sub frame when the Drx-RetransmissionTimer for the DL MAC PDU indicated on the PDCCH in Step 7 is still running, the SS indicates the transmission of a DL MAC PDU. | <-- | MAC PDU | - | - |
| 12 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 2,3 | P |
| Note 1: Invalid MAC PDU is a MAC PDU that fails the CRC check.  Note 2: All DL MAC PDUs are transmitted with the NDI set on the PDCCH.  Note 3: Timer tolerances for the MAC DRX related timers measured in PDCCH occasions(slots). These timers are: drx-InactivityTimer, drx-RetransmissionTimer, Drx-HARQ-RTT-TimerDL.  Note 5: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 6: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete* | | | | | |

7.1.1.5.2.3.3 Specific message contents

Table 7.1.1.5.2.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.5.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  | NR |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.5.2.3.3-2: *CellGroupConfig* (Table 7.1.1.5.2.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer | ms40 |  |  |
| drx-InactivityTimer | ms10 |  |  |
| drx-HARQ-RTT-TimerDL | 56 | Number of slots=4 due to number of symbol per slot=14 | =0,1,2,3,4 ( 2 with normal CP) |
|  | 48 | Number of slots=4 due to number of symbol per slot=12 | = 2 with external CP |
| drx-HARQ-RTT-TimerUL | 56 | Number of slots=4 due to number of symbol per slot=14 | =0,1,2,3,4 ( 2 with normal CP) |
|  | 48 | Number of slots=4 due to number of symbol per slot=12 | = 2 with external CP |
| drx-RetransmissionTimerDL | sl80 |  |  |
| drx-RetransmissionTimerUL | sl80 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms640 | 7 |  |  |
| } |  |  |  |
| shortDRX | Not present |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.5.3 DRX operation / Short cycle configured / Parameters configured by RRC

7.1.1.5.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Short DRX cycle and *drx-SlotOffset* is configured and [(SFN \* 10) + subframe number] modulo *drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*) }

**then** { UE starts the OnDurationTimer after *drx-SlotOffset* and monitors the PDCCH for OnDurationTimer PDCCH-subframes }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { drxShortCycleTimer is expired and [(SFN \* 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset* }

**then** { UE starts the OnDurationTimer after *drx-SlotOffset* and monitors the PDCCH for OnDurationTimer PDCCH-subframes }

}

7.1.1.5.3.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.321, clause 5.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.7]

The MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, and TPC-SRS-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other clauses of this specification. When in RRC\_CONNECTED, if DRX is configured, for all the activated Serving Cells, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this clause; otherwise the MAC entity shall monitor the PDCCH as specified in TS 38.213 [6].

RRC controls DRX operation by configuring the following parameters:

- *drx-onDurationTimer*: the duration at the beginning of a DRX Cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process except for the broadcast process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycleStartOffset*: the Long DRX cycle and *drx-StartOffset* which defines the subframe where the Long and Short DRX Cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process except for the broadcast process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity.

When DRX is configured, the Active Time includes the time while:

- *drx-onDurationTimer* or *drx-InactivityTimer* or *drx-RetransmissionTimerDL* or *drx-RetransmissionTimerUL* or *ra-ContentionResolutionTimer* (as described in clause 5.1.5) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4); or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in clause 5.1.4).

When DRX is configured, the MAC entity shall:

...

1> if *drx-InactivityTimer* expires or a DRX Command MAC CE is received:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer* in the first symbol after the expiry of *drx-InactivityTimer* or in the first symbol after the end of DRX Command MAC CE reception;

3> use the Short DRX Cycle.

2> else:

3> use the Long DRX cycle.

1> if *drx-ShortCycleTimer* expires:

2> use the Long DRX cycle.

1> if a Long DRX Command MAC CE is received:

2> stop *drx-ShortCycleTimer*;

2> use the Long DRX cycle.

1> if the Short DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*); or

1> if the Long DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe.

7.1.1.5.3.3 Test description

7.1.1.5.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.5.3.3.2 Test procedure sequence

For FDD, *NormalSLT* (current SFN, current sub-frame, current slot, y) = y; For TDD, *NormalSLT* (current SFN, current slot, y) counts the minimum number of normal slots needed to cover y number of PDCCH-occasions(slots) until next PDCCH-occasion(slot) available, starting from current slot on current Subframe.

Table 7.1.1.5.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| 1 | SS transmits NR *RRCReconfiguration* message to configure specific DRX parameters for SpCell (Note1). | <-- | - | - | - |
| 2 | The UE transmitNR *RRCReconfigurationComplete* messages. (Note 2) | --> | - | - | - |
| 3 | In the first PDCCH occasion, after the *drx-SlotOffset* when the *drx-onDurationTimer* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. (Note 3)(Note 4)(Note 5) | <-- | MAC PDU | - | - |
| 4 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 3? | --> | HARQ ACK | - | - |
| 5 | At least *drx-InactivityTimer* after the transmission of the MAC PDU in Step 3 has been indicated (This means the next DRX cycle or later after Step 1) in the last PDCCH occasion while the *drx-onDurationTimer* is still running according to [(SFN \* 10) + subframe number] modulo *drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*)), the SS indicates the transmission a DL MAC PDU on the PDDCH. | <-- | MAC PDU | - | - |
| 6 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 5? | --> | HARQ ACK | 1 | P |
| 7 | SS waits for *drx-ShortCycleTimer* to expire. | - | - | - | - |
| 8 | In the first PDCCH occasion after the *drx-SlotOffset* when the *drx-onDurationTimer* of *drx-LongCycle* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 9 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 8? | --> | HARQ ACK | 2 | P |
| Note 1: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 3: The drx-InactivityTimer is started in the first symbol after the end of the PDCCH reception where DL new transmission is indicated.  Note 4: When the *drx-InactivityTimer* expires, UE starts *drx-ShortCycleTimer* in the first symbol after the expiry of *drx-InactivityTimer*.  Note 5: The SS assumes that the UE starts in long DRX after configuration. | | | | | |

7.1.1.5.3.3.3 Specific message contents

Table 7.1.1.5.3.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.5.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  | NR |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.5.3.3.3-2: *CellGroupConfig* (Table 7.1.1.5.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer | ms20 |  |  |
| drx-InactivityTimer | ms10 |  |  |
| drx-HARQ-RTT-TimerDL | 56 |  |  |
| drx-HARQ-RTT-TimerUL | 56 |  |  |
| drx-RetransmissionTimerDL | sl80 |  |  |
| drx-RetransmissionTimerUL | sl80 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms640 | 7 |  |  |
| } |  |  |  |
| shortDRX SEQUENCE { |  |  |  |
| drx-ShortCycle | ms80 |  |  |
| drx-ShortCycleTimer | 7 |  |  |
| } |  |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.5.4 DRX operation / Short cycle configured / DRX command MAC control element reception

7.1.1.5.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Short DRX cycle is configured and a DRX Command MAC control element is received }

**then** { UE successfully decodes the MAC control PDU }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Short DRX cycle is configured and the HARQ RTT Timer is running and a DRX Command MAC control element is received }

**then** { UE continues running the HARQ RTT timer }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Short DRX cycle is configured and the drx-RetransmissionTimer-DL is running and a DRX Command MAC control element is received }

**then** { UE continues running the drx-RetransmissionTimer-DL and monitors the PDCCH }

}

7.1.1.5.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clause 5.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.7]

The MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, and TPC-SRS-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other subclauses of this specification. When in RRC\_CONNECTED, if DRX is configured, for all the activated Serving Cells, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this subclause; otherwise the MAC entity shall monitor the PDCCH continuously.

RRC controls DRX operation by configuring the following parameters:

- *drx-onDurationTimer*: the duration at the beginning of a DRX Cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process except for the broadcast process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycleStartOffset*: the Long DRX cycle and *drx-StartOffset* which defines the subframe where the Long and Short DRX Cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process except for the broadcast process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity.

When a DRX cycle is configured, the Active Time includes the time while:

- *drx-onDurationTimer* or *drx-InactivityTimer* or *drx-RetransmissionTimerDL* or *drx-RetransmissionTimerUL* or *ra-ContentionResolutionTimer* (as described in subclause 5.1.5) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in subclause 5.4.4); or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in subclause 5.1.4).

When DRX is configured, the MAC entity shall:

1> if a MAC PDU is received in a configured downlink assignment:

2> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if a MAC PDU is transmitted in a configured uplink grant:

2> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

2> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

1> if a *drx-HARQ-RTT-TimerDL* expires:

2> if the data of the corresponding HARQ process was not successfully decoded:

3> start the *drx-RetransmissionTimerDL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerDL*.

1> if a *drx-HARQ-RTT-TimerUL* expires:

2> start the *drx-RetransmissionTimerUL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerUL*.

1> if a DRX Command MAC CE or a Long DRX Command MAC CE is received:

2> stop *drx-onDurationTimer*;

2> stop *drx-InactivityTimer*.

1> if *drx-InactivityTimer* expires or a DRX Command MAC CE is received:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer* in the first symbol after the expiry of *drx-InactivityTimer* or in the first symbol after the end of DRX Command MAC CE reception;

3> use the Short DRX Cycle.

2> else:

3> use the Long DRX cycle.

1> if *drx-ShortCycleTimer* expires:

2> use the Long DRX cycle.

1> if a Long DRX Command MAC CE is received:

2> stop *drx-ShortCycleTimer*;

2> use the Long DRX cycle.

1> if the Short DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*); or

1> if the Long DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe.

1> if the MAC entity is in Active Time:

2> monitor the PDCCH;

2> if the PDCCH indicates a DL transmission:

3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

2> if the PDCCH indicates a UL transmission:

3> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

2> if the PDCCH indicates a new transmission (DL or UL):

3> start or restart *drx-InactivityTimer* in the first symbol after the end of the PDCCH reception.

1> in current symbol n, if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this subclause:

2> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7].

1> if CSI masking (*csi-Mask*) is setup by upper layers:

2> in current symbol n, if *onDurationTimer* would not be running considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this subclause:

3> not report CSI on PUCCH.

1> else:

2> in current symbol n, if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this subclause:

3> not report CSI on PUCCH and semi-persistent CSI on PUSCH.

Regardless of whether the MAC entity is monitoring PDCCH or not, the MAC entity transmits HARQ feedback, aperiodic CSI on PUSCH, and aperiodic SRS defined in TS 38.214 [7] when such is expected.

The MAC entity needs not to monitor the PDCCH if it is not a complete PDCCH occasion (e.g. the Active Time starts or ends in the middle of a PDCCH occasion).

7.1.1.5.4.3 Test description

7.1.1.5.4.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.5.4.3.2 Test procedure sequence

For FDD, *NormalSLT*(current SFN, current subframe, current slot, y)=y; For TDD, *NormalSLT*(current SFN, current subframe, current slot, y) counts the minimum number of normal slots needed to cover y number of PDCCH-occasions (slots) until next PDCCH-occasion (slot) available, starting from current slot on current SFN.

Table 7.1.1.5.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits NR RRCReconfigurationmessage to configure specific DRX parameters for NR Cell. (Note 1) | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 2 | The UE transmits NR RRCReconfigurationComplete message. (Note 2) | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 3 | In a PDCCH occasion which is X subframes before the PDCCH occasion in which the *drx-onDurationTimer* expires, with X < *drx-onDurationTimer*-1, the SS indicates the transmission of a DL MAC PDU on the PDCCH. (Note 7) | <-- | MAC PDU | - | - |
| 4 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 3? | --> | HARQ ACK | 1 | P |
| 5 | In a PDCCH occasion before the *drx-onDurationTimer* expires, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU with DRX MAC Control element. UE successfully decodes the MAC PDU. | <-- | MAC PDU (DRX MAC Control element) | - | - |
| 6 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 5? | --> | HARQ ACK | 1 | P |
| 6A | In a PDCCH occasion before the short DRX cycle ends, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU | <-- | MAC PDU |  |  |
| 6B | Check: Does the UE transmit a HARQ ACK in step 6B? | --> | HARQ ACK | 1 | F |
| 7 | On the next or later DRX cycle than the one used for Step 3 and on a PDCCH occasion which is X PDCCH sub frames before the PDCCH occasion in which the *onDurationTimer* expires, with X < drx-onDurationTimer, the SS indicates the transmission of a DL MAC PDU. The SS transmits an invalid MAC PDU. (Note 3) | <-- | MAC PDU | - | - |
| 8 | Check: Does the UE transmit a HARQ NACK for the DL MAC PDU in Step 7? | --> | HARQ NACK | 2,3 | P |
| 8A | In a PDCCH occasion before the *Drx-HARQ-RTT-TimerDL* for the MAC PDU indicated in Step 7 expires, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU with DRX MAC Control element. | <-- | MAC PDU(DRX MAC Control element) |  |  |
| 8B | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 2,3 | P |
| 9 | In a PDCCH occasion which is Z slots before the slot in which the *drx-RetransmissionTimerDL* for the DL MAC PDU in Step 7 expires, with 1 <Z< *drx-RetransmissionTimerDL*, the SS indicates the transmission of a DL MAC PDU. The SS transmits a DL MAC PDU with DRX MAC Control element. | <-- | MAC PDU(DRX MAC Control element) | - | - |
| 10 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 9? | --> | HARQ ACK | 2,3,1 | P |
| 11 | In the last PDCCH occasion when the *drx-RetransmissionTimerDL* for the DL MAC PDU indicated on the PDCCH in Step 7 is still running, the SS indicates the transmission of a DL MAC PDU. | <-- | MAC PDU | - | - |
| 12 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 11? | --> | HARQ ACK | 2,3 | P |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete.*  Note 3: Invalid MAC PDU is a MAC PDU that fails the CRC check.  Note 4: All DL MAC PDUs are transmitted with the NDI set on the PDCCH.  Note 5: Timer tolerances for the MAC DRX related timers measured in PDCCH occasions (slots). These timers are: *drx-InactivityTimer, drx-RetransmissionTimer, Drx-HARQ-RTT-TimerDL*.  Note 6: K is the time for given PDSCH to HARQ feedback of PUCCH and shall be shorter than drx-InactivityTimer. In this TC, the DCI format should be configured to not include the PDSCH-to-HARQ-timing-indicator field. When the UE schedules a PDSCH reception over a number of symbols where the last symbol is within slot n-k, the UE shall provide corresponding HARQ-ACK information in a PUCCH transmission within slot n-k+4 according to TS 38.321 clause 9.2.3. Thus, the maximum value of K is 4 slots in this test case.  Note 7: The SS assumes that the UE starts in long DRX after configuration. | | | | | |

7.1.1.5.4.3.3 Specific message contents

Table 7.1.1.5.4.3.3-1: *RRCReconfiguration* (Step 1, Table 7.1.1.5.4.3.2-1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | | | | | |
| Information Element | | Value/remark | | Comment | | Condition | |
| RRCReconfiguration ::= SEQUENCE { | |  | |  | |  | |
| criticalExtensions CHOICE { | |  | |  | |  | |
| rrcReconfiguration SEQUENCE { | |  | |  | |  | |
| radioBearerConfig | | Not present | |  | |  | |
| secondaryCellGroup | | CellGroupConfig | | OCTET STRING (CONTAINING CellGroupConfig) | | EN-DC | |
| nonCriticalExtension | | Not present | |  | | EN-DC | |
| nonCriticalExtension SEQUENCE{ | |  | |  | | NR | |
| masterCellGroup | | CellGroupConfig | | OCTET STRING (CONTAINING CellGroupConfig) | |  | |
| dedicatedNAS-MessageList | | Not present | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |

Table 7.1.1.5.4.3.3-2: *CellGroupConfig* (Table 7.1.1.5.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer | ms40 |  |  |
| drx-InactivityTimer | Ms10 |  |  |
| drx-HARQ-RTT-TimerDL | 56 |  |  |
| drx-HARQ-RTT-TimerUL | 56 |  |  |
| drx-RetransmissionTimerDL | Sl80 |  |  |
| drx-RetransmissionTimerUL | Sl80 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms640 | 7 |  |  |
| } |  |  |  |
| shortDRX SEQUENCE { |  |  |  |
| drx-ShortCycle | ms80 |  |  |
| drx-ShortCycleTimer | 7 |  |  |
| } |  |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.5.5 DRX operation / Short cycle configured / Long DRX command MAC control element reception

7.1.1.5.5.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { short DRX cycle is configured and a long DRX Command MAC control element is received }

**then** { UE successfully decodes the MAC control PDU }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Long DRX cycle and *drx-SlotOffset* is configured and [(SFN \* 10) + subframe number] modulo *drx-LongCycle*} = *drxStartOffset* }

**then** { UE starts the OnDurationTimer after *drx-SlotOffset* and monitors PDCCH for OnDurationTimer PDCCH-subframes }

}

7.1.1.5.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clause 5.7. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.7]

The MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, and TPC-SRS-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other clauses of this specification. When in RRC\_CONNECTED, if DRX is configured, for all the activated Serving Cells, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this clause; otherwise the MAC entity shall monitor the PDCCH as specified in TS 38.213 [6].

RRC controls DRX operation by configuring the following parameters:

- *drx-onDurationTimer*: the duration at the beginning of a DRX Cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process except for the broadcast process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycleStartOffset*: the Long DRX cycle and *drx-StartOffset* which defines the subframe where the Long and Short DRX Cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process except for the broadcast process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity.

When a DRX cycle is configured, the Active Time includes the time while:

- *drx-onDurationTimer* or *drx-InactivityTimer* or *drx-RetransmissionTimerDL* or *drx-RetransmissionTimerUL* or *ra-ContentionResolutionTimer* (as described in clause 5.1.5) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4); or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in clause 5.1.4).

When DRX is configured, the MAC entity shall:

1> if a MAC PDU is received in a configured downlink assignment:

2> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

1> if a MAC PDU is transmitted in a configured uplink grant:

2> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

2> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

1> if a *drx-HARQ-RTT-TimerDL* expires:

2> if the data of the corresponding HARQ process was not successfully decoded:

3> start the *drx-RetransmissionTimerDL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerDL*.

1> if a *drx-HARQ-RTT-TimerUL* expires:

2> start the *drx-RetransmissionTimerUL* for the corresponding HARQ process in the first symbol after the expiry of *drx-HARQ-RTT-TimerUL*.

1> if a DRX Command MAC CE or a Long DRX Command MAC CE is received:

2> stop *drx-onDurationTimer*;

2> stop *drx-InactivityTimer*.

1> if *drx-InactivityTimer* expires or a DRX Command MAC CE is received:

2> if the Short DRX cycle is configured:

3> start or restart *drx-ShortCycleTimer* in the first symbol after the expiry of *drx-InactivityTimer* or in the first symbol after the end of DRX Command MAC CE reception;

3> use the Short DRX Cycle.

2> else:

3> use the Long DRX cycle.

1> if *drx-ShortCycleTimer* expires:

2> use the Long DRX cycle.

1> if a Long DRX Command MAC CE is received:

2> stop *drx-ShortCycleTimer*;

2> use the Long DRX cycle.

1> if the Short DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-ShortCycle*) = (*drx-StartOffset*) modulo (*drx-ShortCycle*); or

1> if the Long DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe.

1> if the MAC entity is in Active Time:

2> monitor the PDCCH as specified in TS 38.213 [6];

2> if the PDCCH indicates a DL transmission:

3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

2> if the PDCCH indicates a UL transmission:

3> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

2> if the PDCCH indicates a new transmission (DL or UL):

3> start or restart *drx-InactivityTimer* in the first symbol after the end of the PDCCH reception.

1> in current symbol n, if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause:

2> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];

2> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH.

1> if CSI masking (*csi-Mask*) is setup by upper layers:

2> in current symbol n, if *drx-onDurationTimer* would not be running considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause:

3> not report CSI on PUCCH.

NOTE: If a UE multiplexes a CSI configured on PUCCH with other overlapping UCI(s) according to the procedure specified in TS 38.213 [6] subclause 9.2.5 and this CSI multiplexed with other UCI(s) would be reported on a PUCCH resource outside DRX Active Time, it is up to UE implementation whether to report this CSI multiplexed with other UCI(s).

Regardless of whether the MAC entity is monitoring PDCCH or not, the MAC entity transmits HARQ feedback, aperiodic CSI on PUSCH, and aperiodic SRS defined in TS 38.214 [7] when such is expected.

The MAC entity needs not to monitor the PDCCH if it is not a complete PDCCH occasion (e.g. the Active Time starts or ends in the middle of a PDCCH occasion).

7.1.1.5.5.3 Test Description

7.1.1.5.5.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.5.5.3.2 Test procedure sequence

For FDD, *NormalSLT*=(current SFN, current sub-frame, current slot, y)=y; For TDD, *NormalSLT*(current SFN, current slot, y) counts the minimum number of normal slots needed to cover y number of PDCCH-occasions (slots) until next PDCCH-occasion(slot) available, starting from current slot on current SFN.

Table 7.1.1.5.5.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits NR RRCReconfiguration message to configure specific DRX parameters for NR Cell. (Note 1) | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 2 | The UE transmits NR RRCReconfigurationComplete message. (Note 2) | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 3 | In a PDCCH occasion when the *drx-onDurationTimer* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits an valid MAC PDU. (Note 3) | <-- | MAC PDU | - | - |
| 4 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 3? | --> | HARQ ACK | 1 | P |
| 4A | Wait for the expiry of drx-InactivityTimer to ensure that UE starts the Short DRX Cycle. | - | - | - | - |
| 5 | In a PDCCH occasion before the *drx-onDurationTimer* expires, the SS indicates the transmission of a DL MAC PDU on the PDCCH. The SS transmits a DL MAC PDU with Long DRX MAC Control element. UE successfully decodes the MAC PDU. | <-- | MAC PDU (Long DRX MAC Control element) | - | - |
| 6 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 5? | --> | HARQ ACK | 1 | P |
| 7 | In the first PDCCH occasion, after the drx-SlotOffset when the drx-onDurationTimer is running according to [(SFN \* 10) + subframe number] modulo *drx-LongCycle*) = (*drx-StartOffset*) modulo (*drx-LongCycle*)), the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 8 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 7? | --> | HARQ ACK | 2 | P |
| 9 | At least drx-InactivityTimer PDCCH occasions after the transmission of the MAC PDU in Step 7 has been indicated (This means the next DRX cycle or later after Step 7) in the last PDCCH occasion while the drx-onDurationTimer is still running, the SS indicates the transmission a DL MAC PDU on the PDDCH. (Note 7) | <-- | MAC PDU | - | - |
| 10 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 9? | --> | HARQ ACK | 2 | P |
| Note 1: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 3: The SS assumes that the UE starts in long DRX after configuration.  Note 4: All DL MAC PDUs are transmitted with the NDI set on the PDCCH.  Note 5: Timer tolerances for the MAC DRX related timers measured in PDCCH occasions (slots). These timers are: *drx-InactivityTimer, drx-RetransmissionTimer, Drx-HARQ-RTT-TimerDL*.  Note 6: Void  Note 7: The drx-InactivityTimer is started in the next PDCCH occasion of the PDCCH occasion where DL new transmission is indicated. | | | | | |

7.1.1.5.5.3.3 Specific message contents

Table 7.1.1.5.5.3.3-1: *RRCReconfiguration* (Step 1, Table 7.1.1.5.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig with conditions SRB2 and DRB1 |  | NR |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig with condition SRB2\_DRB1 |  | NR |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.5.5.3.3-2: *CellGroupConfig* (Table 7.1.1.5.5.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer | ms40 |  |  |
| drx-InactivityTimer | ms10 |  |  |
| drx-HARQ-RTT-TimerDL | 56 |  |  |
| drx-HARQ-RTT-TimerUL | 56 |  |  |
| drx-RetransmissionTimerDL | sl80 |  |  |
| drx-RetransmissionTimerUL | sl80 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms640 | 7 |  |  |
| } |  |  |  |
| shortDRX SEQUENCE { |  |  |  |
| drx-ShortCycle | ms80 |  |  |
| drx-ShortCycleTimer | 7 |  |  |
| } |  |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 7.1.1.6 Semi-Persistent Scheduling

##### 7.1.1.6.1 Correct handling of DL assignment / Semi-persistent case

7.1.1.6.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in DL is enabled }

**ensure that** {

**when** { UE receives a DL assignment addressed to its stored CS-RNTI in slot y and with NDI set as 0 and PDCCH content indicates activation }

**then** { UE starts receiving DL MAC PDU in slots y+n\*[semiPersistSchedIntervalDL] where ‘n’ is positive integer starting at zero }

}

(2)

**with** { UE in RRC\_Connected state with DRB established and stored DL SPS assignment to receive MAC PDU in slot y+n\*[semiPersistSchedIntervalDL] }

**ensure that** {

**when** { UE receives a DL assignment addressed to its CS-RNTI in slot p and with NDI set as 0, where p!= y+n\*[semiPersistSchedIntervalDL] }

**then** { UE starts receiving DL MAC PDU in slots p+n\*[semiPersistSchedIntervalDL] and stops receiving DL MAC PDU at slots y+n\*[semiPersistSchedIntervalDL]where ‘n’ is positive integer starting at zero }

}

(3)

**with** { UE in RRC\_Connected state with DRB established and stored DL SPS assignment to receive MAC PDU at slot p+n\*[semiPersistSchedIntervalDL] }

**ensure that** {

**when** { UE receives a DL assignment [for retransmission] addressed to its CS-RNTI in Slot z and with NDI set as 1, where z!= p+n\*[semiPersistSchedIntervalDL] }

**then** { UE receives MAC PDU as per the retransmission grant for CS-RNTI }

}

(4)

**with** { UE in RRC\_Connected state with DRB established and stored DL SPS assignment to receive MAC PDU at slot y+n\*[semiPersistSchedIntervalDL] }

**ensure that** {

**when** { UE receives a DL assignment addressed to its C-RNTI in Slot p, such that p= y+n\*[semiPersistSchedIntervalDL] }

**then** { UE receives MAC PDU as per assignment addressed to its C-RNTI }

}

(5)

**with** { UE in RRC\_Connected state with DRB established and stored DL SPS grant to receive MAC PDU at slot z+n\*[semiPersistSchedIntervalDL] }

**ensure that** {

**when** { UE receives a RRC Message including sps-Configuration with sps-ConfigurationDL set as ‘disable’ and hence resulting in DL SPS grant deactivation }

**then** { UE deletes the stored sps-Configuration DL parameters and stops receiving DL MAC PDU’s as per stored SPS assignment in slot z+n\*[semiPersistSchedIntervalDL] }

}

(6)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in DL is enabled }

**ensure that** {

**when** { UE receives a DL assignment addressed to its stored CS-RNTI in slot p and with NDI set as 0 and PDCCH content indicates deactivation }

**then** {UE stops receiving DL MAC PDU’s as per stored SPS assignment }

}

7.1.1.6.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.321, clause 5.3.1, 5.8.1 TS 38.300, clause 10.2 and TS 38.213 clause 102. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.3.1]

Downlink assignments received on the PDCCH both indicate that there is a transmission on a DL-SCH for a particular MAC entity and provide the relevant HARQ information.

When the MAC entity has a C-RNTI, Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion during which it monitors PDCCH and for each Serving Cell:

1> if a downlink assignment for this PDCCH occasion and this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI, or Temporary C‑RNTI:

2> if this is the first downlink assignment for this Temporary C-RNTI:

3> consider the NDI to have been toggled.

2> if the downlink assignment is for the MAC entity's C-RNTI, and if the previous downlink assignment indicated to the HARQ entity of the same HARQ process was either a downlink assignment received for the MAC entity's CS-RNTI or a configured downlink assignment:

3> consider the NDI to have been toggled regardless of the value of the NDI.

2> indicate the presence of a downlink assignment and deliver the associated HARQ information to the HARQ entity.

1> else if a downlink assignment for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:

2> if the NDI in the received HARQ information is 1:

3> consider the NDI for the corresponding HARQ process not to have been toggled;

3> indicate the presence of a downlink assignment for this Serving Cell and deliver the associated HARQ information to the HARQ entity.

2> if the NDI in the received HARQ information is 0:

3> if PDCCH contents indicate SPS deactivation:

4> clear the configured downlink assignment for this Serving Cell (if any);

4> if the timeAlignmentTimer, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted,is running:

5> indicate a positive acknowledgement for the SPS deactivation to the physical layer.

3> else if PDCCH content indicates SPS activation:

4> store the downlink assignment for this Serving Cell and the associated HARQ information as configured downlink assignment;

4> initialise or re-initialise the configured downlink assignment for this Serving Cell to start in the associated PDSCH duration and to recur according to rules in subclause 5.8.1;

For each Serving Cell and each configured downlink assignment, if configured and activated, the MAC entity shall:

1> if the PDSCH duration of the configured downlink assignment does not overlap with the PDSCH duration of a downlink assignment received on the PDCCH for this Serving Cell:

2> instruct the physical layer to receive, in this PDSCH duration, transport block on the DL-SCH according to the configured downlink assignment and to deliver it to the HARQ entity;

2> set the HARQ Process ID to the HARQ Process ID associated with this PDSCH duration;

2> consider the NDI bit for the corresponding HARQ process to have been toggled;

2> indicate the presence of a configured downlink assignment and deliver the stored HARQ information to the HARQ entity.

For configured downlink assignments, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:

HARQ Process ID = [floor (CURRENT\_slot × 10 / (numberOfSlotsPerFrame ×*periodicity* ))] modulo nrofHARQ-Processes

where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].

When the MAC entity needs to read BCCH, the MAC entity may, based on the scheduling information from RRC:

1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the SI-RNTI;

2> indicate a downlink assignment and redundancy version for the dedicated broadcast HARQ process to the HARQ entity.

[TS 38.321, clause 5.8.1]

Semi-Persistent Scheduling (SPS) is configured by RRC per Serving Cell and per BWP. Activation and deactivation of the DL SPS are independent among the Serving Cells.

For the DL SPS, a DL assignment is provided by PDCCH, and stored or cleared based on L1 signalling indicating SPS activation or deactivation.

RRC configures the following parameters when SPS is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;

- *nrofHARQ-Processes*: the number of configured HARQ processes for SPS;

- *periodicity*: periodicity of configured downlink assignment for SPS.

When SPS is released by upper layers, all the corresponding configurations shall be released.

After a downlink assignment is configured for SPS, the MAC entity shall consider sequentially that the Nth downlink assignment occurs in the slot for which:

(*numberOfSlotsPerFrame* × SFN + slot number in the frame) =  
[(*numberOfSlotsPerFrame* × SFNstart time + slotstart time) + N × *periodicity* × *numberOfSlotsPerFrame* / 10] modulo (1024 × *numberOfSlotsPerFrame*)

where SFNstart time and slotstart time are the SFN and slot, respectively, of the first transmission of PDSCH where the configured downlink assignment was (re-)initialised.

[TS 38.300, clause 10.2]

In the downlink, the gNB can dynamically allocate resources to UEs via the C-RNTI on PDCCH(s). A UE always monitors the PDCCH(s) in order to find possible assignments when its downlink reception is enabled (activity governed by DRX when configured). When CA is configured, the same C-RNTI applies to all serving cells.

The gNB may pre-empt an ongoing PDSCH transmission to one UE with a latency-critical transmission to another UE. The gNB can configure UEs to monitor interrupted transmission indications using INT-RNTI on a PDCCH. If a UE receives the interrupted transmission indication, the UE may assume that no useful information to that UE was carried by the resource elements included in the indication, even if some of those resource elements were already scheduled to this UE.

In addition, with Semi-Persistent Scheduling (SPS), the gNB can allocate downlink resources for the initial HARQ transmissions to UEs: RRC defines the periodicity of the configured downlink assignments while PDCCH addressed to CS-RNTI can either signal and activate the configured downlink assignment, or deactivate it; i.e. a PDCCH addressed to CS-RNTI indicates that the downlink assignment can be implicitly reused according to the periodicity defined by RRC, until deactivated.

NOTE: when required, retransmissions are explicitly scheduled on PDCCH(s).

The dynamically allocated downlink reception overrides the configured downlink assignment in the same serving cell, if they overlap in time. Otherwise a downlink reception according to the configured downlink assignment is assumed, if activated.

When CA is configured, at most one configured downlink assignment can be signalled per serving cell. When BA is configured, at most one configured downlink assignment can be signalled per BWP. On each serving cell, there can be only one configured downlink assignment active at a time, and multiple configured downlink assignment can be simultaneously active on different serving cells only. Activation and deactivation of configured downlink assignments are independent among the serving cells.

[TS 38.213, clause 10.2]

A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or configured UL grant Type 2 PDCCH if

- the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and

- the new data indicator field for the enabled transport block is set to '0'.

Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.

If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.

Table 10.2-1: Special fields for DL SPS and UL grant Type 2 scheduling activation PDCCH validation

|  |  |  |  |
| --- | --- | --- | --- |
|  | DCI format 0\_0/0\_1 | DCI format 1\_0 | DCI format 1\_1 |
| HARQ process number | set to all '0's | set to all '0's | set to all '0's |
| Redundancy version | set to '00' | set to '00' | For the enabled transport block: set to '00' |

Table 10.2-2: Special fields for DL SPS and UL grant Type 2 scheduling release PDCCH validation

|  |  |  |
| --- | --- | --- |
|  | DCI format 0\_0 | DCI format 1\_0 |
| HARQ process number | set to all '0's | set to all '0's |
| Redundancy version | set to '00' | set to '00' |
| Modulation and coding scheme | set to all '1's | set to all '1's |
| Frequency domain resource assignment | set to all '1's | set to all '1's |

A UE is expected to provide HARQ-ACK information in response to a SPS PDSCH release after {} symbols from the last symbol of a PDCCH providing the SPS PDSCH release. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the PDCCH providing the SPS PDSCH release,  for ,  for , and  for , otherwise,  for ,  for ,  for , and  for , wherein  corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH providing the SPS PDSCH release and the SCS configuration of a PUCCH carrying the HARQ-ACK information in response to a SPS PDSCH release.

7.1.1.6.1.3 Test description

7.1.1.6.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.6.1.3.2 Test procedure sequence

Table 7.1.1.6.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0A | SS transmits NR *RRCReconfiguration* message to configure DL SPS. (Note 4) | <-- | (NR RRC: RRCReconfiguration) | - | - |
| 0B | The UE transmits NR *RRCReconfigurationComplete* message. (Note 5) | --> | (NR RRC: *RRCReconfigurationComplete*) | - | - |
| 1 | The SS transmits a DL assignment using UE’s CS-RNTI in Slot ‘Y’, NDI=0. | <-- | (DL SPS Grant) | - | - |
| 2 | The SS transmits in Slot ‘Y’, a DL MAC PDU containing a RLC PDU (DL-SQN=0) on UM DRB. | <-- | MAC PDU | - | - |
| 3 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 4 | The SS transmits in Slot ‘Y+X’, a DL MAC PDU containing a RLC PDU (DL-SQN=1) on DRB. (Note 1) | <-- | MAC PDU | - | - |
| 5 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 6 | The SS transmits a DL assignment using UE’s CS-RNTI in Slot ‘P’, NDI=0;  (Where Y+X<P<Y+2X) | <-- | (DL SPS Grant) | - | - |
| 7 | The SS transmits in Slot ‘P’, a DL MAC PDU containing a RLC PDU (DL-SQN=2) on UM DRB. | <-- | MAC PDU | - | - |
| 8 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 2 | P |
| 9 | The SS transmits in Slot ‘Y+2X’, a DL MAC PDU containing a RLC PDU (DL-SQN=3) on UM DRB. | <-- | MAC PDU | - | - |
| 10 | Check: Does the UE transmit a HARQ Feedback? | --> | HARQ ACK/NACK | 2 | F |
| - | EXCEPTION: Steps 11a1-11b2 describe behaviour that depends on UE configuration; the "lower case letter" identifies a step sequence that takes place depending on UE support of K0 greater than 0 for PDSCH mapping type A. | - | - | - | - |
| 11a1 | IF pc\_dl\_SchedulingOffset\_PDSCH\_TypeA THEN the SS transmits a DL assignment using UE’s C-RNTI in Slot ‘P+X-4’, NDI=0, where TDRA indicates the 2nd entry in pdsch-TimeDomainAllocationList (K0=4), and K1=8. | <-- | (DL Grant) | - | - |
| 11a2 | The SS transmits in Slot ‘P+X’, a DL MAC PDU containing a RLC PDU (DL-SQN=3) on UM DRB. (Note 2) | <-- | MAC PDU | - | - |
| 11a3 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 4 | P |
| 11b1 | IF NOT pc\_dl\_SchedulingOffset\_PDSCH\_TypeA THEN the SS transmits in Slot ‘P+X’, a DL MAC PDU containing a RLC PDU (DL-SQN=3) on UM DRB. | <-- | MAC PDU | - | - |
| 11b2 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 12-13 | Void | - | - | - | - |
| 14 | The SS transmits in Slot ‘P+2X’, a DL MAC PDU containing a RLC PDU (DL-SQN=4) on UM DRB. | <-- | MAC PDU | - | - |
| 15 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 16 | The SS transmits a DL assignment using UE’s CS-RNTI in Slot ‘P+3X’, NDI=0. | <-- | (DL SPS Grant) | - | - |
| 17 | The SS transmits in Slot ‘P+3X’, a DL MAC PDU containing 1 RLC PDU’s (DL-SQN=5) on UM DRB; CRC is calculated in such a way will result in CRC error in UE. | <-- | MAC PDU | - | - |
| 18 | Check: Does the UE transmit a HARQ NACK? | --> | HARQ NACK | - | - |
| - | EXCEPTION: Step 19 and 20 shall be repeated until HARQ retransmission count = 3 is reached for MAC PDU at step 17.(Note 3) | - | - | - | - |
| 19 | The SS transmits a DL assignment using UE’s CS-RNTI in Slot ‘Z’, NDI=1;  Where (P+3X < Z <P+4X); The DL HARQ process is same as in step 18. | <-- | (DL SPS Grant) | - | - |
| 20 | The SS re-transmits in Slot ‘Z’, a DL MAC PDU containing a RLC PDU (DL-SQN=5) on UM DRB. | <-- | MAC PDU | - | - |
| - | EXCEPTION: Up to 3 HARQ NACK from the UE should be allowed at step 21(Note 3). | - | - | - | - |
| 21 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 3 | P |
| 22 | The SS Transmits a PDCCH [for DL SPS deactivation] using UE’s CS-RNTI in slot ‘Q’, NDI=0; Where (P+3X< Q <P+4X). | <-- | PDCCH [for DL SPS explicit release] | - | - |
| 23 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 6 | P |
| 24 | The SS transmits in Slot ‘P+5X’, a DL MAC PDU containing 1 RLC PDU’s (DL-SQN=6)on UM DRB; | <-- | MAC PDU | - | - |
| 25 | Check: Does the UE transmit a HARQ Feedback? | --> | HARQ ACK/NACK | 6 | F |
| 26 | The SS Transmits a DL assignment using UE’s CS-RNTI in SF-Num ‘P+6X’, NDI=0 | <-- | (DL SPS Grant) | - | - |
| 27 | The SS transmits in SF-Num ‘P+6X’, a DL MAC PDU containing a RLC PDU (DL-SQN=6)on UM DRB | <-- | MAC PDU | - | - |
| 28 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 29 | SS transmits *NR* RRCReconfiguration to disable SPS-ConfigurationDL.(Note 4) | <-- | RRCReconfiguration | - | - |
| 30 | The UE transmits NR RRCReconfigurationComplete.(Note5) | --> | RRCReconfigurationComplete | - | - |
| 31 | The SS transmits in Slot ‘P+5X’, a DL MAC PDU containing 1 RLC PDU’s (DL-SQN=7) on UM DRB; | <-- | MAC PDU | - | - |
| 32 | Check: Does the UE transmit a HARQ Feedback? | --> | HARQ ACK/NACK | 5 | F |
| Note 1: X is equal to semiPersistSchedIntervalDL in this document.  Note 2: The DL assignment for C-RNTI and hence the size of MAC PDU is different in size than stored CS-RNTI DL assignment in step 6. This assures UE is receiving DSCH data as per DL assignment for C-RNTI and not as per stored grant for CS-RNTI.  Note 3: The value 4 for the maximum number of HARQ retransmissions has been chosen based on an assumption that, given the radio conditions used in this test case, a UE soft combiner implementation should have sufficient retransmissions to be able to successfully decode the data in its soft buffer.  Note 4: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 5: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete.*  Note 6: As per TS 38.508-1[4], the default value for PDSCH slot offset (K0) is 0, hence the DL MAC PDU’s associated with DL SPS grant in Slot X are sent in same slot X. | | | | | |

7.1.1.6.1.3.3 Specific message contents

Table 7.1.1.6.1.3.3-1: *RRCReconfiguration* (Step 0A, Table 7.1.1.6.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) | EN-DC |
|  | Not present |  | NR |
| nonCriticalExtension | Not present |  | EN-DC |
| nonCriticalExtension SEQUENCE{ |  |  | NR |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-2: *CellGroupConfig* (Table 7.1.1.6.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { | |  |  |  |
| spCellConfig SEQUENCE { | |  |  |  |
| servCellIndex | | 1 |  |  |
|  | | Not present |  | NR |
| reconfigurationWithSync SEQUENCE { | |  |  | EN-DC AND pc\_dl\_SchedulingOffset\_PDSCH\_TypeA |
| spCellConfigCommon | | ServingCellConfigCommon |  |  |
| } | |  |  |  |
| spCellConfigDedicated SEQUENCE { | |  |  |  |
| initialDownlinkBWP SEQUENCE { | |  |  |  |
| sps-Config CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| periodicity | | ms80 |  |  |
| nrofHARQ-Processes | | 8 |  |  |
| n1PUCCH-AN SEQUENCE { | |  |  |  |
| pucch-ResourceId | | 6 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| physicalCellGroupConfig SEQUENCE { | |  |  |  |
| cs-RNTI CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| RNTI-Value | | ‘FFE0’H |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.6.1.3.3-2A: *ServingCellConfigCommon* (Table 7.1.1.6.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168: | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| downlinkConfigCommon | DownlinkConfigCommon |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-2B: *DownlinkConfigCommon* (Table 7.1.1.6.1.3.3-2A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-52: | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| DownlinkConfigCommon ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP | BWP-DownlinkCommon | Table 7.1.1.6.1.3.3-5C |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-3: *RRCReconfiguration* (step 29, Table 7.1.1.6.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) | EN-DC |
|  | Not present |  | NR |
| nonCriticalExtension | Not present |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-4: *CellGroupConfig* (Table 7.1.1.6.1.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { | |  |  |  |
| spCellConfig SEQUENCE { | |  |  |  |
| servCellIndex | | 1 |  |  |
|  | | Not present |  | NR |
| spCellConfigDedicated SEQUENCE { | |  |  |  |
| initialDownlinkBWP SEQUENCE { | |  |  |  |
| sps-Config CHOICE { | |  |  |  |
| release | | Null |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.6.1.3.3-5: *SIB1* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| servingCellConfigCommon | | ServingCellConfigCommonSIB |  | pc\_dl\_SchedulingOffset\_PDSCH\_TypeA |
| } | |  |  |  |

Table 7.1.1.6.1.3.3-5A: *ServingCellConfigCommonSIB* (Table 7.1.1.6.1.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-169 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| downlinkConfigCommon | DownlinkConfigCommonSIB |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-5B: *DownlinkConfigCommonSIB* (Table 7.1.1.6.1.3.3-5A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-53 | | | |
| Information Element | Value/remark | Comment | Condition |
| DownlinkConfigCommonSIB ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP | BWP-DownlinkCommon |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-5C: *BWP-DownlinkCommon* (Tables 7.1.1.6.1.3.3-2B and 7.1.1.6.1.3.3-5B)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-10 with condition InitialBWP\_SIB | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-DownlinkCommon ::= SEQUENCE { |  |  |  |
| pdsch-ConfigCommon CHOICE { |  |  |  |
| setup | PDSCH-ConfigCommon |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-5D: *PDSCH-ConfigCommon* (Table 7.1.1.6.1.3.3-5C)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-101 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| pdsch-TimeDomainAllocationList | PDSCH-TimeDomainResourceAllocationList |  |  |
| } |  |  |  |

Table 7.1.1.6.1.3.3-5E: *PDSCH-TimeDomainResourceAllocationList* (Table 7.1.1.6.1.3.3-5D)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation { | 2 entries |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k0 | 0 |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| k0 | 4 |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | S=2, L=12 |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.6.2 Correct handling of UL grant / configured grant Type 1

7.1.1.6.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in UL is enabled with Configured grant type 1 }

**ensure that** {

**when** { The symbol in which equation [(SFN × numberOfSlotsPerFrame × numberOfSymbolsPerSlot) + (slot number in the frame × numberOfSymbolsPerSlot) + symbol number in the slot] =

(timeDomainOffset × numberOfSymbolsPerSlot + S + N × periodicity) modulo (1024 × numberOfSlotsPerFrame × numberOfSymbolsPerSlot)is satisfied }

**then** { UE starts transmitting UL MAC PDU periodically in the symbol associated with the new re-configured grant }

}

(2)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 1 }

**ensure that** {

**when** { UE receives a new UL grant type 1 in an RRC message }

**then** { UE starts transmitting UL MAC PDU periodically in the symbol associated with the new re-configured grant }

}

(3)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 1 }

**ensure that** {

**when** { UE receives a RRC message including sps-Configuration with rrcConfiguredUplinkGrant set as ‘release’ }

**then** { UE deletes the stored configured UL Grant type 1 parameters and stops transmitting UL MAC PDU’s as per configured UL grant type 1 }

}

(4)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 1 }

**ensure that** {

**when** { UE receives a UL grant addressed to its CS-RNTI with NDI set as 1 for retransmission }

**then** { UE re-transmits MAC PDU as per the new grant }

}

(5)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 1 }

**ensure that** {

**when** { UE receives a UL grant addressed to its C-RNTI resulting in UL transmission overlap in time domain as configured grante type 1 }

**then** { UE transmits MAC PDU as per grant addressed to its C-RNTI }

}

7.1.1.6.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321 clauses 5.4.1 and 5.8.2, 3GPP TS 38.300 clause 10.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.4.1]

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, or configured semi-persistently by RRC. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or

1> if an uplink grant has been received in a Random Access Response:

2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:

3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.

2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:

3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

2> deliver the uplink grant and the associated HARQ information to the HARQ entity.

1> else if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:

2> if the NDI in the received HARQ information is 1:

3> consider the NDI for the corresponding HARQ process not to have been toggled;

3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured;

3> deliver the uplink grant and the associated HARQ information to the HARQ entity.

2> else if the NDI in the received HARQ information is 0:

3> if PDCCH contents indicate configured grant Type 2 deactivation:

4> trigger configured uplink grant confirmation.

3> else if PDCCH contents indicate configured grant Type 2 activation:

4> trigger configured uplink grant confirmation;

4> store the uplink grant for this Serving Cell and the associated HARQ information as configured uplink grant;

4> initialise or re-initialise the configured uplink grant for this Serving Cell to start in the associated PUSCH duration and to recur according to rules in subclause 5.8.2;

4> stop the *configuredGrantTimer* for the corresponding HARQ process, if running;

For each Serving Cell and each configured uplink grant, if configured and activated, the MAC entity shall:

1> if the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received on the PDCCH or in a Random Access Response for this Serving Cell:

2> set the HARQ Process ID to the HARQ Process ID associated with this PUSCH duration;

2> if the *configuredGrantTimer* for the corresponding HARQ process is not running:

3> consider the NDI bit for the corresponding HARQ process to have been toggled;

3> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

For configured uplink grants, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

HARQ Process ID = [floor(CURRENT\_symbol/*periodicity*)] modulo *nrofHARQ-Processes*

where CURRENT\_symbol=(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slot number in the frame × *numberOfSymbolsPerSlot* + symbol number in the slot), and *numberOfSlotsPerFrame* and *numberOfSymbolsPerSlot* refer to the number of consecutive slots per frame and the number of consecutive symbols per slot, respectively as specified in TS 38.211 [8].

NOTE 1: CURRENT\_symbol refers to the symbol index of the first transmission occasion of a repetition bundle that takes place.

NOTE 2: A HARQ process is configured for a configured uplink grant if the configured uplink grant is activated and the associated HARQ process ID is less than *nrofHARQ-Processes*.

NOTE 3: If the MAC entity receives both a grant in a Random Access Response and an overlapping grant for its C-RNTI or CS-RNTI, requiring concurrent transmissions on the SpCell, the MAC entity may choose to continue with either the grant for its RA-RNTI or the grant for its C-RNTI or CS-RNTI.

[TS 38.321, clause 5.8.2]

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant;

- configured grant Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signalling indicating configured uplink grant activation or deactivation.

Type 1 and Type 2 are configured by RRC per Serving Cell and per BWP. Multiple configurations can be active simultaneously only on different Serving Cells. For Type 2, activation and deactivation are independent among the Serving Cells. For the same Serving Cell, the MAC entity is configured with either Type 1 or Type 2.

RRC configures the following parameters when the configured grant Type 1 is configured:

- *cs-RNTI*: CS-RNTI for retransmission;

- *periodicity*: periodicity of the configured grant Type 1;

- *timeDomainOffset*: Offset of a resource with respect to SFN=0 in time domain;

- *timeDomainAllocation*: Allocation of configured uplink grant in time domain which contains *startSymbolAndLength* (i.e. *SLIV* in TS 38.214 [7]);

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant.

RRC configures the following parameters when the configured grant Type 2 is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;

- *periodicity*: periodicity of the configured grant Type 2;

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant.

Upon configuration of a configured grant Type 1 for a Serving Cell by upper layers, the MAC entity shall:

1> store the uplink grant provided by upper layers as a configured uplink grant for the indicated Serving Cell;

1> initialise or re-initialise the configured uplink grant to start in the symbol according to *timeDomainOffset* and *S* (derived from *SLIV* as specified in TS 38.214 [7]), and to reoccur with *periodicity*.

After an uplink grant is configured for a configured grant Type 1, the MAC entity shall consider that the uplink grant recurs associated with each symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
 (*timeDomainOffset* × *numberOfSymbolsPerSlot* + *S* + N × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*), for all N >= 0.

After an uplink grant is configured for a configured grant Type 2, the MAC entity shall consider that the uplink grant recurs associated with each symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
[(SFNstart time × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slotstart time × *numberOfSymbolsPerSlot* + symbolstart time) + N × *periodicity*] modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*), for all N >= 0.

where SFNstart time, slotstart time, and symbolstart time are the SFN, slot, and symbol, respectively, of the first transmission opportunity of PUSCH where the configured uplink grant was (re-)initialised.

When a configured uplink grant is released by upper layers, all the corresponding configurations shall be released and all corresponding uplink grants shall be cleared.

The MAC entity shall:

1> if the configured uplink grant confirmation has been triggered and not cancelled; and

1> if the MAC entity has UL resources allocated for new transmission:

2> instruct the Multiplexing and Assembly procedure to generate an Configured Grant Confirmation MAC CE as defined in subclause 6.1.3.7;

2> cancel the triggered configured uplink grant confirmation.

For a configured grant Type 2, the MAC entity shall clear the configured uplink grant immediately after first transmission of Configured Grant Confirmation MAC CE triggered by the configured uplink grant deactivation.

Retransmissions except for repetition of configured uplink grants use uplink grants addressed to CS-RNTI.

[TS 38.300, clause 10.3]

In the uplink, the gNB can dynamically allocate resources to UEs via the C-RNTI on PDCCH(s). A UE always monitors the PDCCH(s) in order to find possible grants for uplink transmission when its downlink reception is enabled (activity governed by DRX when configured). When CA is configured, the same C-RNTI applies to all serving cells.

In addition, with Configured Grants, the gNB can allocate uplink resources for the initial HARQ transmissions to UEs. Two types of configured uplink grants are defined:

- With Type 1, RRC directly provides the configured uplink grant (including the periodicity).

- With Type 2, RRC defines the periodicity of the configured uplink grant while PDCCH addressed to CS-RNTI can either signal and activate the configured uplink grant, or deactivate it; i.e. a PDCCH addressed to CS-RNTI indicates that the uplink grant can be implicitly reused according to the periodicity defined by RRC, until deactivated.

The dynamically allocated uplink transmission overrides the configured uplink grant in the same serving cell, if they overlap in time. Otherwise an uplink transmission according to the configured uplink grant is assumed, if activated.

Retransmissions other than repetitions are explicitly allocated via PDCCH(s).

When CA is configured, at most one configured uplink grant can be signalled per serving cell. When BA is configured, at most one configured uplink grant can be signalled per BWP. On each serving cell, there can be only one configured uplink grant active at a time. A configured uplink grant for one serving cell can either be of Type 1 or Type 2. For Type 2, activation and deactivation of configured uplink grants are independent among the serving cells. When SUL is configured, a configured uplink grant can only be signalled for one of the 2 ULs of the cell.

7.1.1.6.2.3 Test description

7.1.1.6.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 and UM DRB should be established on NR Cell 1 and UM DRB/SRB1 are configured according to Table 7.1.1.6.2.3.1-1 if pc\_lcp\_Restriction = True.

Table 7.1.1.6.2.3.1-1: configuredGrantType1Allowed settings for pc\_lcp\_Restriction = True

|  |  |
| --- | --- |
| RB | configuredGrantType1Allowed |
| SRB1 | true |
| UM DRB | true |

7.1.1.6.2.3.2 Test procedure sequence

Table 7.1.1.6.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits NR *RRCReconfiguration* messageto configure UL configured grant type 1 in SFN 900, *timeDomainOffset* is set to 9. (Note 1) | <-- | (NR RRC: *RRCReconfiguration*) | - | - |
| 2 | The UE transmits NR *RRCReconfigurationComplete* message. (Note 2) | --> | (NR RRC: *RRCReconfigurationComplete*) | - | - |
| 3 | SS transmits a DL MAC PDU containing 2 RLC SDUs of size 99 bytes in SFN 1022 on UM DRB. (Note 3) | <-- | MAC PDU (two RLC SDUs) | - | - |
| 4 | Check: Does the UE transmit a MAC PDU containing first RLC SDU in Symbol ‘x0’, Slot y0’, SFN ‘z0’ after the SFN in step 3 wraps around?  Where  [(z0 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y0 × *numberOfSymbolsPerSlot*) + x0] = (9 × *numberOfSymbolsPerSlo*t + S + 0 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). (Note 4) | --> | MAC PDU (one RLC SDU) | 1 | P |
| 5 | Check: Does the UE transmit a MAC PDU containing second RLC SDU in Symbol ‘x1’, Slot y1’, SFN ‘z1’?  Where  [(z1 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y1 × *numberOfSymbolsPerSlot*) + x1] = (9 × *numberOfSymbolsPerSlo*t + S + 1 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 1 | P |
| 6 | SS transmits NR *RRCReconfiguration* message to configure UL configured grant type 1, *timeDomainOffset* is set to 19. (Note 1) | <-- | (NR RRC: *RRCReconfiguration)* | - | - |
| 7 | The UE transmits NR *RRCReconfigurationComplete* message. (Note 2) | --> | *(*NR RRC: *RRCReconfigurationComplete)* | - | - |
| 7A | SS transmits a DL MAC PDU containing 5 RLC SDUs of size 99 bytes in SFN 1022 on UM DRB. (Note 3) | <-- | MAC PDU (five RLC SDUs) | - | - |
| 8 | Check: Does the UE transmit a MAC PDU containing first RLC SDU received in step 7A in Symbol ‘x2’, Slot y2’, SFN ‘z2’?  Where  [(z2 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y2 × *numberOfSymbolsPerSlot*) + x2] = (9 × *numberOfSymbolsPerSlo*t + S + 0 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*), | --> | MAC PDU (one RLC SDU) | 2 | F |
| 9 | Check: Does the UE transmit a MAC PDU containing first RLC SDU in Symbol ‘x3’, Slot y3’, SFN ‘z3’ after the SFN in step 7A wraps around?  Where  [(z3 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y3 × *numberOfSymbolsPerSlot*) + x3] = (19 × *numberOfSymbolsPerSlo*t + S + 0 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 2 | P |
| 10 | Check: Does the UE transmit a MAC PDU containing second RLC SDU in Symbol ‘x4’, Slot y4’, SFN ‘z4’?  Where  [(z4 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y4 × *numberOfSymbolsPerSlot*) + x4] = (19 × *numberOfSymbolsPerSlo*t + S + 1 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 2 | P |
| 11 | SS transmits a UL grant addressed to UE’s stored CS-RNTI with NDI set as 1 in Slot ‘p0’of PDCCH (p0 = floor ((y4 +2) \* (PDCCHSCS / PUSCHSCS))), allowing the UE to retransmit one loop back SDU. | <-- | (UL Grant) | - | - |
| 12 | Check: Does the UE retransmit the MAC PDU containing the same second RLC SDU as in step 10 in Symbol ‘S’ of Slot ‘q’ of PUSCH?  i.e., in the PUSCH slot q = floor (p0 \* (PUSCHSCS / PDCCHSCS)) + K2. (Note 5) | --> | MAC PDU (one RLC SDU) | 4 | P |
| 13 | Check: Does the UE transmit a MAC PDU containing third RLC SDU in Symbol ‘x5’, Slot y5’, SFN ‘z5’?  Where  [(z5 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y5 × *numberOfSymbolsPerSlot*) + x5] = (19 × *numberOfSymbolsPerSlo*t + S + 2 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 1 | P |
| 14 | SS transmits a UL Grant using UE’s C-RNTI in in Slot ‘p1’ of PDCCH allowing UE to transmit a MAC PDU containing one RLC SDU, where p1 = floor ((z6 × *numberOfSlotsPerFrame* - K2) \* (PDCCHSCS / PUSCHSCS)). (Note 6)  Where  [(z6 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y6 × *numberOfSymbolsPerSlot*) + x6] = (19 × *numberOfSymbolsPerSlo*t + S + 3 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | <-- | (UL Grant) | - | - |
| 15 | Check: Does the UE transmit a MAC PDU containing fourth RLC SDU in Symbol ‘x6’, Slot y6’, SFN ‘z6’? | --> | MAC PDU (one RLC SDU) | 5 | P |
| 16 | Check: Does the UE transmit a MAC PDU containing fifth RLC SDU in Symbol ‘x7’, Slot y7’, SFN ‘z7’?  Where  [(z7 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y7 × *numberOfSymbolsPerSlot*) + x7] = (19 × *numberOfSymbolsPerSlo*t + S + 4 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 1 | P |
| 17 | After step 16, SS transmits NR *RRCReconfiguration* message to release UL configured grant type 1*. (Note 1)* | <-- | (NR RRC: *RRCReconfiguration* | - | - |
| 18 | The UE transmits NR *RRCReconfigurationComplete* message*. (Note 2)* | --> | (NR RRC: *RRCReconfigurationComplete* | - | - |
| 19 | SS transmits a DL MAC PDU containing one RLC SDU of size 99 bytes. | <-- | MAC PDU (one RLC SDU) | - | - |
| 20 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘x8’, Slot y8’, SFN ‘z8’?  Where  [(z8 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y8 × *numberOfSymbolsPerSlot*) + x8] = (19 × *numberOfSymbolsPerSlo*t + S + N × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 3 | F |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete.*  Note 3: According to the setting parameters in Table 7.1.1.6.2.3.3-2, TB size for configured grant type 1 is 848 bits, which is enough to allow the UE to transmit one PDU at a time (99 bytes RLC SDU + 1 byte UM RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding).  Note 4: S is the starting symbol relative to the slot of the first PUSCH transmission for new configured grant type 1. The value of S can be obtained from TS 38.508-1 [4], Table 4.6.3-122.  Note 5: q is the slot where the UE shall transmit the PUSCH and is determined by  as  where  is the slot with the scheduling DCI,  is based on the numerology of PUSCH. S is the starting symbol relatived to the start of the slot q according to TS 38.214 clause 6.1.2.1.  Note 6: The UL grant addressed to C-RNTI should result in UL transmission overlap in time domain as configured grant type 1. | | | | | |

7.1.1.6.2.3.3 Specific message contents

Table 7.1.1.6.2.3.3-1: *RRCReconfiguration* (step 1 and step 6, Table 7.1.1.6.2.3.2-1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | | | | |
| Information Element | | Value/remark | | Comment | Condition | |
| RRCReconfiguration ::= SEQUENCE { | |  | |  |  | |
| criticalExtensions CHOICE { | |  | |  |  | |
| rrcReconfiguration SEQUENCE { | |  | |  |  | |
| radioBearerConfig | | Not present | |  |  | |
| secondaryCellGroup | | CellGroupConfig | | OCTET STRING (CONTAINING CellGroupConfig) | EN-DC | |
|  | | Not Present | |  | NR | |
| nonCriticalExtension | | Not present | |  | | EN-DC |
| nonCriticalExtension SEQUENCE{ | |  | |  | NR | |
| masterCellGroup | | CellGroupConfig | | OCTET STRING (CONTAINING CellGroupConfig) |  | |
| dedicatedNAS-MessageList | | Not present | |  |  | |
| } | |  | |  |  | |
| } | |  | |  |  | |
| } | |  | |  |  | |
| } | |  | |  |  | |

Table 7.1.1.6.2.3.3-2: *CellGroupConfig* (Table 7.1.1.6.2.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList | Not present |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig SEQUENCE { |  |  |  |
| cs-RNTI CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| RNTI-Value | ‘FFE0’H |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | Not present |  | NR |
|  | 1 |  | EN-DC |
| reconfigurationWithSync | Not present |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| pucch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| schedulingRequestResourceToAddModList SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig { | 1 entry |  |  |
| SchedulingRequestResourceConfig[1] SEQUENCE { |  | entry 1 |  |
| schedulingRequestResourceId | 1 |  |  |
| schedulingRequestID | 0 |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl20 | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| configuredGrantConfig CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| cg-DMRS-Configuration | DMRS-UplinkConfig | Reference TS 38.508-1[4], Table 4.6.3-51 |  |
| uci-OnPUSCH CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| semiStatic SEQUENCE { | BetaOffsets |  |  |
| betaOffsetACK-Index1 | 9 |  |  |
| betaOffsetACK-Index2 | 9 |  |  |
| betaOffsetACK-Index3 | 9 |  |  |
| betaOffsetCSI-Part1-Index1 | 6 |  |  |
| betaOffsetCSI-Part1-Index2 | 6 |  |  |
| betaOffsetCSI-Part2-Index1 | 6 |  |  |
| betaOffsetCSI-Part2-Index2 | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| resourceAllocation | ResourceAllocationType1 |  |  |
| powerControlLoopToUse | n0 |  |  |
| p0-PUSCH-Alpha | 1 |  |  |
| nrofHARQ-Processes | 16 |  |  |
| repK | n1 |  |  |
| periodicity | Sym40x14 |  | 15kHz |
| periodicity | Sym80x14 |  | 30kHz |
| periodicity | Sym160x14 |  | 60kHz |
| periodicity | Sym320x14 |  | 120kHz |
| rrc-ConfiguredUplinkGrant SEQUENCE { |  |  |  |
| timeDomainOffset | 9 |  | For Step 1 |
| 19 |  | For Step 6 |
| timeDomainAllocation | 0 | Reference TS 38.508-1 [4], Table 4.6.3-122 |  |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | BIT STRING (SIZE(18), Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB = 2 PRB,  RBstart = 0,  NBWPsize is the size [PRBs] of the active carrier bandwidth part and ontained in TS.38.508-1 [4] clause 4.3.1.1. | FR1\_FDD, FR1\_TDD |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | BIT STRING (SIZE(18), Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB=9 PRB,  RBstart = 0and  NBWPsize is the size [PRBs] of the active carrier bandwidth part and ontained in TS.38.508-1 [4] clause 4.3.1.2. | FR2\_TDD |
| antennaPort | 0 |  |  |
| precodingAndNumberOfLayers | 0 |  |  |
| srs-ResourceIndicator | Not present |  |  |
| mcsAndTBS | 18 |  | FR1\_FDD, FR1\_TDD |
| 25 |  | FR2\_TDD |
| pathlossReferenceIndex | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| pusch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| pusch-TimeDomainAllocationList CHOICE { |  |  |  |
| setup SEQUENCE { | 1 entry |  |  |
| PUSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k2 | n4 |  | FR1 |
|  | n8 |  | FR2 |
| mappingType | typeB |  |  |
| startSymbolAndLength | 0011011 | Start symbol(S)=0, Length(L)=14 | FR1 |
| startSymbolAndLength | 0001110 | S=0, L=2 | FR2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.2.3.3-3: *RRCReconfiguration* (step 17, Table 7.1.1.6.2.3.2-1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | | | | |
| Information Element | | Value/remark | | Comment | Condition | |
| RRCReconfiguration ::= SEQUENCE { | |  | |  |  | |
| criticalExtensions CHOICE { | |  | |  |  | |
| rrcReconfiguration SEQUENCE { | |  | |  |  | |
| radioBearerConfig | Not present | | |  |  | |
| secondaryCellGroup | CellGroupConfig | | | OCTET STRING (CONTAINING CellGroupConfig) | EN-DC | |
|  | Not present | | |  | NR | |
| nonCriticalExtension | | Not present | |  | | EN-DC |
| nonCriticalExtension SEQUENCE { |  | | |  | NR | |
| masterCellGroup | CellGroupConfig | | | OCTET STRING (CONTAINING CellGroupConfig) |  | |
| dedicatedNAS-MessageList | Not present | | |  |  | |
| } |  | | |  |  | |
| } | |  | |  |  | |
| } | |  | |  |  | |
| } | |  | |  |  | |

Table 7.1.1.6.2.3.3-4: *CellGroupConfig* (Table 7.1.1.6.2.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| configuredGrantConfig CHOICE { |  |  |  |
| release | Null |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.6.3 Correct handling of UL grant / configured grant Type 2

7.1.1.6.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in UL is enabled }

**ensure that** {

**when** { UE receives an UL configured grant type 2 addressed to its stored CS-RNTI with NDI set as 0 and PDCCH content indicates SPS activation }

**then** { UE starts transmitting UL MAC PDU periodically in the symbol associated with the configured grant }

}

(2)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 2 }

**ensure that** {

**when** {UE receives a UL grant addressed to its CS-RNTI with NDI set as 0 }

**then** { UE starts transmitting UL MAC PDU periodically in the symbol associated with the new re-configured grant }

}

(3)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 2 }

**ensure that** {

**when** { UE receives a UL grant addressed to its CS-RNTI with NDI set as 1 for retransmission }

**then** { UE re-transmits MAC PDU as per the new grant }

}

(4)

**with**{ UE in RRC\_Connected state with DRB established and configured UL grant type 2 }

**ensure that** {

**when** { UE receives a UL grant addressed to its C-RNTI resulting in UL transmission overlap in time domain as configured grante type 2 }

**then** { UE transmits MAC PDU as per grant addressed to its C-RNTI }

}

(5)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 2 }

**ensure that** {

**when** {UE receives a RRC message including sps-Configuration with sps-ConfigurationUL set as ‘disable’ and hence resulting in UL SPS grant deactivation }

**then** { UE deletes the stored sps-Configuration UL parameters and stops transmitting UL MAC PDU’s as per configured UL grant type 2 }

}

(6)

**with**{ UE in RRC\_Connected state with DRB established and configured UL grant type 2 }

**ensure that** {

**when**{ If in the symbol in which UL Configured Grant type 2 is available but the HARQ buffer is empty (no data for transmission) }

**then**{ UE ignores the UL configured grant type 2 and does not send any MAC PDU }

}

(7)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in UL is enabled }

**ensure that** {

**when** { UE receives UL configured grant type 2 addressed to its stored CS-RNTI in slot p and with NDI set as 0 and PDCCH content indicates SPS deactivation }

**then** {UEtransmits configured Grant Confirmation MAC CE confirming the deactivation and stops transmitting UL MAC PDU’s as per configured UL grant type 2}

}

7.1.1.6.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321 clauses 5.4.1 and 5.8.2, 3GPP TS 38.300 clauses 10.3 and TS 38.213 clause 102. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.4.1]

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, or configured semi-persistently by RRC. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or

1> if an uplink grant has been received in a Random Access Response:

2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:

3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.

2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:

3> start or restart the *configuredGrantTimer* for the correponding HARQ process, if configured.

2> deliver the uplink grant and the associated HARQ information to the HARQ entity.

1> else if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:

2> if the NDI in the received HARQ information is 1:

3> consider the NDI for the corresponding HARQ process not to have been toggled;

3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured;

3> deliver the uplink grant and the associated HARQ information to the HARQ entity.

2> else if the NDI in the received HARQ information is 0:

3> if PDCCH contents indicate configured grant Type 2 deactivation:

4> trigger configured uplink grant confirmation.

3> else if PDCCH contents indicate configured grant Type 2 activation:

4> trigger configured uplink grant confirmation;

4> store the uplink grant for this Serving Cell and the associated HARQ information as configured uplink grant;

4> initialise or re-initialise the configured uplink grant for this Serving Cell to start in the associated PUSCH duration and to recur according to rules in subclause 5.8.2;

4> stop the *configuredGrantTimer* for the corresponding HARQ process, if running;

For each Serving Cell and each configured uplink grant, if configured and activated, the MAC entity shall:

1> if the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received on the PDCCH or in a Random Access Response for this Serving Cell:

2> set the HARQ Process ID to the HARQ Process ID associated with this PUSCH duration;

2> if the *configuredGrantTimer* for the corresponding HARQ process is not running:

3> consider the NDI bit for the corresponding HARQ process to have been toggled;

3> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

For configured uplink grants, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

HARQ Process ID = [floor(CURRENT\_symbol/*periodicity*)] modulo *nrofHARQ-Processes*

where CURRENT\_symbol=(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slot number in the frame × *numberOfSymbolsPerSlot* + symbol number in the slot), and *numberOfSlotsPerFrame* and *numberOfSymbolsPerSlot* refer to the number of consecutive slots per frame and the number of consecutive symbols per slot, respectively as specified in TS 38.211 [8].

NOTE 1: CURRENT\_symbol refers to the symbol index of the first transmission occasion of a repetition bundle that takes place.

NOTE 2: A HARQ process is configured for a configured uplink grant if the configured uplink grant is activated and the associated HARQ process ID is less than *nrofHARQ-Processes*.

NOTE 3: If the MAC entity receives both a grant in a Random Access Response and an overlapping grant for its C-RNTI or CS-RNTI, requiring concurrent transmissions on the SpCell, the MAC entity may choose to continue with either the grant for its RA-RNTI or the grant for its C-RNTI or CS-RNTI.

[TS 38.321, clause 5.8.2]

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant;

- configured grant Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signalling indicating configured uplink grant activation or deactivation.

Type 1 and Type 2 are configured by RRC per Serving Cell and per BWP. Multiple configurations can be active simultaneously only on different Serving Cells. For Type 2, activation and deactivation are independent among the Serving Cells. For the same Serving Cell, the MAC entity is configured with either Type 1 or Type 2.

RRC configures the following parameters when the configured grant Type 1 is configured:

- *cs-RNTI*: CS-RNTI for retransmission;

- *periodicity*: periodicity of the configured grant Type 1;

- *timeDomainOffset*: Offset of a resource with respect to SFN=0 in time domain;

- *timeDomainAllocation*: Allocation of configured uplink grant in time domain which contains *startSymbolAndLength* (i.e. *SLIV* in TS 38.214 [7]);

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant.

RRC configures the following parameters when the configured grant Type 2 is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;

- *periodicity*: periodicity of the configured grant Type 2;

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant.

Upon configuration of a configured grant Type 1 for a Serving Cell by upper layers, the MAC entity shall:

1> store the uplink grant provided by upper layers as a configured uplink grant for the indicated Serving Cell;

1> initialise or re-initialise the configured uplink grant to start in the symbol according to *timeDomainOffset* and *S* (derived from *SLIV* as specified in TS 38.214 [7]), and to reoccur with *periodicity*.

After an uplink grant is configured for a configured grant Type 1, the MAC entity shall consider that the uplink grant recurs associated with each symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
 (*timeDomainOffset* × *numberOfSymbolsPerSlot* + *S* + N × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*), for all N >= 0.

After an uplink grant is configured for a configured grant Type 2, the MAC entity shall consider that the uplink grant recurs associated with each symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
[(SFNstart time × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slotstart time × *numberOfSymbolsPerSlot* + symbolstart time) + N × *periodicity*] modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*), for all N >= 0.

where SFNstart time, slotstart time, and symbolstart time are the SFN, slot, and symbol, respectively, of the first transmission opportunity of PUSCH where the configured uplink grant was (re-)initialised.

When a configured uplink grant is released by upper layers, all the corresponding configurations shall be released and all corresponding uplink grants shall be cleared.

The MAC entity shall:

1> if the configured uplink grant confirmation has been triggered and not cancelled; and

1> if the MAC entity has UL resources allocated for new transmission:

2> instruct the Multiplexing and Assembly procedure to generate an Configured Grant Confirmation MAC CE as defined in subclause 6.1.3.7;

2> cancel the triggered configured uplink grant confirmation.

For a configured grant Type 2, the MAC entity shall clear the configured uplink grant immediately after first transmission of Configured Grant Confirmation MAC CE triggered by the configured uplink grant deactivation.

Retransmissions except for repetition of configured uplink grants use uplink grants addressed to CS-RNTI.

[TS 38.300, clause 10.3]

In the uplink, the gNB can dynamically allocate resources to UEs via the C-RNTI on PDCCH(s). A UE always monitors the PDCCH(s) in order to find possible grants for uplink transmission when its downlink reception is enabled (activity governed by DRX when configured). When CA is configured, the same C-RNTI applies to all serving cells.

In addition, with Configured Grants, the gNB can allocate uplink resources for the initial HARQ transmissions to UEs. Two types of configured uplink grants are defined:

- With Type 1, RRC directly provides the configured uplink grant (including the periodicity).

- With Type 2, RRC defines the periodicity of the configured uplink grant while PDCCH addressed to CS-RNTI can either signal and activate the configured uplink grant, or deactivate it; i.e. a PDCCH addressed to CS-RNTI indicates that the uplink grant can be implicitly reused according to the periodicity defined by RRC, until deactivated.

The dynamically allocated uplink transmission overrides the configured uplink grant in the same serving cell, if they overlap in time. Otherwise an uplink transmission according to the configured uplink grant is assumed, if activated.

Retransmissions other than repetitions are explicitly allocated via PDCCH(s).

When CA is configured, at most one configured uplink grant can be signalled per serving cell. When BA is configured, at most one configured uplink grant can be signalled per BWP. On each serving cell, there can be only one configured uplink grant active at a time. A configured uplink grant for one serving cell can either be of Type 1 or Type 2. For Type 2, activation and deactivation of configured uplink grants are independent among the serving cells. When SUL is configured, a configured uplink grant can only be signalled for one of the 2 ULs of the cell.

[TS 38.213, clause 10.2]

A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or configured UL grant Type 2 PDCCH if

- the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and

- the new data indicator field for the enabled transport block is set to '0'.

Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.

If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.

Table 10.2-1: Special fields for DL SPS and UL grant Type 2 scheduling activation PDCCH validation

|  |  |  |  |
| --- | --- | --- | --- |
|  | DCI format 0\_0/0\_1 | DCI format 1\_0 | DCI format 1\_1 |
| HARQ process number | set to all '0's | set to all '0's | set to all '0's |
| Redundancy version | set to '00' | set to '00' | For the enabled transport block: set to '00' |

Table 10.2-2: Special fields for DL SPS and UL grant Type 2 scheduling release PDCCH validation

|  |  |  |
| --- | --- | --- |
|  | DCI format 0\_0 | DCI format 1\_0 |
| HARQ process number | set to all '0's | set to all '0's |
| Redundancy version | set to '00' | set to '00' |
| Modulation and coding scheme | set to all '1's | set to all '1's |
| Frequency domain resource assignment | set to all '1's | set to all '1's |

A UE is expected to provide HARQ-ACK information in response to a SPS PDSCH release after  symbols from the last symbol of a PDCCH providing the SPS PDSCH release. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the PDCCH providing the SPS PDSCH release,  for ,  for , and  for , otherwise,  for ,  for ,  for , and  for , wherein  corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH providing the SPS PDSCH release and the SCS configuration of a PUCCH carrying the HARQ-ACK information in response to a SPS PDSCH release.

7.1.1.6.3.3 Test description

7.1.1.6.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 and UM DRB should be established on NR Cell 1.The loop back size is set to accommodate one RLC SDU in UL of same size as one RLC SDU in DL and 1 byte MAC subheader for Configured Grant Confirmation MAC CE.

7.1.1.6.3.3.2 Test procedure sequence

Table 7.1.1.6.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits NR *RRCReconfiguration* message to configure UL configured grant type 2. (Note 1) | <-- | (NR RRC: *RRCReconfiguration* | - | - |
| 2 | The UE transmits NR *RRCReconfigurationComplete* message. (Note 2) | --> | (NR RRC: *RRCReconfigurationComplete* | - | - |
| 3 | SS transmits a DL MAC PDU containing 6 RLC SDUs on UM DRB. | <-- | MAC PDU | - | - |
| 4 | The UE transmits a Scheduling Request, indicating that loop back SDUs are ready for transmission in UL RLC. | --> | (SR) | - | - |
| 5 | SS transmits a UL configured grant type 2 addressed to UE’s stored CS-RNTI in Slot ‘n’ of PDCCH, NDI=0, allowing the UE to transmit one loop back SDU and 1 byte MAC subheader for Configured Grant Confirmation MAC CE. | <-- | (UL configured Grant type 2) | - | - |
| 6 | Check: Does the UE transmit a MAC PDU containing one RLC SDU and a Configured Grant Confirmation MAC CE in Symbol ‘S’ of Slot ‘y’ of PUSCH as per grant in step 5?  i.e., in the PUSCH slot y=floor (n \* (PUSCHSCS / PDCCHSCS)) + K2. (Note 3) | --> | MAC PDU | 1 | P |
| 7 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘S’ of Slot ‘y + x’ of PUSCH as per grant in step 5? (Note 4) | --> | MAC PDU | 1 | P |
| 8 | SS transmits a UL configured grant type 2 addressed to UE’s stored CS-RNTI in Slot ‘p’ of PDCCH (p = floor (p0 \* (PDCCHSCS / PUSCHSCS))), NDI = 0, allowing the UE to transmit one loop back SDU and 1 byte MAC subheader for Configured Grant Confirmation MAC CE,  Where p0 is the slot of PUSCH with y + x < p0 < y + 2x - K2. | <-- | (UL configured Grant type 2) | - | - |
| 9 | Check: Does the UE transmit a MAC PDU containing one RLC SDU and 1 byte MAC subheader for Configured Grant Confirmation MAC CE in Symbol ‘S’ of Slot ‘z’ of PUSCH as per grant in step 8?  i.e., in the PUSCH slot z = floor (p \* (PUSCHSCS/ PDCCHSCS)) + K2. (Note 3) | --> | MAC PDU | 2 | P |
| 10 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘S’ of Slot ‘y + 2x’ as per grant in step 5? | --> | MAC PDU | 2 | F |
| 11 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘S’ of Slot ‘z + x’ of PUSCH as per grant in step 8? | --> | MAC PDU | 2 | P |
| 12 | SS transmits a UL configured grant type 2 addressed to UE’s stored CS-RNTI in Slot ‘q’ of PDCCH (q = floor (q0 \* (PDCCHSCS / PUSCHSCS))), NDI = 1; allowing the UE to transmit one loop back SDU. The UL HARQ process is the same as in step 11,  Where q0 is the slot of PUSCH with z + x < q0 < z + 2x - K2. | <-- | (UL configured Grant type 2) | - | - |
| 13 | Check: Does the UE transmit a MAC PDU containing the same RLC SDU as in step 11 in Symbol ‘S’ of Slot ‘w’ of PUSCH?  i.e., in the PUSCH slot w = floor (q \* (PUSCHSCS / PDCCHSCS)) + K2. (Note 3) | --> | MAC PDU | 3 | P |
| 14 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘S’ of Slot ‘z + 2x’ of PUSCH as per grant in step 8? | --> | MAC PDU | 1 | P |
| 15 | SS transmits a UL Grant using UE’s C-RNTI in in Slot ‘r’ of PDCCH allowing UE to transmit a MAC PDU containing one RLC SDU, where r = floor ((z + 3x - K2) \* (PDCCHSCS / PUSCHSCS)). | <-- | (UL Grant) | - | - |
| 16 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘S’ of Slot ‘z + 3x’ of PUSCH as per grant in step 8? | --> | MAC PDU | 4 | P |
| 17 | Check: Does the UE transmit a MAC PDU in Slot ‘z + 4x’ as per grant in containing zero MAC SDU? (Note 5) | --> | MAC PDU | 6 | F |
| 18 | SS transmits a DL MAC PDU containing 3 RLC SDUs on UM DRB after step 17. | <-- | MAC PDU | - | - |
| 19 | Check: Does the UE transmit a MAC PDU containing one RLC SDU in Symbol ‘S’ of Slot ‘z + 5x’ of PUSCH as per grant in step 8? | --> | MAC PDU | 1 | P |
| 20 | The SS transmits a PDCCH [for UL configured grant type 2 explicit release] using UE’s CS-RNTI in Symbol ‘S’ of slot ‘p’ with NDI=0. Where (z+5x< p <z+6x). | <-- | PDCCH [for UL configured grant type 2 explicit release] | - | - |
| 21 | Check: Does the UE transmit a MAC PDU containing a Configured Grant Confirmation MAC CE and one RLC SDU in ‘S’ of Slot ‘z + 6x’ of PUSCH as per grant in step 8? | --> | MAC PDU | 7 | P |
| 21A | Check: Does the UE transmit a MAC PDU containing one RLC SDU in ‘S’ of Slot ‘z + 7x’ of PUSCH as per grant in step 8? | --> | MAC PDU | 7 | F |
| 22 | SS transmits a UL configured grant type 2 addressed to UE’s stored CS-RNTI in Slot ‘j’ of PDCCH, NDI=0, allowing the UE to transmit one loop back SDU and 1 byte MAC subheader for Configured Grant Confirmation MAC CE. | <-- | (UL configured grant type 2) | - | - |
| 23 | Check: Does the UE transmit a MAC PDU containing one RLC SDU and a Configured Grant Confirmation MAC CE in Symbol ‘S’ of Slot ‘y’ of PUSCH as per grant in step 22?  i.e., in the PUSCH slot y=floor (n \* (PUSCHSCS / PDCCHSCS)) + K2. (Note 3) | --> | MAC PDU | 1 | P |
| 24 | SS transmits *RRCReconfiguration* to disable UL configured grant type 2*. (Note 1)* | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 25 | The UE transmits *RRCReconfigurationComplete. (Note 2)* | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 26 | SS transmits a DL MAC PDU containing 1 RLC SDU. | <-- | MAC PDU | - | - |
| 27 | Check: Does the UE transmit a MAC PDU in PUSCH as per configured UL grant type 2 in step 22. | --> | MAC PDU | 5 | F |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete.*  Note 3: y is the slot where the UE shall transmit the PUSCH and is determined by  as  where n is the slot with the scheduling DCI,  is based on the numerology of PUSCH. S is the starting symbol relatived to the start of the slot y according to TS 38.214 clause 6.1.2.1.  Note 4: x is equal to *periodicity /* 14in this test case.  Note 5: If the MAC entity does not generate a MAC PDU, one of the conditions which shall be satisfied is that there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.321 clause 5.4.3.1.3. | | | | | |

7.1.1.6.3.3.3 Specific message contents

Table 7.1.1.6.3.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.6.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | Not present |  |  |
| secondaryCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) | EN-DC |
|  | Not present |  | NR |
| nonCriticalExtension | Not present |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| dedicatedNAS-MessageList | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.3.3.3-2: *CellGroupConfig* (Table 7.1.1.6.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList | Not present |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig SEQUENCE { |  |  |  |
| cs-RNTI CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| RNTI-Value | ‘FFE0’H |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| pucch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| schedulingRequestResourceToAddModList SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig { | 1 entry |  |  |
| SchedulingRequestResourceConfig[1] SEQUENCE { |  | entry 1 |  |
| schedulingRequestResourceId | 1 |  |  |
| schedulingRequestID | 0 |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl20 | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| configuredGrantConfig CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| cg-DMRS-Configuration | DMRS-UplinkConfig | Reference TS 38.508-1 [4], Table 4.6.3-51 |  |
| uci-OnPUSCH CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| semiStatic SEQUENCE { | BetaOffsets |  |  |
| betaOffsetACK-Index1 | 9 |  |  |
| betaOffsetACK-Index2 | 9 |  |  |
| betaOffsetACK-Index3 | 9 |  |  |
| betaOffsetCSI-Part1-Index1 | 6 |  |  |
| betaOffsetCSI-Part1-Index2 | 6 |  |  |
| betaOffsetCSI-Part2-Index1 | 6 |  |  |
| betaOffsetCSI-Part2-Index2 | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| resourceAllocation | ResourceAllocationType1 |  |  |
| powerControlLoopToUse | n0 |  |  |
| p0-PUSCH-Alpha | 0 |  |  |
| nrofHARQ-Processes | 16 |  |  |
| repK | n1 |  |  |
| periodicity | Sym40x14 |  | 15kHz |
| periodicity | Sym80x14 |  | 30kHz |
| periodicity | Sym160x14 |  | 60kHz |
| periodicity | Sym320x14 |  | 120kHz |
| } |  |  |  |
| } |  |  |  |
| pusch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| pusch-TimeDomainAllocationList CHOICE { |  |  |  |
| setup SEQUENCE { | 1 entry |  |  |
| PUSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k2 | 4 |  | FR1 |
|  | 8 |  | FR2 |
| mappingType | typeB |  |  |
| startSymbolAndLength | 0011011 |  | FR1 |
| startSymbolAndLength | 0001110 |  | FR2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.3.3.3-3: *RRCReconfiguration* (step 24,Table 7.1.1.6.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | Not present |  |  |
| secondaryCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) | EN-DC |
|  | Not present |  | NR |
| nonCriticalExtension | Not present |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| dedicatedNAS-MessageList | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.3.3.3-4: *CellGroupConfig* (Table 7.1.1.6.3.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| cellGroupId | 1 |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| configuredGrantConfig CHOICE { |  |  |  |
| release | Null |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.6.4 Correct handling of DL assignment / Multi Semi-persistent configuration

7.1.1.6.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in DL is enabled }

**ensure that** {

**when** { UE receives a DL assignment addressed to its stored CS-RNTI in slot y and with NDI set as 0 with *sps-ConfigIndex*=0 }

**then** {UE starts receiving DL MAC PDU in slots y+n\*[semiPersistSchedIntervalDL] where ‘n’ is positive integer starting at zero }

}

(2)

**with** { UE in RRC\_Connected state with DRB established and stored DL SPS assignment to receive MAC PDU in slot y+n\*[semiPersistSchedIntervalDL] }

**ensure that** {

**when** { UE receives another DL assignment addressed to its CS-RNTI in slot p and with NDI set as 0 associated with *sps-ConfigIndex*=1, where p!= y+n\*[semiPersistSchedIntervalDL] }

**then** { UE starts receiving DL MAC PDU in slots p+n\*[semiPersistSchedIntervalDL] and continue receiving DL MAC PDU at slots y+n\*[semiPersistSchedIntervalDL] where ‘n’ is positive integer starting at zero }

}

7.1.1.6.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.321, clause 5.3.1, 5.8.1 TS 38.300, clause 10.2, and TS 38.213, clause 10.2. Unless otherwise stated these are Rel-16 requirements.

[TS 38.321, clause 5.3.1]

Downlink assignments received on the PDCCH both indicate that there is a transmission on a DL-SCH for a particular MAC entity and provide the relevant HARQ information.

When the MAC entity has a C-RNTI, Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion during which it monitors PDCCH and for each Serving Cell:

1> if a downlink assignment for this PDCCH occasion and this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI, or Temporary C‑RNTI:

2> if this is the first downlink assignment for this Temporary C-RNTI:

3> consider the NDI to have been toggled.

2> if the downlink assignment is for the MAC entity's C-RNTI, and if the previous downlink assignment indicated to the HARQ entity of the same HARQ process was either a downlink assignment received for the MAC entity's CS-RNTI or a configured downlink assignment:

3> consider the NDI to have been toggled regardless of the value of the NDI.

2> indicate the presence of a downlink assignment and deliver the associated HARQ information to the HARQ entity.

1> else if a downlink assignment for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:

2> if the NDI in the received HARQ information is 1:

3> consider the NDI for the corresponding HARQ process not to have been toggled;

3> indicate the presence of a downlink assignment for this Serving Cell and deliver the associated HARQ information to the HARQ entity.

2> if the NDI in the received HARQ information is 0:

3> if PDCCH contents indicate SPS deactivation:

4> clear the configured downlink assignment for this Serving Cell (if any);

4> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is running:

5> indicate a positive acknowledgement for the SPS deactivation to the physical layer.

3> else if PDCCH content indicates SPS activation:

4> store the downlink assignment for this Serving Cell and the associated HARQ information as configured downlink assignment;

4> initialise or re-initialise the configured downlink assignment for this Serving Cell to start in the associated PDSCH duration and to recur according to rules in clause 5.8.1;

For each Serving Cell and each configured downlink assignment, if configured and activated, the MAC entity shall:

1> if the PDSCH duration of the configured downlink assignment does not overlap with the PDSCH duration of a downlink assignment received on the PDCCH for this Serving Cell:

2> instruct the physical layer to receive, in this PDSCH duration, transport block on the DL-SCH according to the configured downlink assignment and to deliver it to the HARQ entity;

2> set the HARQ Process ID to the HARQ Process ID associated with this PDSCH duration;

2> consider the NDI bit for the corresponding HARQ process to have been toggled;

2> indicate the presence of a configured downlink assignment and deliver the stored HARQ information to the HARQ entity.

For configured downlink assignments without *harq-ProcID-Offset*, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:

HARQ Process ID = [floor (CURRENT\_slot × 10 / (*numberOfSlotsPerFrame* × *periodicity*))] modulo *nrofHARQ-Processes*

where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].

NOTE 1: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the HARQ Process ID used for configured downlink assignments.

For configured downlink assignments with *harq-ProcID-Offset*, the HARQ Process ID associated with the slot where the DL transmission starts is derived from the following equation:

HARQ Process ID = [floor (CURRENT\_slot × 10 / (numberOfSlotsPerFrame × periodicity))] modulo nrofHARQ-Processes + harq-ProcID-Offset

where CURRENT\_slot = [(SFN × *numberOfSlotsPerFrame*) + slot number in the frame] and *numberOfSlotsPerFrame* refers to the number of consecutive slots per frame as specified in TS 38.211 [8].

NOTE 2: CURRENT\_slot refers to the slot index of the first transmission occasion of a bundle of configured downlink assignment.

When the MAC entity needs to read BCCH, the MAC entity may, based on the scheduling information from RRC:

1> if a downlink assignment for this PDCCH occasion has been received on the PDCCH for the SI-RNTI;

2> indicate a downlink assignment and redundancy version for the dedicated broadcast HARQ process to the HARQ entity.

[TS 38.321, clause 5.8.1]

Semi-Persistent Scheduling (SPS) is configured by RRC per Serving Cell and per BWP. Multiple assignments can be active simultaneously in the same BWP. Activation and deactivation of the DL SPS are independent among the Serving Cells.

For the DL SPS, a DL assignment is provided by PDCCH, and stored or cleared based on L1 signalling indicating SPS activation or deactivation.

RRC configures the following parameters when the SPS is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;

- *nrofHARQ-Processes*: the number of configured HARQ processes for SPS;

- *harq-ProcID-Offset*: Offset of HARQ process for SPS;

- *periodicity*: periodicity of configured downlink assignment for SPS.

When the SPS is released by upper layers, all the corresponding configurations shall be released.

After a downlink assignment is configured for SPS, the MAC entity shall consider sequentially that the Nth downlink assignment occurs in the slot for which:

(*numberOfSlotsPerFrame* × SFN + slot number in the frame) =  
[(*numberOfSlotsPerFrame* × SFNstart time + slotstart time) + N × *periodicity* × *numberOfSlotsPerFrame* / 10] modulo (1024 × *numberOfSlotsPerFrame*)

where SFNstart time and slotstart time are the SFN and slot, respectively, of the first transmission of PDSCH where the configured downlink assignment was (re-)initialised.

NOTE: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the occurrences of configured downlink assignments.

[TS 38.300, clause 10.2]

In the downlink, the gNB can dynamically allocate resources to UEs via the C-RNTI on PDCCH(s). A UE always monitors the PDCCH(s) in order to find possible assignments when its downlink reception is enabled (activity governed by DRX when configured). When CA is configured, the same C-RNTI applies to all serving cells.

The gNB may pre-empt an ongoing PDSCH transmission to one UE with a latency-critical transmission to another UE. The gNB can configure UEs to monitor interrupted transmission indications using INT-RNTI on a PDCCH. If a UE receives the interrupted transmission indication, the UE may assume that no useful information to that UE was carried by the resource elements included in the indication, even if some of those resource elements were already scheduled to this UE.

In addition, with Semi-Persistent Scheduling (SPS), the gNB can allocate downlink resources for the initial HARQ transmissions to UEs: RRC defines the periodicity of the configured downlink assignments while PDCCH addressed to CS-RNTI can either signal and activate the configured downlink assignment, or deactivate it; i.e. a PDCCH addressed to CS-RNTI indicates that the downlink assignment can be implicitly reused according to the periodicity defined by RRC, until deactivated.

NOTE: When required, retransmissions are explicitly scheduled on PDCCH(s).

The dynamically allocated downlink reception overrides the configured downlink assignment in the same serving cell, if they overlap in time. Otherwise a downlink reception according to the configured downlink assignment is assumed, if activated.

The UE may be configured with up to 8 active configured downlink assignments for a given BWP of a serving cell. When more than one is configured:

- The network decides which of these configured downlink assignments are active at a time (including all of them); and

- Each configured downlink assignment is activated separately using a DCI command and deactivation of configured downlink assignments is done using a DCI command, which can either deactivate a single configured downlink assignment or multiple configured downlink assignments jointly.

[TS 38.213, clause 10.2]

A UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or a configured UL grant Type 2 PDCCH if

- the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and

- the new data indicator field in the DCI format for the enabled transport block is set to '0', and

- the DFI flag field, if present, in the DCI format is set to '0', and

- if validation is for scheduling activation and if the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format is present, the PDSCH-to-HARQ\_feedback timing indicator field does not provide an inapplicable value from *dl-DataToUL-ACK-r16*.

If a UE is provided a single configuration for UL grant Type 2 PUSCH or for SPS PDSCH, validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.

If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH, a value of the HARQ process number field in a DCI format indicates an activation for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *ConfiguredGrantConfigIndex* or by *sps-ConfigIndex*, respectively. Validation of the DCI format is achieved if the RV field for the DCI format is set as in Table 10.2-3.

If a UE is provided more than one configuration for UL grant Type 2 PUSCH or for SPS PDSCH

- if the UE is provided *ConfiguredGrantConfigType2DeactivationStateList* or *sps-ConfigDeactivationStateList*, a value of the HARQ process number field in a DCI format indicates a corresponding entry for scheduling release of one or more UL grant Type 2 PUSCH or SPS PDSCH configurations

- if the UE is not provided *ConfiguredGrantConfigType2DeactivationStateList* or *sps-ConfigDeactivationStateList*, a value of the HARQ process number field in a DCI format indicates a release for a corresponding UL grant Type 2 PUSCH or for a SPS PDSCH configuration with a same value as provided by *ConfiguredGrantConfigIndex* or by *sps-ConfigIndex*, respectively.

Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-4.

If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.

Table 10.2-1: Special fields for single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided a single SPS PDSCH or UL grant Type 2 configuration in the active DL/UL BWP of the scheduled cell

|  |  |  |  |
| --- | --- | --- | --- |
|  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_2 | DCI format 1\_1 |
| HARQ process number | set to all '0's | set to all '0's | set to all '0's |
| Redundancy version | set to all '0's | set to all '0's | For the enabled transport block: set to all '0's |

Table 10.2-2: Special fields for single DL SPS or single UL grant Type 2 scheduling release PDCCH validation when a UE is provided a single SPS PDSCH or UL grant Type 2 configuration in the active DL/UL BWP of the scheduled cell

|  |  |  |
| --- | --- | --- |
|  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 |
| HARQ process number | set to all '0's | set to all '0's |
| Redundancy version | set to all '0's | set to all '0's |
| Modulation and coding scheme | set to all '1's | set to all '1's |
| Frequency domain resource assignment | set to all '0's for FDRA Type 2 with  set to all '1's, otherwise | set to all '0's for FDRA Type 0 or for *dynamicSwitch*  set to all '1's for FDRA Type 1 |

Table 10.2-3: Special fields for a single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations in the active DL/UL BWP of the scheduled cell

|  |  |  |  |
| --- | --- | --- | --- |
|  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_2 | DCI format 1\_1 |
| Redundancy version | set to all '0's | set to all '0's | For the enabled transport block: set to all '0's |

Table 10.2-4: Special fields for a single or multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations in the active DL/UL BWP of the scheduled cell

|  |  |  |
| --- | --- | --- |
|  | DCI format 0\_0/0\_1/0\_2 | DCI format 1\_0/1\_1/1\_2 |
| Redundancy version | set to all '0's | set to all '0's |
| Modulation and coding scheme | set to all '1's | set to all '1's |
| Frequency domain resource assignment | set to all '0's for FDRA Type 2 with  set to all '1's, otherwise | set to all '0's for FDRA Type 0 or for *dynamicSwitch*  set to all '1's for FDRA Type 1 |

A UE is expected to provide HARQ-ACK information in response to a SPS PDSCH release after symbols from the last symbol of a PDCCH providing the SPS PDSCH release. If *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell with the PDCCH providing the SPS PDSCH release, for , for , and for , otherwise, for , for , for , and for , wherein corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH providing the SPS PDSCH release and the SCS configuration of a PUCCH carrying the HARQ-ACK information in response to a SPS PDSCH release.

7.1.1.6.4.3 Test description

7.1.1.6.4.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink and that the UM DRB is configured according to Table 7.1.1.6.4.3.1-1.

Table 7.1.1.6.4.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink UM RLC sn-FieldLength | IF (pc\_um\_WithShortSN ) size6  ELSE size12 |
| Downlink UM RLC sn-FieldLength | F (pc\_um\_WithShortSN ) size6  ELSE size12 |

7.1.1.6.4.3.2 Test procedure sequence

Table 7.1.1.6.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS transmits *NR* RRCReconfiguration to config SPS-ConfigurationDL. | <-- | RRCReconfiguration | - | - |
| 2 | The UE transmits NR RRCReconfigurationComplete. | --> | RRCReconfigurationComplete | - | - |
| 3 | The SS transmits a DL assignment using UE’s CS-RNTI associated with *sps-ConfigIndex*=0 in Slot ‘Y’, NDI=0. | <-- | (DL SPS Grant) | - | - |
| 4 | The SS transmits in Slot ‘Y’, a DL MAC PDU containing a RLC PDU on UM DRB. | <-- | MAC PDU | - | - |
| 5 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 6 | The SS transmits in Slot ‘Y+X’, a DL MAC PDU containing a RLC PDU on DRB. (Note 1) | <-- | MAC PDU | - | - |
| 7 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 1 | P |
| 8 | Void | - | - | - | - |
| 9 | Void | - | - | - | - |
| 10 | The SS transmits a DL assignment using UE’s CS-RNTI associated with *sps-ConfigIndex*=1 in Slot ‘P’, NDI=0;  (Where Y+X<P<Y+2X) | <-- | (DL SPS Grant) | - | - |
| 11 | The SS transmits in Slot ‘P’, a DL MAC PDU containing a RLC PDU on UM DRB. | <-- | MAC PDU | - | - |
| 12 | Check: Does the UE transmit a HARQ ACK? | --> | HARQ ACK | 2 | P |
| 13 | The SS transmits in Slot ‘Y+2X’, a DL MAC PDU containing a RLC PDU on UM DRB. | <-- | MAC PDU | - | - |
| 14 | Check: Does the UE transmit a HARQ Feedback? | --> | HARQ ACK | 2 | P |
| 15 | The SS transmits in Slot ‘P+X’, a DL MAC PDU containing a RLC PDU (DL-SQN=1) on UM DRB. | <-- | MAC PDU | - | - |
| 16 | Check: Does the UE transmit a HARQ Feedback? | --> | HARQ ACK | 2 | P |
| 17 | SS transmits *NR* RRCReconfiguration to disable SPS-ConfigurationDL. | <-- | RRCReconfiguration | - | - |
| 18 | The UE transmits NR RRCReconfigurationComplete. | --> | RRCReconfigurationComplete | - | - |
| Note 1: X is equal to semiPersistSchedIntervalDL in this document.  Note 2: Void.  Note 3: Void.  Note 4: As per TS 38.508-1[4], the default value for PDSCH slot offset (K0) is 0, hence the DL MAC PDU’s associated with DL SPS grant in Slot X are sent in same slot X. | | | | | |

7.1.1.6.4.3.3 Specific message contents

Table 7.1.1.6.4.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.6.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| secondaryCellGroup | Not present |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.4.3.3-2: *CellGroupConfig* (Table 7.1.1.6.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| physicalCellGroupConfig | PhysicalCellGroupConfig | Table 7.1.1.6.4.3.3-3 |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | Not present |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| initialDownlinkBWP SEQUENCE { |  |  |  |
| sps-ConfigToAddModList-r16 SEQUENCE (SIZE (1..maxNrofSPS-Config-r16)) OF SPS-Config { | 2 entries |  |  |
| SPS-Config[1] SEQUENCE { |  | entry 1 |  |
| periodicity | ms160 |  |  |
| nrofHARQ-Processes | 8 |  |  |
| sps-ConfigIndex-r16 | 0 |  |  |
| harq-ProcID-Offset-r16 | 0 |  |  |
| sps-ConfigIndex-r16 | 0 |  |  |
| } |  |  |  |
| SPS-Config[2] SEQUENCE { |  | entry 2 |  |
| periodicity | ms160 |  |  |
| nrofHARQ-Processes | 8 |  |  |
| sps-ConfigIndex-r16 | 1 |  |  |
| harq-ProcID-Offset-r16 | 8 |  |  |
| sps-ConfigIndex-r16 | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.4.3.3-3: PhysicalCellGroupConfig(Table 7.1.1.6.4.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-106 | | | |
| Information Element | Value/remark | Comment | Condition |
| PhysicalCellGroupConfig ::= SEQUENCE { |  |  |  |
| cs-RNTI | ‘FFE0’H |  |  |
| } |  |  |  |

Table 7.1.1.6.4.3.3-4: *RRCReconfiguration* (step 17, Table 7.1.1.6.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| secondaryCellGroup | Not present |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.4.3.3-5: *CellGroupConfig* (Table 7.1.1.6.4.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { | |  |  |  |
| spCellConfig SEQUENCE { | |  |  |  |
| servCellIndex | | Not present |  |  |
| spCellConfigDedicated SEQUENCE { | |  |  |  |
| initialDownlinkBWP SEQUENCE { | |  |  |  |
| sps-ConfigToReleaseList-r16 SEQUENCE (SIZE (1..maxNrofSPS-Config-r16)) OF SPS-ConfigIndex-r16 { | | 2 entries | Release all the SPS entries configured previously |  |
| SPS-ConfigIndex-r16[1] | | 0 |  |  |
| SPS-ConfigIndex-r16[2] | | 1 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

##### 7.1.1.6.5 Correct handling of UL grant / Multi configured uplink grants

7.1.1.6.5.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_Connected state with DRB established and sps-Configuration in UL is enabled with Configured grant type 1 }

**ensure that** {

**when** { The symbol in which equation [(SFN × numberOfSlotsPerFrame × numberOfSymbolsPerSlot) + (slot number in the frame × numberOfSymbolsPerSlot) + symbol number in the slot] =

(timeDomainOffset × numberOfSymbolsPerSlot + S + N × periodicity) modulo (1024 × numberOfSlotsPerFrame × numberOfSymbolsPerSlot) is satisfied }

**then** { UE starts transmitting UL MAC PDU periodically in the symbol associated with the new re-configured grant }

}

(2)

**with** { UE in RRC\_Connected state with DRB established and configured UL grant type 1 }

**ensure that** {

**when** { UE receives another UL grant type 1 in an RRC message with timeDomainOffset 15 }

**then** { UE starts transmitting UL MAC PDU in symbol with timeDomainOffset 15 and continue transmitting UL MAC PDU in symbol with timeDomainOffset 5 }

}

7.1.1.6.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in TS 38.321, clause 5.4.1, 5.8.2 TS 38.300, clause 10.3. Unless otherwise stated these are Rel-16 requirements.

[TS 38.321, clause 5.4.1]

Uplink grant is either received dynamically on the PDCCH, in a Random Access Response, configured semi-persistently by RRC or determined to be associated with the PUSCH resource of MSGA as specified in clause 5.1.2a. The MAC entity shall have an uplink grant to transmit on the UL-SCH. To perform the requested transmissions, the MAC layer receives HARQ information from lower layers. An uplink grant addressed to CS-RNTI with NDI = 0 is considered as a configured uplink grant. An uplink grant addressed to CS-RNTI with NDI = 1 is considered as a dynamic uplink grant.

If the MAC entity has a C-RNTI, a Temporary C-RNTI, or CS-RNTI, the MAC entity shall for each PDCCH occasion and for each Serving Cell belonging to a TAG that has a running *timeAlignmentTimer* and for each grant received for this PDCCH occasion:

1> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's C-RNTI or Temporary C-RNTI; or

1> if an uplink grant has been received in a Random Access Response:

2> if the uplink grant is for MAC entity's C-RNTI and if the previous uplink grant delivered to the HARQ entity for the same HARQ process was either an uplink grant received for the MAC entity's CS-RNTI or a configured uplink grant:

3> consider the NDI to have been toggled for the corresponding HARQ process regardless of the value of the NDI.

2> if the uplink grant is for MAC entity's C-RNTI, and the identified HARQ process is configured for a configured uplink grant:

3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured.

3> stop the *cg-RetransmissionTimer* for the corresponding HARQ process, if running.

2> deliver the uplink grant and the associated HARQ information to the HARQ entity.

1> else if an uplink grant for this PDCCH occasion has been received for this Serving Cell on the PDCCH for the MAC entity's CS-RNTI:

2> if the NDI in the received HARQ information is 1:

3> consider the NDI for the corresponding HARQ process not to have been toggled;

3> start or restart the *configuredGrantTimer* for the corresponding HARQ process, if configured;

3> stop the *cg-RetransmissionTimer* for the corresponding HARQ process, if running;

3> deliver the uplink grant and the associated HARQ information to the HARQ entity.

2> else if the NDI in the received HARQ information is 0:

3> if PDCCH contents indicate configured grant Type 2 deactivation:

4> trigger configured uplink grant confirmation.

3> else if PDCCH contents indicate configured grant Type 2 activation:

4> trigger configured uplink grant confirmation;

4> store the uplink grant for this Serving Cell and the associated HARQ information as configured uplink grant;

4> initialise or re-initialise the configured uplink grant for this Serving Cell to start in the associated PUSCH duration and to recur according to rules in clause 5.8.2;

4> stop the *configuredGrantTimer* for the corresponding HARQ process, if running;

4> stop the *cg-RetransmissionTimer* for the corresponding HARQ process, if running.

For each Serving Cell and each configured uplink grant, if configured and activated, the MAC entity shall:

1> if the MAC entity is configured with *lch-basedPrioritization*, and the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received in a Random Access Response or with the PUSCH duration of an uplink grant addressed to Temporary C-RNTI or the PUSCH duration of a MSGA payload for this Serving Cell; or

1> if the MAC entity is not configured with *lch-basedPrioritization*, and the PUSCH duration of the configured uplink grant does not overlap with the PUSCH duration of an uplink grant received on the PDCCH or in a Random Access Response or the PUSCH duration of a MSGA payload for this Serving Cell:

2> set the HARQ Process ID to the HARQ Process ID associated with this PUSCH duration;

2> if, for the corresponding HARQ process, the *configuredGrantTimer* is not running and *cg-RetransmissionTimer* is not configured (i.e. new transmission):

3> consider the NDI bit for the corresponding HARQ process to have been toggled;

3> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

2> else if the *cg-RetransmissionTimer* for the corresponding HARQ process is configured and not running, then for the corresponding HARQ process:

3> if the *configuredGrantTimer* is not running, and the HARQ process is not pending (i.e. new transmission):

4> consider the NDI bit to have been toggled;

4> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

3> else if the previous uplink grant delivered to the HARQ entity for the same HARQ process was a configured uplink grant (i.e. retransmission on configured grant):

4> deliver the configured uplink grant and the associated HARQ information to the HARQ entity.

For configured uplink grants neither configured with *harq-ProcID-Offset2* nor with *cg-RetransmissionTimer*, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

HARQ Process ID = [floor(CURRENT\_symbol/*periodicity*)] modulo *nrofHARQ-Processes*

For configured uplink grants with *harq-ProcID-Offset2*, the HARQ Process ID associated with the first symbol of a UL transmission is derived from the following equation:

HARQ Process ID = [floor(CURRENT\_symbol / *periodicity*)] modulo *nrofHARQ-Processes* + *harq-ProcID-Offset2*

where CURRENT\_symbol = (SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slot number in the frame × *numberOfSymbolsPerSlot* + symbol number in the slot), and *numberOfSlotsPerFrame* and *numberOfSymbolsPerSlot* refer to the number of consecutive slots per frame and the number of consecutive symbols per slot, respectively as specified in TS 38.211 [8].

[TS 38.321, clause 5.8.2]There are two types of transmission without dynamic grant:

- configured grant Type 1 where an uplink grant is provided by RRC, and stored as configured uplink grant;

- configured grant Type 2 where an uplink grant is provided by PDCCH, and stored or cleared as configured uplink grant based on L1 signalling indicating configured uplink grant activation or deactivation.

Type 1 and Type 2 are configured by RRC for a Serving Cell per BWP. Multiple configurations can be active simultaneously in the same BWP. For Type 2, activation and deactivation are independent among the Serving Cells. For the same BWP, the MAC entity can be configured with both Type 1 and Type 2.

RRC configures the following parameters when the configured grant Type 1 is configured:

- *cs-RNTI*: CS-RNTI for retransmission;

- *periodicity*: periodicity of the configured grant Type 1;

- *timeDomainOffset*: Offset of a resource with respect to SFN = *timeReferenceSFN* in time domain;

- *timeDomainAllocation*: Allocation of configured uplink grant in time domain which contains *startSymbolAndLength* (i.e. *SLIV* in TS 38.214 [7]) or *startSymbol* (i.e. *S* in TS 38.214 [7]);

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant;

- *harq-ProcID-Offset*: offset of HARQ process for configured grant for operation with shared spectrum channel access;

- *harq-ProcID-Offset2*: offset of HARQ process for configured grant;

- *timeReferenceSFN*: SFN used for determination of the offset of a resource in time domain. The UE uses the closest SFN with the indicated number preceding the reception of the configured grant configuration.

RRC configures the following parameters when the configured grant Type 2 is configured:

- *cs-RNTI*: CS-RNTI for activation, deactivation, and retransmission;

- *periodicity*: periodicity of the configured grant Type 2;

- *nrofHARQ-Processes*: the number of HARQ processes for configured grant;

- *harq-ProcID-Offset*: offset of HARQ process for configured grant for operation with shared spectrum channel access;

- *harq-ProcID-Offset2*: offset of HARQ process for configured grant.

RRC configures the following parameters when retransmissions on configured uplink grant is configured:

- *cg-RetransmissionTimer*: the duration after a configured grant (re)transmission of a HARQ process when the UE shall not autonomously retransmit that HARQ process.

Upon configuration of a configured grant Type 1 for a BWP of a Serving Cell by upper layers, the MAC entity shall:

1> store the uplink grant provided by upper layers as a configured uplink grant for the indicated BWP of the Serving Cell;

1> initialise or re-initialise the configured uplink grant to start in the symbol according to *timeDomainOffset*, *timeReferenceSFN*, and *S* (derived from *SLIV* or provided by *startSymbol* as specified in TS 38.214 [7]), and to reoccur with *periodicity*.

After an uplink grant is configured for a configured grant Type 1, the MAC entity shall consider sequentially that the Nth (N >= 0) uplink grant occurs in the symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
 (*timeReferenceSFN* × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* *+* *timeDomainOffset* × *numberOfSymbolsPerSlot* + *S* + N × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*).

After an uplink grant is configured for a configured grant Type 2, the MAC entity shall consider sequentially that the Nth (N >= 0) uplink grant occurs in the symbol for which:

[(SFN × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (slot number in the frame × *numberOfSymbolsPerSlot*) + symbol number in the slot] =  
[(SFNstart time × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot* + slotstart time × *numberOfSymbolsPerSlot* + symbolstart time) + N × *periodicity*] modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*).

where SFNstart time, slotstart time, and symbolstart time are the SFN, slot, and symbol, respectively, of the first transmission opportunity of PUSCH where the configured uplink grant was (re-)initialised.

If *cg-nrofPUSCH-InSlot* or *cg-nrofSlots* is configured for a configured grant Type 1 or Type 2, the MAC entity shall consider the uplink grants occur in those additional PUSCH allocations as specified in clause 6.1.2.3 of TS 38.214 [7].

NOTE: In case of unaligned SFN across carriers in a cell group, the SFN of the concerned Serving Cell is used to calculate the occurrences of configured uplink grants.

When the configured uplink grant is released by upper layers, all the corresponding configurations shall be released and all corresponding uplink grants shall be cleared.

The MAC entity shall:

1> if at least one configured uplink grant confirmation has been triggered and not cancelled; and

1> if the MAC entity has UL resources allocated for new transmission:

2> if, in this MAC entity, at least one configured uplink grant is configured by *configuredGrantConfigToAddModList*:

3> instruct the Multiplexing and Assembly procedure to generate a Multiple Entry Configured Grant Confirmation MAC CE as defined in clause 6.1.3.31.

2> else:

3> instruct the Multiplexing and Assembly procedure to generate a Configured Grant Confirmation MAC CE as defined in clause 6.1.3.7.

2> cancel all triggered configured uplink grant confirmation(s).

For a configured grant Type 2, the MAC entity shall clear the configured uplink grant(s) immediately after first transmission of Configured Grant Confirmation MAC CE or Multiple Entry Configured Grant Confirmation MAC CE which confirms the configured uplink grant deactivation.

Retransmissions use:

- repetition of configured uplink grants; or

- received uplink grants addressed to CS-RNTI; or

- configured uplink grants with *cg-RetransmissionTimer* configured.

[TS 38.300, clause 10.3]

In the uplink, the gNB can dynamically allocate resources to UEs via the C-RNTI on PDCCH(s). A UE always monitors the PDCCH(s) in order to find possible grants for uplink transmission when its downlink reception is enabled (activity governed by DRX when configured). When CA is configured, the same C-RNTI applies to all serving cells.

The gNB may cancel a PUSCH transmission, or a repetition of a PUSCH transmission, or an SRS transmission of a UE for another UE with a latency-critical transmission. The gNB can configure UEs to monitor cancelled transmission indications using CI-RNTI on a PDCCH. If a UE receives the cancelled transmission indication, the UE shall cancel the PUSCH transmission from the earliest symbol overlapped with the resource or the SRS transmission overlapped with the resource indicated by cancellation (see clause 11.2A of TS 38.213 [38]).

In addition, with Configured Grants, the gNB can allocate uplink resources for the initial HARQ transmissions and HARQ retransmissions to UEs. Two types of configured uplink grants are defined:

- With Type 1, RRC directly provides the configured uplink grant (including the periodicity).

- With Type 2, RRC defines the periodicity of the configured uplink grant while PDCCH addressed to CS-RNTI can either signal and activate the configured uplink grant, or deactivate it; i.e. a PDCCH addressed to CS-RNTI indicates that the uplink grant can be implicitly reused according to the periodicity defined by RRC, until deactivated.

If the UE is not configured with enhanced intra-UE overlapping resources prioritization, the dynamically allocated uplink transmission overrides the configured uplink grant in the same serving cell, if they overlap in time. Otherwise an uplink transmission according to the configured uplink grant is assumed, if activated.

If the UE is configured with enhanced intra-UE overlapping resources prioritization, in case a configured uplink grant transmission overlaps in time with dynamically allocated uplink transmission or with another configured uplink grant transmission in the same serving cell, the UE prioritizes the transmission based on the comparison between the highest priority of the logical channels that have data to be transmitted and which are multiplexed or can be multiplexed in MAC PDUs associated with the overlapping resources. Similarly, in case a configured uplink grant transmissions or a dynamically allocated uplink transmission overlaps in time with a scheduling request transmission, the UE prioritizes the transmission based on the comparison between the priority of the logical channel which triggered the scheduling request and the highest priority of the logical channels that have data to be transmitted and which are multiplexed or can be multiplexed in MAC PDU associated with the overlapping resource. In case the MAC PDU associated with a deprioritized transmission has already been generated, the UE keeps it stored to allow the gNB to schedule a retransmission. The UE may also be configured by the gNB to transmit the stored MAC PDU as a new transmission using a subsequent resource of the same configured uplink grant configuration when an explicit retransmission grant is not provided by the gNB.

Retransmissions other than repetitions are explicitly allocated via PDCCH(s) or via configuration of a retransmission timer.

The UE may be configured with up to 12 active configured uplink grants for a given BWP of a serving cell. When more than one is configured, the network decides which of these configured uplink grants are active at a time (including all of them). Each configured uplink grant can either be of Type 1 or Type 2. For Type 2, activation and deactivation of configured uplink grants are independent among the serving cells. When more than one Type 2 configured grant is configured, each configured grant is activated separately using a DCI command and deactivation of Type 2 configured grants is done using a DCI command, which can either deactivate a single configured grant configuration or multiple configured grant configurations jointly.

When SUL is configured, the network should ensure that an active configured uplink grant on SUL does not overlap in time with another active configured uplink grant on the other UL configuration.

For both dynamic grant and configured grant, for a transport block, two or more repetitions can be in one slot, or across slot boundary in consecutive available slots with each repetition in one slot. For both dynamic grant and configured grant Type 2, the number of repetitions can be also dynamically indicated in the L1 signalling. The dynamically indicated number of repetitions shall override the RRC configured number of repetitions, if both are present.

7.1.1.6.5.3 Test description

7.1.1.6.5.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 and UM DRB should be established on NR Cell 1.

7.1.1.6.5.3.2 Test procedure sequence

Table 7.1.1.6.5.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits NR *RRCReconfiguration* messageto configure 2 UL configured grant type 1's . | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 2 | The UE transmits NR *RRCReconfigurationComplete* message. | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 3 | SS transmits a DL MAC PDU containing 6 RLC SDUs of size 96 bytes on UM DRB. (Note 1) | <-- | MAC PDU (six RLC SDUs) | - | - |
| 4 | Check: Does the UE transmit a MAC PDU containing first RLC SDU in Symbol ‘x0’, Slot y0’, SFN ‘z0’ after the SFN in step 3 wraps around?  Where  [(z0 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y0 × *numberOfSymbolsPerSlot*) + x0] = (9 × *numberOfSymbolsPerSlo*t + S + 0 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). (Note 2) | --> | MAC PDU (one RLC SDU) | 1 | P |
| 5 | Check: Does the UE transmit a MAC PDU containing second RLC SDU in Symbol ‘x1’, Slot y1’, SFN ‘z1’?  Where  [(z1 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y1 × *numberOfSymbolsPerSlot*) + x1] = (5 × *numberOfSymbolsPerSlo*t + S + 1 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 1 | P |
| 6 | Check: Does the UE transmit a MAC PDU containing third RLC SDU in Symbol ‘x0’, Slot y0’, SFN ‘z2’ after the SFN in step 6 wraps around?  Where  [(z2 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y0 × *numberOfSymbolsPerSlot*) + x0] = (5 × *numberOfSymbolsPerSlo*t + S + 0 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 2 | P |
| 7 | Check: Does the UE transmit a MAC PDU containing fourth RLC SDU in Symbol ‘x2’, Slot y2’, SFN ‘z2?  Where  [(z2 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y2 × *numberOfSymbolsPerSlot*) + x2] = (15 × *numberOfSymbolsPerSlo*t + S + 0 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 2 | P |
| 8 | Check: Does the UE transmit a MAC PDU containing fifth RLC SDU in Symbol ‘x1’, Slot y1’, SFN ‘z3’ after the SFN in step 8 wraps around?  Where  [(z3 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y3 × *numberOfSymbolsPerSlot*) + x3] = (5 × *numberOfSymbolsPerSlo*t + S + 1 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 2 | P |
| 9 | Check: Does the UE transmit a MAC PDU containing sixth RLC SDU in Symbol ‘x3’, Slot y3’, SFN ‘z3’?  Where  [(z3 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*) + (y3 × *numberOfSymbolsPerSlot*) + x3] = (15 × *numberOfSymbolsPerSlo*t + S + 1 × *periodicity*) modulo (1024 × *numberOfSlotsPerFrame* × *numberOfSymbolsPerSlot*). | --> | MAC PDU (one RLC SDU) | 2 | P |
| 10 | SS transmits NR *RRCReconfiguration* message to release configured UL configured grant type 1. | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 11 | The UE transmits NR *RRCReconfigurationComplete* message. | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| Note 1: According to the setting parameters in Table 7.1.1.6.2.3.3-2, TB size for configured grant type 1 is 808 bits, which is enough to allow the UE to transmit one PDU at a time (96 bytes RLC SDU + 1 byte UM RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding).  Note 2: S is the starting symbol relative to the slot of the first PUSCH transmission for new configured grant type 1. The value of S can be obtained from TS 38.508-1 [4], Table 4.6.3-122.  Note 3: q is the slot where the UE shall transmit the PUSCH and is determined by  as  where  is the slot with the scheduling DCI,  is based on the numerology of PUSCH. S is the starting symbol relative to the start of the slot q according to TS 38.214 clause 6.1.2.1.  Note 4: Void. | | | | | |

7.1.1.6.5.3.3 Specific message contents

Table 7.1.1.6.5.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.6.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | Not present |  |  |
| secondaryCellGroup | Not Present |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| dedicatedNAS-MessageList | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.6.5.3.3-2: *CellGroupConfig* (Table 7.1.1.6.5.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList | Not present |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig SEQUENCE { |  |  |  |
| cs-RNTI CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| RNTI-Value | ‘FFE0’H |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | Not present |  |  |
| reconfigurationWithSync | Not present |  |  |
| spCellConfigDedicated SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP SEQUENCE { |  |  |  |
| pucch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| schedulingRequestResourceToAddModList SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig { | 1 entry |  |  |
| SchedulingRequestResourceConfig[1] SEQUENCE { |  | entry 1 |  |
| schedulingRequestResourceId | 1 |  |  |
| schedulingRequestID | 0 |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl20 | 10 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| configuredGrantConfigToAddModList-r16 SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfig { | 2 entries |  |  |
| ConfiguredGrantConfig[1] SEQUENCE { |  | entry 1 |  |
| cg-DMRS-Configuration | DMRS-UplinkConfig | Reference TS 38.508-1[4], Table 4.6.3-51 |  |
| uci-OnPUSCH CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| semiStatic SEQUENCE { | BetaOffsets |  |  |
| betaOffsetACK-Index1 | 9 |  |  |
| betaOffsetACK-Index2 | 9 |  |  |
| betaOffsetACK-Index3 | 9 |  |  |
| betaOffsetCSI-Part1-Index1 | 6 |  |  |
| betaOffsetCSI-Part1-Index2 | 6 |  |  |
| betaOffsetCSI-Part2-Index1 | 6 |  |  |
| betaOffsetCSI-Part2-Index2 | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| resourceAllocation | ResourceAllocationType1 |  |  |
| powerControlLoopToUse | n0 |  |  |
| p0-PUSCH-Alpha | 1 |  |  |
| nrofHARQ-Processes | 16 |  |  |
| repK | n1 |  |  |
| periodicity | Sym160x14 |  | 15kHz |
| periodicity | Sym320x14 |  | 30kHz |
| periodicity | Sym640x14 |  | 60kHz |
| periodicity | Sym1280x14 |  | 120kHz |
| rrc-ConfiguredUplinkGrant SEQUENCE { |  |  |  |
| timeDomainOffset | 9 |  |  |
| timeDomainAllocation | 0 | Reference TS 38.508-1 [4], Table 4.6.3-122 |  |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | BIT STRING (SIZE(18), Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB = 2 PRB,  RBstart = 0,  NBWPsize is the size [PRBs] of the active carrier bandwidth part and contained in TS.38.508-1 [4] clause 4.3.1.1. | FR1\_FDD, FR1\_TDD |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | BIT STRING (SIZE(18), Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB=9 PRB,  RBstart = 0and  NBWPsize is the size [PRBs] of the active carrier bandwidth part and contained in TS.38.508-1 [4] clause 4.3.1.2. | FR2\_TDD |
| antennaPort | 0 |  |  |
| precodingAndNumberOfLayers | 0 |  |  |
| srs-ResourceIndicator | Not present |  |  |
| mcsAndTBS | 18 |  | FR1\_FDD, FR1\_TDD |
|  | 25 |  | FR2\_TDD |
| pathlossReferenceIndex | 0 |  |  |
| } |  |  |  |
| configuredGrantConfigIndex-r16 | 0 |  |  |
| } |  |  |  |
| ConfiguredGrantConfig[2] SEQUENCE { |  | entry 2 |  |
| cg-DMRS-Configuration | DMRS-UplinkConfig | Reference TS 38.508-1[4], Table 4.6.3-51 |  |
| uci-OnPUSCH CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| semiStatic SEQUENCE { | BetaOffsets |  |  |
| betaOffsetACK-Index1 | 9 |  |  |
| betaOffsetACK-Index2 | 9 |  |  |
| betaOffsetACK-Index3 | 9 |  |  |
| betaOffsetCSI-Part1-Index1 | 6 |  |  |
| betaOffsetCSI-Part1-Index2 | 6 |  |  |
| betaOffsetCSI-Part2-Index1 | 6 |  |  |
| betaOffsetCSI-Part2-Index2 | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| resourceAllocation | ResourceAllocationType1 |  |  |
| powerControlLoopToUse | n0 |  |  |
| p0-PUSCH-Alpha | 1 |  |  |
| nrofHARQ-Processes | 16 |  |  |
| repK | n1 |  |  |
| periodicity | Sym160x14 |  | 15kHz |
| periodicity | Sym320x14 |  | 30kHz |
| periodicity | Sym6400x14 |  | 60kHz |
| periodicity | Sym1280x14 |  | 120kHz |
| rrc-ConfiguredUplinkGrant SEQUENCE { |  |  |  |
| timeDomainOffset | 89 |  |  |
| timeDomainAllocation | 0 | Reference TS 38.508-1 [4], Table 4.6.3-122 |  |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | BIT STRING (SIZE(18), Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB = 2 PRB,  RBstart = 0,  NBWPsize is the size [PRBs] of the active carrier bandwidth part and contained in TS.38.508-1 [4] clause 4.3.1.1. | FR1\_FDD, FR1\_TDD |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | BIT STRING (SIZE(18), Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB=9 PRB,  RBstart = 0and  NBWPsize is the size [PRBs] of the active carrier bandwidth part and contained in TS.38.508-1 [4] clause 4.3.1.2. | FR2\_TDD |
| antennaPort | 0 |  |  |
| precodingAndNumberOfLayers | 0 |  |  |
| srs-ResourceIndicator | Not present |  |  |
| mcsAndTBS | 18 |  | FR1\_FDD, FR1\_TDD |
|  | 25 |  | FR2\_TDD |
| pathlossReferenceIndex | 0 |  |  |
| } |  |  |  |
| configuredGrantConfigIndex-r16 | 1 |  |  |
| } |  |  |  |
| } |  |  |  |
| pusch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| pusch-TimeDomainAllocationList CHOICE { |  |  |  |
| setup SEQUENCE { | 1 entry |  |  |
| PUSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k2 | n8 |  | FR1 and FR2 |
| mappingType | typeB |  |  |
| startSymbolAndLength | 0011011 | Start symbol(S)=0, Length(L)=14 | FR1 |
| startSymbolAndLength | 0001110 | S=0, L=2 | FR2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 7.1.1.7 Activation/Deactivation of SCells

##### 7.1.1.7.1 Activation/Deactivation of SCells / Activation/Deactivation MAC control element reception / sCellDeactivationTimer

###### 7.1.1.7.1.1 Activation/Deactivation of SCells / Activation/Deactivation MAC control element reception / sCellDeactivationTimer / Intra-band Contiguous CA

7.1.1.7.1.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with SCell configured }

**ensure that** {

**when** { UE receives an SCell Activation/Deactivation MAC CE activating the Scell }

**then** { UE starts monitoring PDCCH on activated SCell }

}

(2)

**with**( UE in RRC\_CONNECTED state with SCell activated )

**ensure that** {

**when**{ UE receives a DL assignment on SCell PDCCH }

**then** { UE restarts the sCellDeactivationTimer }

}

(3)

**with** ( UE in RRC\_CONNECTED state with SCell activated )

**ensure that** {

**when**{ UE sCellDeactivationTimer expires }

**then** { UE deactivates the SCell and stops monitoring PDCCH on SCell }

}

(4)

**with** ( UE in RRC\_CONNECTED state with SCell activated )

**ensure that** {

**when**{ UE receives a SCell Activation/Deactivation MAC CE deactivating the SCell }

**then** { UE deactivates the SCell and stops monitoring PDCCH on SCell }

}

(5)

**with**( UE in RRC\_CONNECTED state with SCell activated and UL CA is supported )

**ensure that** {

**when**{ UE receives a UL assignment on SCell and has data available for transmission }

**then** { UE transmits the UL MAC PDU }

}

7.1.1.7.1.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clauses 5.9 and TS 38.331 clause 5.3.5.5.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.9]

If the MAC entity is configured with one or more SCells, the network may activate and deactivate the configured SCells. Upon configuration of an SCell, the SCell is deactivated.

The configured SCell(s) is activated and deactivated by:

- receiving the SCell Activation/Deactivation MAC CE described in subclause 6.1.3.10;

- configuring *sCellDeactivationTimer* timer per configured SCell (except the SCell configured with PUCCH, if any): the associated SCell is deactivated upon its expiry.

The MAC entity shall for each configured SCell:

1> if an SCell Activation/Deactivation MAC CE is received activating the SCell:

2> activate the SCell according to the timing defined in TS 38.213 [6]; i.e. apply normal SCell operation including:

3> SRS transmissions on the SCell;

3> CSI reporting for the SCell;

3> PDCCH monitoring on the SCell;

3> PDCCH monitoring for the SCell;

3> PUCCH transmissions on the SCell, if configured.

2> start or restart the *sCellDeactivationTimer* associated with the SCell in the slot when the SCell Activation/Deactivation MAC CE was received;

2> (re-)initialize any suspended configured uplink grants of configured grant Type 1 associated with this SCell according to the stored configuration, if any, and to start in the symbol according to rules in subclause 5.8.2;

2> trigger PHR according to subclause 5.4.6.

1> else if an SCell Activation/Deactivation MAC CE is received deactivating the SCell; or

1> if the *sCellDeactivationTimer* associated with the activated SCell expires:

2> deactivate the SCell according to the timing defined in TS 38.213 [6];

2> stop the *sCellDeactivationTimer* associated with the SCell;

2> stop the *bwp-InactivityTimer* associated with the SCell;

2> clear any configured downlink assignment and any configured uplink grant Type 2 associated with the SCell respectively;

2> suspend any configured uplink grant Type 1 associated with the SCell;

2> flush all HARQ buffers associated with the SCell.

1> if PDCCH on the activated SCell indicates an uplink grant or downlink assignment; or

1> if PDCCH on the Serving Cell scheduling the activated SCell indicates an uplink grant or a downlink assignment for the activated SCell; or

1> if a MAC PDU is transmitted in a configured uplink grant or received in a configured downlink assignment:

2> restart the *sCellDeactivationTimer* associated with the SCell.

1> if the SCell is deactivated:

2> not transmit SRS on the SCell;

2> not report CSI for the SCell;

2> not transmit on UL-SCH on the SCell;

2> not transmit on RACH on the SCell;

2> not monitor the PDCCH on the SCell;

2> not monitor the PDCCH for the SCell;

2> not transmit PUCCH on the SCell.

HARQ feedback for the MAC PDU containing SCell Activation/Deactivation MAC CE shall not be impacted by PCell, PSCell and PUCCH SCell interruptions due to SCell activation/deactivation in TS 38.133 [11].

When SCell is deactivated, the ongoing Random Access procedure on the SCell, if any, is aborted.

[TS 38.321, clause 6.1.3.10]

The SCell Activation/Deactivation MAC CE of one octet is identified by a MAC PDU subheader with LCID as specified in Table 6.2.1-1. It has a fixed size and consists of a single octet containing seven C-fields and one R-field. The SCell Activation/Deactivation MAC CE with one octet is defined as follows (Figure 6.1.3.10-1).

The SCell Activation/Deactivation MAC CE of four octets is identified by a MAC PDU subheader with LCID as specified in Table 6.2.1-1. It has a fixed size and consists of four octets containing 31 C-fields and one R-field. The SCell Activation/Deactivation MAC CE of four octets is defined as follows (Figure 6.1.3.10-2).

For the case with no Serving Cell with a *ServCellIndex* as specified in TS 38.331 [8] larger than 7, SCell Activation/Deactivation MAC CE of one octet is applied, otherwise SCell Activation/Deactivation MAC CE of four octets is applied.

- Ci: If there is an SCell configured for the MAC entity with *SCellIndex* i as specified in TS 38.331 [8], this field indicates the activation/deactivation status of the SCell with *SCellIndex* i, else the MAC entity shall ignore the Ci field. The Ci field is set to "1" to indicate that the SCell with *SCellIndex* i shall be activated. The Ci field is set to "0" to indicate that the SCell with *SCellIndex* i shall be deactivated;

- R: Reserved bit, set to "0".



Figure 6.1.3.10-1: SCell Activation/Deactivation MAC CE of one octet



Figure 6.1.3.10-2: SCell Activation/Deactivation MAC CE of four octets

7.1.1.7.1.1.3 Test description

7.1.1.7.1.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that DRB is configured in RLC AM mode according to Table 7.1.1. 7.1.1.3.1-1 and in additionNR Cell 3 is configured as NR Active SCell.

Table 7.1.1. 7.1.1.3.1-1: RLC parameters

|  |  |
| --- | --- |
| *t-PollRetransmit* | ms80 |

7.1.1.7.1.1.3.2 Test procedure sequence

Table 7.1.1.7.1.1.3.2-1: Time instances of cell power level and parameter changes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 3** |
| T0 | SS/PBCH SSS EPRE | dBm/SCS | -85 | -85 |

Table 7.1.1.7.1.1.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | SS transmits an RRCReconfiguration message toconfigure NR SCell(NR Cell 3). Note 1 | <-- | (RRCReconfiguration) | - | - |
| 2 | The UE transmits RRCReconfigurationComplete message. Note 2 | --> | (RRCReconfigurationComplete) | - | - |
| 3 | The SS transmits Activation MAC control element to activate NR SCell on NR SpCell. | <-- | MAC PDU (SCell Activation/Deactivation MAC CE of one octet (C1=1)) | - | - |
| 4 | 200 ms after step 3, the SS indicates a new transmission on PDCCH of SCell and transmits a MAC PDU (containing an RLC PDU). | <-- | MAC PDU | - | - |
| 5 | Check: Does the UE transmit a Scheduling Request on PUCCH? | --> | (SR) | 1 | P |
| 6 | The SS sends an UL grant suitable for transmitting loop back PDU on NR SpCell. | <-- | (UL Grant) | - | - |
| 7 | The UE transmits a MAC PDU containing the loop back PDU corresponding to step 4. | --> | MAC PDU | - | - |
| 8 | The SS transmits a MAC PDU containing RLC status PDU acknowledging reception of RLC PDU in step 7 on NR SpCell. | <-- | MAC PDU | - | - |
| 9 | 400 ms(sCellDeactivationTimer = 320 ms) after step 4, the SS indicates a new transmission on PDCCH of NR SCell and transmits a MAC PDU (containing an RLC PDU). | <-- | MAC PDU | - | - |
| 10 | Check: Does the UE transmit a Scheduling Request on PUCCH in next 1 second? | --> | (SR) | 3 | F |
| 11 | The SS transmits Activation MAC control element to activate SCell on NR SpCell. | <-- | MAC PDU ((SCell Activation/Deactivation MAC CE of one octet (C1=1)) | - | - |
| 12 | 200 ms after step 11 The SS indicates a new transmission on PDCCH of NR SCell and transmits a MAC PDU (containing just padding or RLC status PDU, but no RLC data PDU). | <-- | MAC PDU | - | - |
| 13 | 400 ms after step 11 the SS indicates a new transmission on PDCCH of NR SCell and transmits a MAC PDU (containing an RLC PDU). | <-- | MAC PDU | - | - |
| 14 | Check: Does the UE transmit a Scheduling Request on PUCCH on NR SpCell? | --> | (SR) | 1,2 | P |
| 15 | The SS sends an UL grant suitable for transmitting loop back PDU IF (pc\_UL\_NR\_CA\_2CC for NR or pc\_EN\_DC\_NR\_UL\_2CC for EN-DC) on NR SCell ELSE the SS sends an UL grant suitable for transmitting loop back PDU on NR SpCell. | <-- | (UL Grant) | - | - |
| 16 | The UE transmits a MAC PDU containing the loop back PDU corresponding to step 13 IF (pc\_UL\_NR\_CA\_2CC for NR or pc\_EN\_DC\_NR\_UL\_2CC for EN-DC) on NR SCell ELSE on NR SpCell. | --> | MAC PDU | 5 | P |
| 17 | The SS transmits a MAC PDU containing RLC status PDU acknowledging reception of RLC PDU in step 16 IF (pc\_UL\_NR\_CA\_2CC for NR or pc\_EN\_DC\_NR\_UL\_2CC for EN-DC) on NR SCell ELSE on NR SpCell. | <-- | MAC PDU | - | - |
| 18 | The SS transmits Deactivation MAC control element to de-activate SCell on NR SpCell. | <-- | MAC PDU (SCell Activation/Deactivation MAC CE of one octet (C1=0)) | - | - |
| 19 | The SS indicates a new transmission on PDCCH of NR SCell and transmits a MAC PDU (containing an RLC PDU). | <-- | MAC PDU | - | - |
| 20 | Check: Does the UE transmit a Scheduling Request on PUCCH in the next 1 second? | --> | (SR) | 4 | F |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete.* | | | | | |

7.1.1.7.1.1.3.3 Specific message contents

Table 7.1.1.7.1.1.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.7.1.1.3.2-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| secondaryCellGroup | | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { | |  |  | NR |
| masterCellGroup | | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.7.1.1.3.3-2: CellGroupConfig (Table 7.1.1.7.1.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { | |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxMeasId)) OF SCellConfig { | | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { | |  | entry 1 |  |
| sCellIndex | | SCellIndex as per TS 38.508-1 [4] table 4.6.3-154 |  |  |
| sCellConfigCommon | | ServingCellConfigCommon |  |  |
| sCellConfigDedicated | | ServingCellConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.7.1.1.3.3-3: ServingCellConfigCommon (Table 7.1.1.7.1.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| physCellId | Physical Cell Identity of NR Cell 3 |  |  |
| uplinkConfigCommon | Not present |  | Not pc\_UL\_NR\_CA\_2CC for NR or Not pc\_EN\_DC\_NR\_UL\_2CC for EN-DC |
|  | UplinkConfigCommon as per TS 38.508-1 [4] table 4.6.3-201 |  | pc\_UL\_NR\_CA\_2CC for NR5GC or Not pc\_EN\_DC\_NR\_UL\_2CC for EN-DC |
| } |  |  |  |

Table 7.1.1.7.1.1.3.3-4: ServingCellConfig (Table 7.1.1.7.1.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig | Not present |  | Not pc\_UL\_NR\_CA\_2CC for NR or Not pc\_EN\_DC\_NR\_UL\_2CC for EN-DC |
| uplinkConfig SEQUENCE { |  |  | pc\_UL\_NR\_CA\_2CC for NR or Not pc\_EN\_DC\_NR\_UL\_2CC for EN-DC |
| initialUplinkBWP | BWP-UplinkDedicated |  |  |
| } |  |  |  |
| sCellDeactivationTimer | ms320 |  |  |
| } |  |  |  |

Table 7.1.1.7.1.1.3.3-5: BWP-UplinkDedicated (Table 7.1.1.7.1.1.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkDedicated ::= SEQUENCE { |  |  |  |
| pucch-Config | Not present |  |  |
| } |  |  |  |

Table 7.1.1.7.1.1.3.3-6: BWP-UplinkCommon (Table 7.1.1.7.1.1.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| pucch-ConfigCommon | Not present |  |  |
| } |  |  |  |

###### 7.1.1.7.1.2 Activation/Deactivation of SCells / Activation/Deactivation MAC control element reception / sCellDeactivationTimer / Inter-Band CA

The scope and description of the present TC is the same as test case 7.1.1.7.1.1 with the following differences:

- CA configuration: Inter-band CA replaces Intra-band Contiguous CA

- Cells configuration: NR Cell 10 replaces NR Cell 3

###### 7.1.1.7.1.3 Activation/Deactivation of SCells / Activation/Deactivation MAC control element reception / sCellDeactivationTimer / Intra-band non-Contiguous CA

The scope and description of the present TC is the same as test case 7.1.1.7.1.1 with the following differences:

- CA configuration: Intra-band non-Contiguous CA replaces Intra-band Contiguous CA

- pc\_UL\_NR\_CA\_2CC or pc\_EN\_DC\_NR\_UL\_2CC in specific message content is replaced by pc\_UL\_intra\_non\_contiguous\_CA\_NR\_FR1\_Class\_(2A) for FR1 or pc\_UL\_intra\_non\_contiguous\_CA\_NR\_FR2\_Class\_(2A) for FR2

#### 7.1.1.8 Bandwidth Part (BWP) operation

##### 7.1.1.8.1 Bandwidth Part (BWP) operation UL/DL

Editors Note: Test case is only applicable to NR FR1 TDD bands and is FFS for NR FR1 FDD and NR FR2 bands due to open issues and alignment with respective PICS.

7.1.1.8.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives BandwidthPart-Config IE included in RRC Message received on SpCell (i.e. PSCell in case of EN-DC or PCell in case of SA) }

**then** { UE starts normal MAC operation in the FirstActive UL and DL Bandwidth part }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a DL DCI format 1\_1 assigning a BWP different than the previously configured BWP }

**then** { UE starts normal MAC operation in the received new BWP }

}

(3)

**with** { UE in RRC\_CONNECTED }

**ensure that** {

**when** { UE receives a UL DCI format 0\_1 assigning a BWP different than the previously configured BWP }

**then** { UE starts normal MAC operation in the received new BWP }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE determines that a RACH Procedure is triggered in SpCell (i.e. PSCell in case of EN-DC or PCell in case of SA) and PRACH occasions are not configured }

**then** { UE initiates the PRACH procedure in the initial BWP }

}

(5)

**with** { UE in RRC\_Connected State with defaultDownlinkBWP configured }

**ensure that** {

**when** { UE bwp-InactivityTimer expires }

**then** { UE performs BWP switching to a BWP indicated by the defaultDownlinkBWP }

}

(6)

**with** { UE in RRC\_Connected State with defaultDownlinkBWP configured and Active BWP is different than defaultDownlinkBWP and bwp-InactivityTimer is running }

**ensure that** {

**when** { UE receives UL assignment or DL grant addressed to its C-RNTI }

**then** { UE restarts the bwp-InactivityTimer }

}

7.1.1.8.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.211 clause 4.4.5, TS 38.212 clause 7.3.1.1.2 and 7.3.1.2.2, TS 38.321 clause 5.15 and TS 38.331 clause 5.3.5.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.211, clause 4.4.5]

A bandwidth part is a subset of contiguous common resource blocks defined in subclause 4.4.4.3 for a given numerology  in bandwidth part  on a given carrier. The starting position  and the number of resource blocks  in a bandwidth part shall fulfil  and , respectively. Configuration of a bandwidth part is described in clause 12 of [5, TS 38.213].

A UE can be configured with up to four bandwidth parts in the downlink with a single downlink bandwidth part being active at a given time. The UE is not expected to receive PDSCH, PDCCH, or CSI-RS (except for RRM) outside an active bandwidth part.

A UE can be configured with up to four bandwidth parts in the uplink with a single uplink bandwidth part being active at a given time. If a UE is configured with a supplementary uplink, the UE can in addition be configured with up to four bandwidth parts in the supplementary uplink with a single supplementary uplink bandwidth part being active at a given time. The UE shall not transmit PUSCH or PUCCH outside an active bandwidth part. For an active cell, the UE shall not transmit SRS outside an active bandwidth part.

Unless otherwise noted, the description in this specification applies to each of the bandwidth parts. When there is no risk of confusion, the index may be dropped from , , , and .

[TS 38.212, clause 7.3.1.1.2]

DCI format 0\_1 is used for the scheduling of PUSCH in one cell.

The following information is transmitted by means of the DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bit

- The value of this bit field is always set to 0, indicating an UL DCI format

- Carrier indicator – 0 or 3 bits, as defined in Subclause 10.1 of [5, TS 38.213].

- UL/SUL indicator – 0 bit for UEs not configured with SUL in the cell or UEs configured with SUL in the cell but only PUCCH carrier in the cell is configured for PUSCH transmission; 1 bit for UEs configured with SUL in the cell as defined in Table 7.3.1.1.1-1.

- Bandwidth part indicator – 0, 1 or 2 bits as determined by the number of UL BWPs  configured by higher layers, excluding the initial UL bandwidth part. The bitwidth for this field is determined as bits, where

-  if , in which case the bandwidth part indicator is equivalent to the ascending order of the higher layer parameter *BWP-Id*;

- otherwise , in which case the bandwidth part indicator is defined in Table 7.3.1.1.2-1;

If a UE does not support active BWP change via DCI, the UE ignores this bit field.

[TS 38.212, clause 7.3.1.2.2]

DCI format 1\_1 is used for the scheduling of PDSCH in one cell.

The following information is transmitted by means of the DCI format 1\_1 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

- Identifier for DCI formats – 1 bits

- The value of this bit field is always set to 1, indicating a DL DCI format

- Carrier indicator – 0 or 3 bits as defined in Subclause 10.1 of [5, TS 38.213].

- Bandwidth part indicator – 0, 1 or 2 bits as determined by the number of DL BWPs  configured by higher layers, excluding the initial DL bandwidth part. The bitwidth for this field is determined as bits, where

-  if , in which case the bandwidth part indicator is equivalent to the higher layer parameter *BWP-Id*;

- otherwise , in which case the bandwidth part indicator is defined in Table 7.3.1.1.2-1;

If a UE does not support active BWP change via DCI, the UE ignores this bit field.

[TS 38.321, clause 5.15]

In addition to clause 12 of TS 38.213 [6], this subclause specifies requirements on BWP operation.

A Serving Cell may be configured with one or multiple BWPs, and the maximum number of BWP per Serving Cell is specified in TS 38.213 [6].

The BWP switching for a Serving Cell is used to activate an inactive BWP and deactivate an active BWP at a time. The BWP switching is controlled by the PDCCH indicating a downlink assignment or an uplink grant, by the *bwp-InactivityTimer*, by RRC signalling, or by the MAC entity itself upon initiation of Random Access procedure. Upon RRC (re-)configuration of *firstActiveDownlinkBWP-Id* and/or *firstActiveUplinkBWP-Id* for SpCell or activation of an SCell, the DL BWP and/or UL BWP indicated by *firstActiveDownlinkBWP-Id* and/or *firstActiveUplinkBWP-Id* respectively (as specified in TS 38.331 [5]) is active without receiving PDCCH indicating a downlink assignment or an uplink grant. The active BWP for a Serving Cell is indicated by either RRC or PDCCH (as specified in TS 38.213 [6]). For unpaired spectrum, a DL BWP is paired with a UL BWP, and BWP switching is common for both UL and DL.

For each activated Serving Cell configured with a BWP, the MAC entity shall:

1> if a BWP is activated:

2> transmit on UL-SCH on the BWP;

2> transmit on RACH on the BWP, if PRACH occasions are configured;

2> monitor the PDCCH on the BWP;

2> transmit PUCCH on the BWP, if configured;

2> report CSI for the BWP;

2> transmit SRS on the BWP, if configured;

2> receive DL-SCH on the BWP;

2> (re-)initialize any suspended configured uplink grants of configured grant Type 1 on the active BWP according to the stored configuration, if any, and to start in the symbol according to rules in subclause 5.8.2.

1> if a BWP is deactivated:

2> not transmit on UL-SCH on the BWP;

2> not transmit on RACH on the BWP;

2> not monitor the PDCCH on the BWP;

2> not transmit PUCCH on the BWP;

2> not report CSI for the BWP;

2> not transmit SRS on the BWP;

2> not receive DL-SCH on the BWP;

2> clear any configured downlink assignment and configured uplink grant of configured grant Type 2 on the BWP;

2> suspend any configured uplink grant of configured grant Type 1 on the inactive BWP.

Upon initiation of the Random Access procedure on a Serving Cell, after the selection of carrier for performing Random Access procedure as specified in subclause 5.1.1, the MAC entity shall for the selected carrier of this Serving Cell:

1> if PRACH occasions are not configured for the active UL BWP:

2> switch the active UL BWP to BWP indicated by *initialUplinkBWP*;

2> if the Serving Cell is a SpCell:

3> switch the active DL BWP to BWP indicated by *initialDownlinkBWP*.

1> else:

2> if the Serving Cell is a SpCell:

3> if the active DL BWP does not have the same *bwp-Id* as the active UL BWP:

4> switch the active DL BWP to the DL BWP with the same *bwp-Id* as the active UL BWP.

1> stop the *bwp-InactivityTimer* associated with the active DL BWP of this Serving Cell, if running.

1> if the Serving Cell is SCell:

2> stop the *bwp-InactivityTimer* associated with the active DL BWP of SpCell, if running.

1> perform the Random Access procedure on the active DL BWP of SpCell and active UL BWP of this Serving Cell.

If the MAC entity receives a PDCCH for BWP switching of a Serving Cell, the MAC entity shall:

1> if there is no ongoing Random Access procedure associated with this Serving Cell; or

1> if the ongoing Random Access procedure associated with this Serving Cell is successfully completed upon reception of this PDCCH addressed to C-RNTI (as specified in subclauses 5.1.4 and 5.1.5):

2> perform BWP switching to a BWP indicated by the PDCCH.

If the MAC entity receives a PDCCH for BWP switching for a Serving Cell while a Random Access procedure associated with that Serving Cell is ongoing in the MAC entity, it is up to UE implementation whether to switch BWP or ignore the PDCCH for BWP switching, except for the PDCCH reception for BWP switching addressed to the C-RNTI for successful Random Access procedure completion (as specified in subclauses 5.1.4 and 5.1.5) in which case the UE shall perform BWP switching to a BWP indicated by the PDCCH. Upon reception of the PDCCH for BWP switching other than successful contention resolution, if the MAC entity decides to perform BWP switching, the MAC entity shall stop the ongoing Random Access procedure and initiate a Random Access procedure after performing the BWP switching; if the MAC decides to ignore the PDCCH for BWP switching, the MAC entity shall continue with the ongoing Random Access procedure on the Serving Cell.

Upon reception of RRC (re-)configuration for BWP switching for a Serving Cell while a Random Access procedure associated with that Serving Cell is ongoing in the MAC entity, the MAC entity shall stop the ongoing Random Access procedure and initiate a Random Access procedure after performing the BWP switching.

The MAC entity shall for each activated Serving Cell configured with *bwp-InactivityTimer*:

1> if the *defaultDownlinkBWP-Id* is configured, and the active DL BWP is not the BWP indicated by the *defaultDownlinkBWP-Id*; or

1> if the *defaultDownlinkBWP-Id* is not configured, and the active DL BWP is not the *initialDownlinkBWP*:

2> if a PDCCH addressed to C-RNTI or CS-RNTI indicating downlink assignment or uplink grant is received on the active BWP; or

2> if a PDCCH addressed to C-RNTI or CS-RNTI indicating downlink assignment or uplink grant is received for the active BWP; or

2> if a MAC PDU is transmitted in a configured uplink grant or received in a configured downlink assignment:

3> if there is no ongoing random access procedure associated with this Serving Cell; or

3> if the ongoing Random Access procedure associated with this Serving Cell is successfully completed upon reception of this PDCCH addressed to C-RNTI (as specified in subclauses 5.1.4 and 5.1.5):

4> start or restart the *bwp-InactivityTimer* associated with the active DL BWP.

2> if the *bwp-InactivityTimer* associated with the active DL BWP expires:

3> if the *defaultDownlinkBWP-Id* is configured:

4> perform BWP switching to a BWP indicated by the *defaultDownlinkBWP-Id*.

3> else:

4> perform BWP switching to the *initialDownlinkBWP*.

NOTE: If a Random Access procedure is initiated on an SCell, both this SCell and the SpCell are associated with this Random Access procedure.

1> if a PDCCH for BWP switching is received, and the MAC entity switches the active DL BWP:

2> if the *defaultDownlinkBWP-Id* is configured, and the MAC entity switches to the DL BWP which is not indicated by the *defaultDownlinkBWP-Id*; or

2> if the *defaultDownlinkBWP-Id* is not configured, and the MAC entity switches to the DL BWP which is not the *initialDownlinkBWP*:

3> start or restart the *bwp-InactivityTimer* associated with the active DL BWP.

[TS 38.331, clause 5.2.1]

System Information (SI) is divided into the *MIB* and a number of SIBs where:

- ...

- For a UE in RRC\_CONNECTED, the network can provide system information through dedicated signalling using the *RRCReconfiguration* message, e.g. if the UE has an active BWP with no common search space configured to monitor system information or paging.

- For PSCell and SCells, the network provides the required SI by dedicated signalling, i.e. within an *RRCReconfiguration* message. Nevertheless, the UE shall acquire MIB of the PSCell to get SFN timing of the SCG (which may be different from MCG). Upon change of relevant SI for SCell, RAN releases and adds the concerned SCell. For PSCell, SI can only be changed with Reconfiguration with Sync.

NOTE: The physical layer imposes a limit to the maximum size a SIB can take. The maximum *SIB1* or *SI message* size is 2976 bits.

[TS 38.331, clause 5.3.5.3]

The UE shall perform the following actions upon reception of the *RRCReconfiguration*:

...

1> if the UE is configured with E-UTRA *nr-SecondaryCellGroupConfig* (MCG is E-UTRA):

2> if *RRCReconfiguration* was received via SRB1:

3> submit the *RRCReconfigurationComplete* via the EUTRA MCG embedded in E-UTRA RRC message *RRCConnectionReconfigurationComplete* as specified in TS 36.331 [10];

3> if reconfigurationWithSync was included in spCellConfig of an SCG:

4> initiate the random access procedure on the SpCell, as specified in TS 38.321 [3];

...

NOTE: For EN-DC, in the case *RRCReconfiguration* is received via SRB1, the random access is triggered by RRC layer itself as there is not necessarily other UL transmission. In the case *RRCReconfiguration* is received via SRB3, the random access is triggered by the MAC layer due to arrival of *RRCReconfigurationComplete*.

7.1.1.8.1.3 Test description

7.1.1.8.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0.

7.1.1.8.1.3.2 Test procedure sequence

Table 7.1.1.8.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |
| 0 | The SS transmits RRCReconfiguration to configure the dedicated BWPs incl. the FirstActive BWP. (Note 1) (Note 4). | <-- | *RRCReconfiguration* | - | - |
| - | EXCEPTION: Steps 0Aa1 to 0Ab2 describe behaviour which depends on procedure parameters; the "lower case letter" identifies a step sequence that take place if a procedure parameter has a particular value. | - | - | - | - |
| 0Aa1 | IF *Connectivity* is *EN-DC* or *NGEN-DC*, the UE sends RRCReconfigurationComplete (Note 2). | --> | *RRCReconfigurationComplete* | - | - |
| 0Ab1 | IF *Connectivity* is *NR*, the SS allocates (transmitted in FirstActiveDownlinkBWP) an UL Grant with DCI format 0\_1 indicating FirstActiveUplinkBWP (BWP#1). | <-- | UL Grant | - | - |
| 0Ab2 | Check: Does the UE send RRCReconfigurationComplete in the FirstActive BWP configured? Note 3 (Note 5) | --> | *(RRCReconfigurationComplete)* | 1 | P |
| 1 | The SS transmits a valid MAC PDU containing RLC PDU in the configured FirstActive Downlink BWP configured. | <-- | MAC PDU | - | - |
| 2 | After 100ms from step 1, the SS allocates (transmitted in FirstActiveDownlinkBWP) an UL Grant. | <-- | UL Grant | - | - |
| 3 | Check: Does the UE transmit a MAC PDU including one RLC SDU in the FirstActive BWP configured? (Note 5) | --> | MAC PDU | 1 | P |
| 3A | SS transmits a MAC PDU containing an RLC STATUS PDU acknowledging the reception of the AMD PDU in step 3. | <-- | MAC PDU (RLC STATUS PDU) | - | - |
| 4 | Void | - | - | - | - |
| 5 | The SS indicates on PDCCH (transmitted in Downlink BWP#1) DL DCI format 1\_1 with new BWP Id (IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD THEN BWP #0 ELSE IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD THEN = BWP #2) and transmits a MAC PDU containing RLC PDU on the newly configured BWP (i.e. IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD THEN Downlink BWP#0 ELSE IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD THEN Downlink BWP#2). | <-- | MAC PDU | - | - |
| 6 | After 100ms from step 5, the SS allocates (transmitted in Downlink BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD ELSE in Downlink BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD) an UL Grant (with DCI indicating BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD; ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD), sufficient for loopback of the RLC SDU from step 5 in a Slot. (Note 3) | <-- | UL Grant | - | - |
| 7 | Check: Does the UE transmit a MAC PDU including one RLC SDU in the configured BWP (i.e. Uplink BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD)? (Note 5) | --> | MAC PDU | 2 | P |
| 7A | SS transmits a MAC PDU containing an RLC STATUS PDU acknowledging the reception of the AMD PDU in step 7. | <-- | MAC PDU (RLC STATUS PDU) | - |  |
| 8 | Void | - | - | - | - |
| 9 | The SS transmits a valid MAC PDU containing RLC PDU in the configured BWP (i.e. Downlink BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD; ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD). | <-- | MAC PDU | - | - |
| 10 | After 100ms from step 9 the SS indicates on PDCCH (transmitted in Downlink BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD) UL DCI format 0\_1 with new BWP Id (=IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD, THEN BWP #3 ELSE IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD THEN BWP #1) and allocates an UL Grant, sufficient for loopback of the RLC SDU from step 9 in a Slot. | <-- | UL Grant | - | - |
| 11 | Check: Does the UE transmit a MAC PDU including one RLC SDU in the configured BWP (i.e. (IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD, THEN BWP #3 ELSE IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD THEN BWP #1, for FDD and for TDD)? (Note 5) | --> | MAC PDU | 3 | P |
| 11AA | SS transmits a MAC PDU containing an RLC STATUS PDU acknowledging the reception of the AMD PDUs in step 11. | <-- | MAC PDU (RLC STATUS PDU) | - | - |
| 11A | The SS transmits a valid MAC PDU containing RLC PDU in the configured BWP (IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD, THEN BWP #3 ELSE IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD THEN BWP #1 for TDD and for FDD). | <-- | MAC PDU | - | - |
| 12 | After 100ms from step 11A the SS indicates PDCCH order on CSS for contention-based random access (transmitted in Downlink BWP (IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD, THEN BWP #3 ELSE IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD THEN BWP #1 for TDD and for FDD). | <-- | PDCCH Order  (ra-PreambleIndex = '000000'B) | - | - |
| 13 | Check: Does the UE send PRACH Preamble in the initial BWP (UL BWP#0)? | --> | PRACH Preamble | 4 | P |
| 13A | The SS transmits (in Downlink BWP #0) a MAC PDU addressed to UE RA-RNTI, containing RAR with matching RAPID in MAC sub header. | <-- | Random Access Response | - | - |
| 13B | The UE sends (in UL BWP#0) a msg3 in the grant associated to the received Random Access Response. | --> | msg3 (C-RNTI MAC CONTROL ELEMENT) | - | - |
| 13C | SS schedules (in Downlink BWP#0) PDCCH transmission for UE C-RNTI and allocates UL grant sufficient for the UE to loop back the data received at step 11A. | <-- | Contention Resolution | - | - |
| 13D | Check: Does the UE transmit a MAC PDU including one RLC SDU in the initial BWP (i.e. Uplink BWP#0)? (Note 5) | --> | MAC PDU | 4 | P |
| 13E | SS transmits a MAC PDU containing an RLC STATUS PDU acknowledging the reception of the AMD PDU in step 13D. | <-- | MAC PDU (RLC STATUS PDU) | - |  |
| 14-15 | Void | - | *-* | - | - |
| 16 | The SS indicates on PDCCH (transmitted in Downlink BWP#0) DL DCI format 1\_1 with BWP Id (= BWP #1) and transmits a MAC PDU containing RLC PDU on the configured BWP (i.e. Downlink BWP#1). | <-- | *MAC PDU* | - | - |
| 17 | After 200 ms from step 16, the SS transmits another valid MAC PDU containing RLC PDU in the active BWP (i.e. Downlink BWP#1). | <-- | *MAC PDU* | - | - |
| 18 | After 200 ms from step 17, the SS allocates (transmitted in Downlink BWP#1) an UL Grant (with DCI indicating BWP#1), sufficient for loopback of a MAC PDU containing both RLC SDUs from steps 16 and 17 in a Slot. (Note 3) | <-- | *UL Grant* | - | - |
| 19 | Check: Does the UE transmit a MAC PDU containing both RLC SDUs in the active BWP (i.e. Uplink BWP#1)? (Note 5) | --> | *MAC PDU* | 6 | P |
| 19A | SS transmits a MAC PDU containing an RLC STATUS PDU acknowledging the reception of the AMD PDU in step 19. | <-- | MAC PDU (RLC STATUS PDU) | - |  |
| 20 | The SS waits 1000 ms from step 18 to ensure that the bwp-InactivityTimer expired and then transmits a valid MAC PDU containing RLC PDU in the BWP with defaultDownlinkBWP-Id (= Downlink BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD). | <-- | MAC PDU | - | - |
| 21 | The SS allocates (transmitted in the defaultDownlinkBWP, i.e. Downlink BWP#2) an UL Grant (with DCI indicating BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD), sufficient for loopback of the RLC SDU from step 20 in a Slot. (Note 3) | <-- | UL Grant | - | - |
| 22 | Check: Does the UE transmit a MAC PDU in Uplink BWP#2 IF pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD ELSE BWP#0 IF pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD (= BWP Id of the defaultDownlinkBWP)? (Note 5) | --> | MAC PDU | 5 | P |
| 22A | SS transmits a MAC PDU containing an RLC STATUS PDU acknowledging the reception of the AMD PDU in step 22. | <-- | MAC PDU (RLC STATUS PDU) | - |  |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete*.  Note 3: In paired spectrum (= FDD), the switching of Downlink BWP and Uplink BWP can happen independently. Whereas in TDD, the switching of BWP for Downlink and Uplink is always at the same time instance. Currently, the scope of the Test Purposes (TP) is considered to not cover checking of a BWP deviation which results from non-synchronized Downlink and Uplink BWP switching in FDD.  Note 4: After the preamble the UE is in RRC\_CONNECTED, therefore SRBs and DRBs are already established. The RRCReconfiguration message in step 0 shall not contain any elements like e.g. "rlc-BearerToAddModList" whose value(s) remain unchanged since the preamble. The sole purpose of the RRCReconfiguration message in step 0 is to configure BWPs and related fields for switching of BWPs.  Note 5: When the UE does not use the expected BWP for the UL transmission the SS shall not receive the data what implicitly fails the test case. | | | | | |

7.1.1.8.1.3.3 Specific message contents

Table 7.1.1.8.1.3.3-0: Conditions for specific message contents

|  |  |
| --- | --- |
| Condition | Explanation |
| BWP#1 | Bandwidth part 1 |
| BWP#2 | Bandwidth part 2 |
| BWP#3 | Bandwidth part 3 |

Table 7.1.1.8.1.3.3-0A: PDSCH-TimeDomainResourceAllocationList (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-103 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation { | 2 entries |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | S=2, L=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| k0 | 1 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_15KHz |
| 6 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_15KHz |
| 2 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_30KHz |
| 6 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_30KHz |
| 3 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_60KHz |
| 9 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_60KHz |
| 6 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_120KHz |
| 18 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_120KHz |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-0B: SchedulingRequest-Config (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-155 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestConfig ::= SEQUENCE { |  |  |  |
| schedulingRequestToAddModList SEQUENCE (SIZE(1..maxNrofSR-ConfigPerCellGroup)) OF SchedulingRequestToAddMod { | 1 entry |  |  |
| SchedulingRequestToAddMod[1] SEQUENCE { |  | entry 1 |  |
| sr-TransMax | n64 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-1: RRCReconfiguration (step 0)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 (see also Note 4 in Table 7.1.1.8.1.3.2-1) | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| secondaryCellGroup | | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { | |  |  | NR |
| masterCellGroup | | CellGroupConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.8.1.3.3-1A: CellGroupConfig (Table 7.1.1.8.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig | Not present |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | Not present |  |  |
| ServCellIndex |  | EN-DC |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig*-*Dedicated | Table 7.1.1.8.1.3.3-2 |  |
| } |  |  |  |
| reportUplinkTxDirectCurrent | true |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2: *ServingCellConfig-Dedicated* (Table 7.1.1.8.1.3.3-1A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.3-167 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| tdd-UL-DL-ConfigurationDedicated | Not present |  |  |
|  |  |  |
| downlinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) BWP-Downlink { | 3 entries |  |  |
| BWP-Downlink[1] | BWP-Downlink-BWP-N with condition BWP#1 | entry 1 |  |
| BWP-Downlink[2] | BWP-Downlink-BWP-N with condition BWP#2 | entry 2 | pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD |
| BWP-Downlink[3] | BWP-Downlink-BWP-N with condition BWP#3 | entry 3 | pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD |
| } |  |  |  |
| firstActiveDownlinkBWP-Id | 1 |  |  |
| bwp-InactivityTimer | ms750 |  |  |
| defaultDownlinkBWP-Id | 2 |  | pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD |
|  | 0 |  | pc\_bwp\_sameNumerology\_upto2\_FR1\_TDD and band under test is FR1 TDD |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkDedicated |  |  |
| uplinkBWP-ToReleaseList | Not present |  |  |
| uplinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) OF BWP-Uplink { | 3 entries |  |  |
| BWP-Uplink[1] | BWP-Uplink-BWP-N with condition BWP#1 | entry 1 |  |
| BWP-Uplink[2] | BWP-Uplink-BWP-N with condition BWP#2 | entry 2 | pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD |
| BWP-Uplink[3] | BWP-Uplink-BWP-N with condition BWP#3 | entry 3 | pc\_bwp\_sameNumerology\_upto4\_FR1\_TDD and band under test is FR1 TDD |
| } |  |  |  |
| firstActiveUplinkBWP-Id | 1 |  |  |
| pusch-ServingCellConfig | Not present |  |  |
| } |  |  |  |
| pdcch-ServingCellConfig | Not present |  |  |
| pdsch-ServingCellConfig | Not present |  |  |
| csi-MeasConfig | Not present |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2A: *BWP-Downlink-BWP-N* (Table 7.1.1.8.1.3.3-2 and Table 7.1.1.8.1.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-Downlink ::= SEQUENCE { |  |  |  |
| bwp-Id | 1 |  | BWP#1 |
|  | 2 |  | BWP#2 |
|  | 3 |  | BWP#3 |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters SEQUENCE { |  |  |  |
| locationAndBandwidth | 6600 | Note 2 | BWP#1,2,3 and 5MHz |
|  | 6325 | Note 5 | BWP#1,2,3 and 10MHz and SCS30 |
|  | 7975 | Note 3 | BWP#1 |
|  | 12925 | Note 3 | BWP#2 |
|  | 13475 | Note 3 | BWP#3 |
|  | 17875 | Note 4 | BWP#1 and 100MHz |
|  | 14575 | Note 4 | BWP#2 and 100MHz |
|  | 16225 | Note 4 | BWP#3 and 100MHz |
| } |  |  |  |
| pdcch-ConfigCommon | Not present | no cell specific configuration for dedicated BWP |  |
| pdsch-ConfigCommon | Not present | no cell specific configuration for dedicated BWP |  |
| } |  |  |  |
| bwp-Dedicated SEQUENCE { |  |  |  |
| pdcch-Config CHOICE { |  |  |  |
| setup | PDCCH-Config-BWP-N with condition BWP#N |  |  |
| } |  |  |  |
| pdsch-Config CHOICE { |  |  |  |
| setup | PDSCH-Config-BWP-N with condition BWP#N |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| Note 1:Void  Note 2: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=25 and RBStart=0 for BWP#1,2,3  Note 3: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=30,48,50 and RBStart=0 for BWP#1,2,3  Note 4: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=66,54,60 and RBStart=0 for BWP#1,2,3  Note 5: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=24 and RBStart=0 for BWP#1,2,3 | | | |

Table 7.1.1.8.1.3.3-2B: *PDCCH-Config-BWP-N* (Table 7.1.1.8.1.3.3-2A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE (SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet-BWP-N with condition BWP#N | entry 1 |  |
| } |  |  |  |
| searchSpacesToAddModList SEQUENCE (SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[1] | SearchSpace-BWP-N with condition BWP#N | entry 1 |  |
| SearchSpace[2] | SearchSpace-CSS-BWP-N with condition BWP#N | entry 2 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2C: *PDSCH-Config-BWP-N* (Table 7.1.1.8.1.3.3-2A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| pdsch-TimeDomainAllocationList CHOICE { |  |  |  |
| setup | PDSCH-TimeDomainResourceAllocationList |  |  |
| } |  |  |  |
| } |  |  |  |

**Table 7.1.1.8.1.3.3-2CA: PDSCH-TimeDomainResourceAllocationList (Table 7.1.1.8.1.3.3-2C)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainAllocationList ::= SEQUENCE { | 2 entries |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| k0 | 1 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_15KHz |
| 6 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_15KHz |
| 2 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_30KHz |
| 6 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_30KHz |
| 3 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_60KHz |
| 9 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_60KHz |
| 6 |  | pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_120KHz |
| 18 |  | pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_120KHz |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2D: *ControlResourceSet-BWP-N* (Table 7.1.1.8.1.3.3-2B)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 9 |  | BWP#1 |
|  | 10 |  | BWP#2 |
|  | 11 |  | BWP#3 |
| frequencyDomainResources | 10000000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 6 RBs of each BWP |  |
| duration | 2 | SearchSpace duration of 2 symbols |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2E: *SearchSpace-BWP-N* (Table 7.1.1.8.1.3.3-2B)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-162 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 37 |  | BWP#1 |
|  | 38 |  | BWP#2 |
|  | 39 |  | BWP#3 |
| controlResourceSetId | 9 |  | BWP#1 |
|  | 10 |  | BWP#2 |
|  | 11 |  | BWP#3 |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n1 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n0 |  |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2F: *BWP-Uplink-BWP-N* (Table 7.1.1.8.1.3.3-2 and Table 7.1.1.8.1.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-Uplink ::= SEQUENCE { |  |  |  |
| bwp-Id | 1 |  | BWP#1 |
| 2 |  | BWP#2 |
| 3 |  | BWP#3 |
| bwp-Common SEQUENCE { |  |  |  |
| genericParameters SEQUENCE { |  |  |  |
| locationAndBandwidth | 6600 | Note 2 | BWP#1,2,3 and 5MHz |
|  | 6325 | Note 5 | BWP#1,2,3 and 10MHz and SCS30 |
|  | 7975 | Note 3 | BWP#1 |
|  | 12925 | Note 3 | BWP#2 |
|  | 13475 | Note 3 | BWP#3 |
|  | 17875 | Note 4 | BWP#1 and 100MHz |
|  | 14575 | Note 4 | BWP#2 and 100MHz |
|  | 16225 | Note 4 | BWP#3 and 100MHz |
| } |  |  |  |
| rach-ConfigCommon | Not present | No cell specific configuration for dedicated BWP |  |
| pusch-ConfigCommon CHOICE { |  |  |  |
| setup | PUSCH-ConfigCommon-BWP-N |  |  |
| } |  |  |  |
| pucch-ConfigCommon CHOICE { |  |  |  |
| setup | PUCCH-ConfigCommon-BWP-N |  |  |
| } |  |  |  |
| } |  |  |  |
| bwp-Dedicated SEQUENCE { |  |  |  |
| pucch-Config CHOICE { |  |  |  |
| setup | PUCCH-Config-BWP-N |  |  |
| } |  |  |  |
| pusch-Config CHOICE { |  |  |  |
| setup | PUSCH-Config-BWP-N |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| Note 1:Void  Note 2: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=25 and RBStart=0 for BWP#1,2,3  Note 3: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=30,48,50 and RBStart=0 for BWP#1,2,3  Note 4: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=66,54,60 and RBStart=0 for BWP#1,2,3  Note 5: According to TS 38.214 [21] clause 5.1.2.2.2 with =275, LRBs=24 and RBStart=0 for BWP#1,2,3 | | | |

|  |  |
| --- | --- |
| Condition | Explanation |
| 5MHz | According to TS 38.508-1 [4] clause 6.2.3.1 with CBW=5Mhz |
| 100MHz | According to TS 38.508-1 [4] clause 6.2.3.1 with CBW=100Mhz |

Table 7.1.1.8.1.3.3-2G: *PUCCH-Config-BWP-N* (Table 7.1.1.8.1.3.3-2F)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-112 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  |  |
| resourceSetToAddModList SEQUENCE (SIZE (1..4)) OF PUCCH-ResourceSet { | 1 entry |  |  |
| PUCCH-ResourceSet[1] SEQUENCE { |  | entry 1 |  |
| pucch-ResourceSetId | 0 |  |  |
| resourceList SEQUENCE (SIZE (1..32)) OF PUCCH-ResourceId { | 1 entry |  |  |
| PUCCH-ResourceId[1] | 0 | entry 1 |  |
| } |  |  |  |
| maxPayloadSize | 256 |  |  |
| } |  |  |  |
| } |  |  |  |
| resourceToAddModList SEQUENCE (SIZE (1..128)) OF PUCCH-Resource { | 1 entry |  |  |
| PUCCH-Resource[1] SEQUENCE { |  | entry 1 |  |
| pucch-RessourceId | 0 |  |  |
| startingPRB | 0 |  | BWP#1 |
| 0 |  | BWP#2 |
| 0 |  | BWP#3 |
| intraSlotFrequencyHopping | disabled |  |  |
| secondHopPRB | Not Present |  |  |
| format CHOICE { |  |  |  |
| format0 SEQUENCE { |  |  |  |
| initialCyclicShift | 0 |  |  |
| nrofSymbols | 2 |  |  |
| startingSymbolIndex | 10 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| schedulingRequestResourceToAddModList SEQUENCE (SIZE (1..maxNrofSR-Resources)) OF SchedulingRequestResourceConfig { | 1 entry |  |  |
| SchedulingRequestResourceConfig[1] | SchedulingRequestResourceConfig | entry 1  Table 7.1.1.8.1.3.3-2K |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2H: *PUSCH-Config-BWP-N* (Table 7.1.1.8.1.3.3-2F)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-118 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-Config ::= SEQUENCE { |  |  |  |
| pusch-TimeDomainAllocationList CHOICE { |  |  |  |
| setup | PUSCH-TimeDomainResourceAllocationList |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2I: PUSCH-TimeDomainResourceAllocationList (Table 7.1.1.8.1.3.3-2F and Table 7.1.1.8.1.3.3-2M)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-122 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF PUSCH-TimeDomainResourceAllocation { | 2 entries |  |  |
| PUSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| k2 | 4 |  |  |
|  | 6 |  | (pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_30KHz) OR (pc\_bwp\_SwitchingDelay\_Type1 AND SCS\_120KHz) |
|  | 18 |  | (pc\_bwp\_SwitchingDelay\_Type2 AND SCS\_120KHz) |
| } |  |  |  |
| PUSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| k2 | Not present |  |  |
|  | 2 |  | FR1 AND SCS15 |
|  | 6 |  | FR1 AND SCS30 |
|  | 3 |  | FR2 |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2J: Physical layer parameters for DCI format 1\_1 (Steps 5-22A, Table 7.1.1.8.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PUCCH resource indicator | *PUCCH-ResourceId* = 0 | “000” |  |

Table 7.1.1.8.1.3.3-2K: *SchedulingRequestResourceConfig* (Table 7.1.1.8.1.3.3-2G)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| resource | 0 |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2L: BWP-UplinkDedicated (Table 7.1.1.8.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkDedicated ::= SEQUENCE { |  | BWP-UplinkDedicated ::= SEQUENCE { |  |
| pusch-Config CHOICE { |  |  |  |
| setup | PUSCH-Config |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-2M: PUSCH-Config (Table 7.1.1.8.1.3.3-2L)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-118 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-Config:: = SEQUENCE { |  |  |  |
| pusch-TimeDomainAllocationList CHOICE { |  |  |  |
| setup | PUSCH-TimeDomainResourceAllocationList | Table 7.1.1.8.1.3.3-2I |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-3: *PUCCH-ConfigCommon-BWP-N* (Table 7.1.1.8.1.3.3-2F)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-113 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| pucch-ResourceCommon | Not Present |  |  |
| pucch-GroupHopping | enable |  |  |
| hoppingId | Not present |  |  |
| p0-nominal | Not Present |  |  |
| } |  |  |  |

**Table 7.1.1.8.1.3.3-4: *SearchSpace-CSS-BWP-N* (Table 7.1.1.8.1.3.3-2B)**

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[4], Table 4.6.3-162 with condition CSS | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 30 |  | BWP#1 |
|  | 31 |  | BWP#2 |
|  | 32 |  | BWP#3 |
| controlResourceSetId | 9 |  | BWP#1 |
|  | 10 |  | BWP#2 |
|  | 11 |  | BWP#3 |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n1 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n0 |  |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

**Table 7.1.1.8.1.3.3-5: *Void***

**Table 7.1.1.8.1.3.3-6: Void**

**Table 7.1.1.8.1.3.3-7: Void**

**Table 7.1.1.8.1.3.3-8: Void**

Table 7.1.1.8.1.3.3-9: *PUSCH-ConfigCommon-BWP-N* (Table 7.1.1.8.1.3.3-2F)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| groupHoppingEnabledTransformPrecoding | Not present |  |  |
| pusch-TimeDomainAllocationList | Not present |  |  |
| msg3-DeltaPreamble | 1 |  |  |
| p0-NominalWithGrant | -90 |  |  |
| } |  |  |  |

Table 7.1.1.8.1.3.3-10: Void

##### 7.1.1.8.2

##### 7.1.1.8.3 Separate BWP / IDLE / RedCap

7.1.1.8.3.1 Test Purpose (TP)

(1)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { initialDownlinkBWP-RedCap is configured }

**then** { the UE shall monitor the PDCCH on the BWP configured by initialDownlinkBWP-RedCap }

}

(2)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { initialUplinkBWP-RedCap is configured and the UE needs to perform the Random Access procedure }

**then** { the UE shall perform the Random Access procedure by using the BWP configured by initialUplinkBWP-RedCap }

}

7.1.1.8.3.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.321, clause 5.15.1. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.15.1]

A RedCap UE may be configured with a RedCap-specific initial UL BWP in *initialUplinkBWP-RedCap*, as specified in TS 38.331 [5].

Upon initiation of the Random Access procedure on a Serving Cell, after the selection of carrier for performing Random Access procedure as specified in clause 5.1.1, the MAC entity shall for the selected carrier of this Serving Cell:

1> if PRACH occasions are not configured for the active UL BWP:

2> if the UE is a RedCap UE; and

2> if *initialUplinkBWP-RedCap* is configured:

3> switch the active UL BWP to BWP configured by *initialUplinkBWP-RedCap*.

2> else:

3> switch the active UL BWP to BWP indicated by *initialUplinkBWP*.

2> if the Serving Cell is an SpCell:

3> if the UE is a RedCap UE; and

3> if *initialDownlinkBWP-RedCap* is configured:

4> switch the active DL BWP to BWP configured by *initialDownlinkBWP-RedCap*.

3> else:

4> switch the active DL BWP to BWP indicated by *initialDownlinkBWP*.

1> else:

2> if the Serving Cell is an SpCell:

3> if the active DL BWP does not have the same *bwp-Id* as the active UL BWP:

4> switch the active DL BWP to the DL BWP with the same *bwp-Id* as the active UL BWP.

1> stop the *bwp-InactivityTimer* associated with the active DL BWP of this Serving Cell, if running.

1> if the Serving Cell is SCell:

2> stop the *bwp-InactivityTimer* associated with the active DL BWP of SpCell, if running.

1> perform the Random Access procedure on the active DL BWP of SpCell and active UL BWP of this Serving Cell.

If the MAC entity receives a PDCCH for BWP switching of a Serving Cell, the MAC entity shall:

1> if there is no ongoing Random Access procedure associated with this Serving Cell; or

1> if the ongoing Random Access procedure associated with this Serving Cell is successfully completed upon reception of this PDCCH addressed to C-RNTI (as specified in clauses 5.1.4, 5.1.4a, and 5.1.5):

2> cancel, if any, triggered consistent LBT failure for this Serving Cell;

2> perform BWP switching to a BWP indicated by the PDCCH.

…

Upon reception of RRC (re-)configuration for BWP switching for a Serving Cell, cancel any triggered LBT failure in this Serving Cell.

The MAC entity shall for each activated Serving Cell configured with *bwp-InactivityTimer*:

1> if the *defaultDownlinkBWP-Id* is configured, and the active DL BWP is not the BWP indicated by the *defaultDownlinkBWP-Id*, and the active DL BWP is not the BWP indicated by the *dormantBWP-Id* if configured; or

1> if the *defaultDownlinkBWP-Id* is not configured, and if the UE is not a RedCap UE, and the active DL BWP is not the *initialDownlinkBWP*, and the active DL BWP is not the BWP indicated by the *dormantBWP-Id* if configured; or

1> if the *defaultDownlinkBWP-Id* is not configured and if the UE is a RedCap UE, and *initialDownlinkBWP-RedCap* is not configured, and the active DL BWP is not the *initialDownlinkBWP*, and the active DL BWP is not the BWP indicated by the *dormantBWP-Id* if configured; or

1> if the *defaultDownlinkBWP-Id* is not configured and if the UE is a RedCap UE, and *initialDownlinkBWP-RedCap* is configured, the active DL BWP is not the *initialDownlinkBWP-RedCap*, and the active DL BWP is not the BWP indicated by the *dormantBWP-Id* if configured:

2> if a PDCCH addressed to C-RNTI or CS-RNTI indicating downlink assignment or uplink grant is received on the active BWP; or

2> if a PDCCH addressed to G-RNTI or G-CS-RNTI configured for multicast indicating downlink assignment is received on the active BWP; or

2> if a PDCCH addressed to C-RNTI or CS-RNTI indicating downlink assignment or uplink grant is received for the active BWP; or

2> if a MAC PDU is transmitted in a configured uplink grant and LBT failure indication is not received from lower layers; or

2> if a MAC PDU is received in a configured downlink assignment for unicast or MBS multicast:

3> if there is no ongoing Random Access procedure associated with this Serving Cell; or

3> if the ongoing Random Access procedure associated with this Serving Cell is successfully completed upon reception of this PDCCH addressed to C-RNTI (as specified in clauses 5.1.4, 5.1.4a and 5.1.5):

4> start or restart the *bwp-InactivityTimer* associated with the active DL BWP.

2> if the *bwp-InactivityTimer* associated with the active DL BWP expires:

3> if the *defaultDownlinkBWP-Id* is configured:

4> perform BWP switching to a BWP indicated by the *defaultDownlinkBWP-Id*.

3> else:

4> if the UE is a RedCap UE; and

4> if *initialDownlinkBWP-RedCap* is configured:

5> perform BWP switching to the *initialDownlinkBWP-RedCap*.

4> else:

5> perform BWP switching to the *initialDownlinkBWP*.

NOTE: If a Random Access procedure is initiated on an SCell, both this SCell and the SpCell are associated with this Random Access procedure.

1> if a PDCCH for BWP switching is received, and the MAC entity switches the active DL BWP:

2> if the *defaultDownlinkBWP-Id* is configured, and the MAC entity switches to the DL BWP which is not indicated by the *defaultDownlinkBWP-Id* and is not indicated by the *dormantBWP-Id* if configured; or

2> if the *defaultDownlinkBWP-Id* is not configured, and the MAC entity switches to the DL BWP which is not the *initialDownlinkBWP* and is not indicated by the *dormantBWP-Id* if configured:

3> start or restart the *bwp-InactivityTimer* associated with the active DL BWP.

Upon initiation of the Random Access procedure, after selection of the carrier for performing Random Access procedure as specified in clause 5.1.1, if the UE is a RedCap UE in RRC\_IDLE or RRC\_INACTIVE mode, the MAC entity shall:

1> if *initialUplinkBWP-RedCap* is configured:

2> perform the Random Access procedure as specified in clause 5.1 by using the BWP configured by *initialUplinkBWP-RedCap*.

1> else:

2> perform the Random Access procedure as specified in clause 5.1 by using the BWP configured by *initialUplinkBWP*.

1> if *initialDownlinkBWP-RedCap* is configured:

2> monitor the PDCCH on the BWP configured by *initialDownlinkBWP-RedCap*.

1> else:

2> monitor the PDCCH on the BWP configured by *initialDownlinkBWP*.

7.1.1.8.3.3 Test description

7.1.1.8.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 2.

UE:

- None

Preamble:

- The UE is in NR RRC\_Idle mode (state 1N-A) on NR Cell 2 according to 38.508-1 [4] Table 4.4A.2-1.

7.1.1.8.3.3.2 Test procedure sequence

Table 7.1.1.8.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS changes the SIB1 of NR Cell 2 to configure *initialDownlinkBWP-RedCap* and *initialUplinkBWP-RedCap*. | - | - | - | -- |
| 2 | The SS transmits a Short message on PDCCH using P-RNTI indicating a *systemInfoModification*. | <-- | PDCCH (DCI 1\_0): Short Message | - | - |
| 3 | Wait for 2.1\* modification period second for the UE to receive new system information.  (Note 1) | - | - | - | - |
| 4 | The SS transmits a *Paging* message within the BWP configured by *initialDownlinkBWP-RedCap*. | <-- | NR RRC: *Paging* | - | - |
| 5 | Check: Does the UE transmit an *RRCSetupRequest* message by setting LCID to 35? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 6 | The SS transmits an *RRCSetup* message. | <-- | NR RRC: *RRCSetup* | - | - |
| 7 | Check: Does the UE transmit HARQ ACK for step 6 on PUCCH configured by *initialUplinkBWP-RedCap*? | --> | HARQ ACK | 2 | P |
| 8-13a1 | Steps 4-9a1 of Generic procedure as specified in TS 38.508-1 [4] Table 4.9.4.2.2-1 are performed. | - | - | - | - |
| Note 1: The modification period, expressed in number of radio frames = modificationPeriodCoeff \* defaultPagingCycle. | | | | | |

7.1.1.8.3.3.3 Specific message contents

Table 7.1.1.8.3.3.3-1: *SIB1* (step 1, Table 7.1.1.8.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| servingCellConfigCommon | | ServingCellConfigCommonSIB | Table 7.1.1.8.3.3.3-2 |  |
| } | |  |  |  |

Table 7.1.1.8.3.3.3-2: *ServingCellConfigCommonSIB* (Table 7.1.1.8.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-169 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| downlinkConfigCommon | DownlinkConfigCommonSIB | Table 7.1.1.8.3.3.3-3 |  |
| uplinkConfigCommon-v1700 ::= SEQUENCE { |  |  |  |
| initialUplinkBWP-RedCap-r17 | BWP-UplinkCommon | Table 7.1.1.8.3.3.3-8 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.3.3.3-3: *DownlinkConfigCommonSIB* (Table 7.1.1.8.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-53 | | | |
| Information Element | Value/remark | Comment | Condition |
| DownlinkConfigCommonSIB ::= SEQUENCE { |  |  |  |
| pei-Config-r17 | Not present |  |  |
| initialDownlinkBWP-RedCap-r17 | BWP-DownlinkCommon-RedCap | Table 7.1.1.8.3.3.3-4 |  |
| } |  |  |  |

Table 7.1.1.8.3.3.3-4: *BWP-DownlinkCommon-RedCap* (Table 7.1.1.8.3.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-10 with condition InitialBWP\_SIB | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-DownlinkCommon ::= SEQUENCE { |  |  |  |
| pdcch-ConfigCommon CHOICE { |  |  |  |
| setup | PDCCH-ConfigCommon | Table 7.1.1.8.3.3.3-5 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.3.3.3-5: *PDCCH-ConfigCommon* (Table 7.1.1.8.3.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-96 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| commonSearchSpaceList SEQUENCE (SIZE (1..4)) OF SearchSpace { | 2 entries |  |  |
| SearchSpace[1] | SearchSpace with condition CSS as specified in TS 38.508-1 [4] Table 4.6.3-162 | entry 1 |  |
| SearchSpace[2] | SearchSpace | entry 2, Table 7.1.1.8.3.3.3-6 |  |
| } |  |  |  |
| searchSpaceOtherSystemInformation | Not present |  |  |
| pagingSearchSpace | 4 |  |  |
| } |  |  |  |

Table 7.1.1.8.3.3.3-6: *SearchSpace* (Table 7.1.1.8.3.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-162 with condition CSS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 4 |  |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl10 | 2 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.3.3.3-7: Void

Table 7.1.1.8.3.3.3-8: *BWP-UplinkCommon* (Table 7.1.1.8.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| pucch-ConfigCommon CHOICE { |  |  |  |
| setup | PUCCH-ConfigCommon | Table 7.1.1.8.3.3.3-9 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.3.3.3-9: *PUCCH-ConfigCommon* (Table 7.1.1.8.3.3.3-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-113 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| pucch-ResourceCommon | Not present |  |  |
| nrofPRBs | Not present |  |  |
| intra-SlotFH-r17 | fromLowerEdge |  |  |
| pucch-ResourceCommon-RedCap-r17 | 1 |  |  |
| additionalPRBOffset-r17 | n2 |  |  |
| } |  |  |  |

##### 7.1.1.8.4 Separate BWP / RedCap-specific initial DL BWP without CORESET#0 / NCD-SSB

7.1.1.8.4.1 Test Purpose (TP)

(1)

**with** { UE supporting RedCap and in NR RRC\_IDLE state }

**ensure that** {

**when** { *initialDownlinkBWP-RedCap* does not contain the entire CORESET#0 }

**then** { UE uses this BWP for receiving DL messages during initial access and after initial access }

}

(2)

**with** { UE in NR RRC\_CONNECTED and the active BWP is RedCap-specific initial downlink BWP and this BWP does not include CD-SSB and the entire CORESET#0 }

**ensure that** {

**when** { NCD-SSB is configured for a RedCap UE in *RRCSetup* }

**then** { UE replies *RRCSetupComplete* }

}

(3)

**with** { UE in NR RRC\_CONNECTED and the active BWP is RedCap-specific initial downlink BWP and this BWP does not include CD-SSB and the entire CORESET#0 }

**ensure that** {

**when** { SS sends *RRCRelease* to trigger UE move to RRC\_IDLE }

**then** { UE shall monitor paging in the initial DL BWP that includes CORESET#0 }

}

7.1.1.8.4.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.300, clauses 16.13.5, and TS 38.331, clause 6.3.2. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.15.1]

Upon initiation of the Random Access procedure, after selection of the carrier for performing Random Access procedure as specified in clause 5.1.1, if the UE is a RedCap UE in RRC\_IDLE or RRC\_INACTIVE mode, the MAC entity shall:

1> if *initialUplinkBWP-RedCap* is configured for the selected carrier:

2> perform the Random Access procedure as specified in clause 5.1 by using the BWP configured by *initialUplinkBWP-RedCap*.

1> else:

2> perform the Random Access procedure as specified in clause 5.1 by using the BWP configured by *initialUplinkBWP*.

1> if *initialDownlinkBWP-RedCap* is configured:

2> if the Random Access procedure was initiated for SI request (as specified in TS 38.331 [5]) and the Random Access Resources for SI request have been explicitly provided by RRC, and if the selected carrier is SUL carrier:

3> monitor the PDCCH on the BWP configured by *initialDownlinkBWP*.

2> else:

3> monitor the PDCCH on the BWP configured by *initialDownlinkBWP-RedCap*.

1> else:

2> monitor the PDCCH on the BWP configured by *initialDownlinkBWP*.

[TS 38.300, clause 16.13.5]

A RedCap UE may be configured with multiple NCD-SSBs provided that each BWP is configured with at most one SSB. NCD-SSB may be configured for a RedCap UE in RRC\_CONNECTED to perform RLM, BFD, and RRM measurements when the active BWP does not contain CD-SSB.

[TS 38.331, clause 6.3.2]

|  |
| --- |
| *DownlinkConfigCommonSIB* field descriptions |
| ***initialDownlinkBWP-RedCap***  If present, RedCap UEs use this DL BWP instead of *initialDownlinkBWP*. If the *locationAndBandwidth* of this BWP contains the entire CORESET#0, the UE applies the *locationAndBandwidth* upon reception of this field (e.g. to determine the frequency position of signals described in relation to this *locationAndBandwidth*) but it keeps CORESET#0 until after reception of *RRCSetup*/*RRCResume/RRCReestablishment*. Otherwise, i.e., if the *locationAndBandwidth* of this BWP does not contain the entire CORESET#0, the UE uses this BWP for receiving DL messages during initial access (Msg2, MsgB, Msg4) and after initial access.  If absent, RedCap UEs use *initialDownlinkBWP* provided that it does not exceed the RedCap UE maximum bandwidth (see also clause 5.2.2.4.2). |

|  |
| --- |
| *BWP-DownlinkDedicated* field descriptions |
| ***nonCellDefiningSSB***  If configured, the RedCap UE operating in this BWP uses this SSB for the purposes for which it would otherwise have used the cell-defining SSB of the serving cell (e.g. obtaining sync, measurements, RLM). Furthermore, other parts of the BWP configuration that refer to an SSB (e.g. the "SSB" configured in the *QCL-Info* IE; the "ssb-Index" configured in the *RadioLinkMonitoringRS*; *CFRA-SSB-Resource*; *PRACH-ResourceDedicatedBFR*) refer implicitily to this NCD-SSB.  The NCD-SSB has the same values for the properties (e.g., *ssb-PositionsInBurst*, *PCI*, *ssb-periodicity*, *ssb-PBCH-BlockPower*) of the corresponding CD-SSB apart from the values of the properties configured in the *NonCellDefiningSSB-r17* IE. |

|  |
| --- |
| *PDCCH-ConfigCommon* field descriptions |
| ***commonControlResourceSet***  An additional common control resource set which may be configured and used for any common or UE-specific search space. If the network configures this field, it uses a *ControlResourceSetId* other than 0 for this *ControlResourceSet*. The network configures the *commonControlResourceSet* in *SIB1* so that it is contained in the bandwidth of CORESET#0. If the RedCap-specific initial downlink BWP does not contain the entire CORESET#0, the network configures the *commonControlResourceSet* in the RedCap-specific initial downlink BWP in *SIB1* for RedCap such that it does not have to be contained in the bandwidth of CORESET#0. |
| ***pagingSearchSpace***  ID of the search space for paging (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive paging in this BWP (see TS 38.213 [13], clause 10). This field is absent for the RedCap-specific initial downlink BWP, if it does not include CD-SSB and the entire CORESET#0. In that case, a RedCap UE in RRC\_IDLE or RRC\_INACTIVE while SDT procedure is not ongoing, shall monitor paging in the initial DL BWP that includes CORESET#0. |
| ***ra-SearchSpace***  ID of the Search space for random access procedure (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive RAR in this BWP. This field is mandatory present in the DL BWP(s) if the conditions described in TS 38.321 [3], clause 5.15 are met. |
| ***searchSpaceOtherSystemInformation***  ID of the Search space for other system information, i.e., *SIB2* and beyond (see TS 38.213 [13], clause 10.1). If the field is absent, the UE does not receive other system information in this BWP. This field is absent for the RedCap-specific initial DL BWP, if it does not include CD-SSB and the entire CORESET#0. In that case, a RedCap UE in RRC\_IDLE or RRC\_INACTIVE shall monitor PDCCH to receive other system information using *searchSpaceOtherSystemInformation* in the initial DL BWP that includes CD-SSB and the entire CORESET#0. |
| ***searchSpaceSIB1***  ID of the search space for *SIB1* message. In the initial DL BWP of the UE′s PCell, the network sets this field to 0. If the field is absent, the UE does not receive *SIB1* in this BWP. (see TS 38.213 [13], clause 10). This field is absent for the RedCap-specific initial DL BWP, if it does not include CD-SSB and the entire CORESET#0. In that case, a RedCap UE in RRC\_IDLE or RRC\_INACTIVE shall monitor PDCCH to receive SIB1 using *searchSpaceSIB1* in the initial DL BWP that includes CD-SSB and the entire CORESET#0. |

7.1.1.8.4.3 Test description

7.1.1.8.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 is configured to use Test frequency NRf1 as specified in TS 38.508-1 [4] Table 6.2.3.1-8 and Table 6.2.3.1-9 using the common highest mandatory UL and DL channel bandwidth and using the default subcarrier spacing specified in TS 38.508-1 [4] clause 6.2.3.1.

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR Cell 1 with SIB1 content as specified in Table 7.1.1.8.4.3.3-1 and SS broadcasts CD-SSB and NCD-SSB. MIB for NCD-SSB is specified in Table 7.1.1.8.4.3.3-0.

UE:

- None

Preamble:

- The UE is in state Switched OFF (state 0-A) as defined in TS 38.508-1 [4], subclause 4.4A on NR Cell 1.

7.1.1.8.4.3.2 Test procedure sequence

Table 7.1.1.8.4.3.2-1: Void

Table 7.1.1.8.4.3.2-2: Void

Table 7.1.1.8.4.3.2-3: Void

Table 7.1.1.8.4.3.2-4: Void

Table 7.1.1.8.4.3.2-5: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Void. | - | - | - | - |
| 2 | Power on the UE. | - | - | - | - |
| 3 | The UE transmits a preamble on PRACH in *initialUplinkBWP-RedCap*? | --> | PRACH Preamble | - | - |
| 4 | The SS transmits Random Access Response in *initialDownlinkBWP-RedCap*. | <-- | Random Access Response | - | - |
| 5 | Check: Does the UE transmit a MAC PDU containing an *RRCSetupRequest* message? | --> | NR RRC: *RRCSetupRequest* | 1 | P |
| 6 | The SS transmits *RRCSetup* including NCD-SSB. | <-- | NR RRC: *RRCSetup* | - | - |
| 7 | Check: Does the UE transmit an *RRCSetupComplete* message? | --> | NR RRC: *RRCSetupComplete* | 2 | P |
| 8-23a1 | Steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed on NR Cell 1.  NOTE: The UE performs registration and the RRC connection is released. | - | - | - | - |
| 24 | The SS transmits a Paging message including a matched UE identity. | <-- | NR RRC: *Paging* | - | - |
| 25 | The UE transmits a preamble on PRACH in *initialUplinkBWP-RedCap*? | --> | PRACH Preamble | - | - |
| 26 | The SS transmits Random Access Response in *initialDownlinkBWP-RedCap*. | <-- | Random Access Response | - | - |
| 27 | Check: Does the UE transmit a MAC PDU containing an *RRCSetupRequest* message? | --> | NR RRC: *RRCSetupRequest* | 1,3 | P |
| 28 | The SS transmits *RRCSetup* including NCD-SSB. | <-- | NR RRC: *RRCSetup* | - | - |
| 29 | Check: Does the UE transmit an *RRCSetupComplete* message? | --> | NR RRC: *RRCSetupComplete* | 2 | P |
| 30-34a1 | Steps 5-9a1 of Generic procedure as specified in TS 38.508-1 [4] Table 4.9.4.2.2-1 are performed. | - | - | - | - |

7.1.1.8.4.3.3 Specific message contents

Table 7.1.1.8.4.3.3-0: MIB for NCD-SSB(preamble and all steps, Table 7.1.1.8.4.3.2-5)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-11 with condition NCD-SSB |

Table 7.1.1.8.4.3.3-1: *SIB1* (preamble and all steps, Table 7.1.1.8.4.3.2-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-28 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SIB1 ::= SEQUENCE { | |  |  |  |
| servingCellConfigCommon | | ServingCellConfigCommonSIB | Table 7.1.1.8.4.3.3-2 |  |
| } | |  |  |  |

Table 7.1.1.8.4.3.3-2: *ServingCellConfigCommonSIB* (Table 7.1.1.8.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-169 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| downlinkConfigCommon | DownlinkConfigCommonSIB | Table 7.1.1.8.4.3.3-3 |  |
| uplinkConfigCommon-v1700 SEQUENCE { |  |  |  |
| initialUplinkBWP-RedCap-r17 | BWP-UplinkCommon-RedCap | Table 7.1.1.8.4.3.3-9 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-3: *DownlinkConfigCommonSIB* (Table 7.1.1.8.4.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-53 | | | |
| Information Element | Value/remark | Comment | Condition |
| DownlinkConfigCommonSIB ::= SEQUENCE { |  |  |  |
| pei-Config-r17 | Not present |  |  |
| initialDownlinkBWP-RedCap-r17 | BWP-DownlinkCommon-RedCap | Table 7.1.1.8.4.3.3-4 |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-4: *BWP-DownlinkCommon-RedCap* (Table 7.1.1.8.4.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-10 with condition InitialBWP\_SIB | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-DownlinkCommon ::= SEQUENCE { |  |  |  |
| genericParameters | BWP-RedCap |  |  |
| pdcch-ConfigCommon CHOICE { |  |  |  |
| setup | PDCCH-ConfigCommon-RedCap | Table 7.1.1.8.4.3.3-5 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-5: *PDCCH-ConfigCommon-RedCap* (Table 7.1.1.8.4.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-96 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| controlResourceSetZero | Not present |  |  |
| commonControlResourceSet | ControlResourceSet | Table 7.1.1.8.4.3.3-6 |  |
| searchSpaceZero | Not present |  |  |
| commonSearchSpaceList SEQUENCE (SIZE (1..4)) OF SearchSpace { | 1 entry |  |  |
| SearchSpace[1] | SearchSpace | entry 1  Table 7.1.1.8.4.3.3-7 |  |
| } |  |  |  |
| searchSpaceSIB1 | Not present |  |  |
| searchSpaceOtherSystemInformation | Not present |  |  |
| pagingSearchSpace | Not present |  |  |
| ra-SearchSpace | SearchSpaceId with condition CSS |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-6: *ControlResourceSet* (Table 7.1.1.8.4.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-7: *SearchSpace* (Table 7.1.1.8.4.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-162 with condition CSS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-8: *BWP-RedCap* (Table 7.1.1.8.4.3.3-4 and Table 7.1.1.8.4.3.3-9)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP ::= SEQUENCE { |  |  |  |
| locationAndBandwidth | Set to value of locationAndBandwidth in TS 38.508-1 [4] Table 6.2.3.1-8 |  | FR1 |
|  | Set to value of locationAndBandwidth in TS 38.508-1 [4] Table 6.2.3.1-9 |  | FR2 |
| } |  |  |  |

Table 7.1.1.8.4.3.3-9: *BWP-UplinkCommon-RedCap* (Table 7.1.1.8.4.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| genericParameters | BWP-RedCap | Table 7.1.1.8.4.3.3-8 |  |
| pucch-ConfigCommon CHOICE { |  |  |  |
| setup | PUCCH-ConfigCommon-RedCap | Table 7.1.1.8.4.3.3-10 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-10: *PUCCH-ConfigCommon-RedCap* (Table 7.1.1.8.4.3.3-9)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-113 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| pucch-ResourceCommon | Not present |  |  |
| pucch-ResourceCommonRedCap-r17 | 0 |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-11: *RRCSetup* (step 6, Table 7.1.1.8.4.3.2-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-21 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCSetup ::= SEQUENCE { | |  |  |  |
| rrc-TransactionIdentifier | | RRC-TransactionIdentifier |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcSetup SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig-RedCap | Table 7.1.1.8.4.3.3-12 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.8.4.3.3-12: *CellGroupConfig-RedCap* (Table 7.1.1.8.4.3.3-11)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated | ServingCellConfig-RedCap | Table 7.1.1.8.4.3.3-13 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-13: *ServingCellConfig-RedCap* (Table 7.1.1.8.4.3.3-12)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP | BWP-DownlinkDedicated-RedCap | Table 7.1.1.8.4.3.3-14 |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkDedicated-RedCap | Table 7.1.1.8.4.3.3-15 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-14: *BWP-DownlinkDedicated-RedCap* (Table 7.1.1.8.4.3.3-13)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-DownlinkDedicated ::= SEQUENCE { |  |  |  |
| pdcch-Config CHOICE { |  |  |  |
| setup | PDCCH-Config | Table 7.1.1.8.4.3.3-16 |  |
| } |  |  |  |
| nonCellDefiningSSB-r17 | NonCellDefiningSSB | Table 7.1.1.8.4.3.3-18 |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-15: *BWP-UplinkDedicated-RedCap* (Table 7.1.1.8.4.3.3-13)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkDedicated ::= SEQUENCE { |  |  |  |
| pucch-Config CHOICE { |  |  |  |
| setup | PUCCH-Config | Table 7.1.1.8.4.3.3-19 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-16: *PDCCH-Config* (Table 7.1.1.8.4.3.3-14)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList | Not present |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| searchSpacesToAddModList SEQUENCE(SIZE (1..10)) OF SearchSpace { | 1 entry |  |  |
| SearchSpace[1] | SearchSpace | entry 1  Table 7.1.1.8.4.3.3-17 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-17: *SearchSpace* (Table 7.1.1.8.4.3.3-16)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-162 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-18: *NonCellDefiningSSB* (Table 7.1.1.8.4.3.3-14)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-84AAA | | | |
| Information Element | | Value/remark | Comment | Condition |
| NonCellDefiningSSB-r17 ::= SEQUENCE { | |  |  |  |
| absoluteFrequencySSB-r17 | | Set to value of absoluteFrequencySSB for NCD-SSB in TS 38.508-1 [4] Table 6.2.3.1-8/9 |  |  |
| ssb-Periodicity-r17 | | Not present | The periodicity of this NCD-SSB is same as SSB periodicity of the CD-SSB |  |
| ssb-TimeOffset-r17 | | Not present | The time offset between the first burst of CD-SSB transmitted in the serving cell and the first burst of this NCD-SSB transmitted is zero |  |
| } | |  |  |  |

Table 7.1.1.8.4.3.3-19: *PUCCH-Config* (Table 7.1.1.8.4.3.3-15)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-112 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  |  |
| resourceToAddModList SEQUENCE (SIZE (1..maxNrofPUCCH-Resources)) OF PUCCH-Resource { | 16 entries |  |  |
| PUCCH-Resource[n] SEQUENCE { |  | entry 1- 16  n=1,2,…16 |  |
| secondHopPRB | PRB-Id | Table 7.1.1.8.4.3.3-20 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.8.4.3.3-20: *PRB-Id* (Table 7.1.1.8.4.3.3-19)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-109 | | | |
| Information Element | Value/remark | Comment | Condition |
| PRB-Id | Set to value of the *L\_RBs* - *nrofPRBs* where *L\_RBs* is LRB of initialDownlinkBWP-RedCap found in TS 38.508-1 [4] Table 6.2.3.1-8 or TS 38.508-1 [4] Table 6.2.3.1-9 and *nrofPRBs* is defined for the corresponding *PUCCH-Resource* (1 otherwise). |  |  |

#### 7.1.1.9 MAC Reconfiguration and Reset

##### 7.1.1.9.1 MAC Reset

7.1.1.9.1.1 Test Purpose (TP)

(1)

**Void**

(2)

**with** { UE in RRC\_CONNECTED state )

**ensure that** {

**when**{ UE MAC is reset, due to reconfiguration with sync on same cell }

**then** { UE considers the next transmission for each DL HARQ process as very first }

}

(3)

**Void**

(4)

**with** ( UE in RRC\_CONNECTED state )

**ensure that** {

**when**{ UE MAC is reset, due to reconfiguration with sync on same cell }

**then** { UE flushes UL HARQ buffer }

}

(5)

**with** (UE in RRC\_CONNECTED state )

**ensure that** {

**when**{ UE MAC is reset, due to reconfiguration with sync on same cell }

**then** { UE Considers the next transmission for each UL HARQ process as very first }

}

7.1.1.9.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clauses 5.12 and TS 38.331 clause 5.3.5.5.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.12]

If a reset of the MAC entity is requested by upper layers, the MAC entity shall:

1> initialize *Bj* for each logical channel to zero;

1> stop (if running) all timers;

1> consider all *timeAlignmentTimer*s as expired and perform the corresponding actions in subclause 5.2;

1> set the NDIs for all uplink HARQ processes to the value 0;

1> stop, if any, ongoing Random Access procedure;

1> discard explicitly signalled contention-free Random Access Resources, if any;

1> flush Msg3 buffer;

1> cancel, if any, triggered Scheduling Request procedure;

1> cancel, if any, triggered Buffer Status Reporting procedure;

1> cancel, if any, triggered Recommended bit rate query procedure;

1> cancel, if any, triggered Configured uplink grant confirmation;

1> cancel, if any, triggered Power Headroom Reporting procedure;

1> flush the soft buffers for all DL HARQ processes;

1> for each DL HARQ process, consider the next received transmission for a TB as the very first transmission;

1> release, if any, Temporary C-RNTI;

1> reset *BFI\_COUNTER*.

[TS 38.331, clause 5.3.5.5.2]

The UE shall perform the following actions to execute a reconfiguration with sync.

1> if the AS security is not activated, perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with the release cause '*other*' upon which the procedure ends;

1> stop timer T310 for the corresponding SpCell, if running;

1> start timer T304 for the corresponding SpCell with the timer value set to *t304*, as included in the *reconfigurationWithSync*;

1> if the *frequencyInfoDL* is included:

2> consider the target SpCell to be one on the SSB frequency indicated by the *frequencyInfoDL* with a physical cell identity indicated by the *physCellId*;

1> else:

2> consider the target SpCell to be one on the SSB frequency of the source SpCell with a physical cell identity indicated by the *physCellId*;

1> start synchronising to the DL of the target SpCell;

1> apply the specified BCCH configuration defined in 9.1.1.1;

1> acquire the *MIB,* which is scheduled as specified in TS 38.213 [13];

NOTE 1: The UE should perform the reconfiguration with sync as soon as possible following the reception of the RRC message triggering the reconfiguration with sync, which could be before confirming successful reception (HARQ and ARQ) of this message.

NOTE 2: The UE may omit reading the MIB if the UE already has the required timing information, or the timing information is not needed for random access.

1> reset the MAC entity of this cell group;

1> consider the SCell(s) of this cell group, if configured, to be in deactivated state;

1> apply the value of the *newUE-Identity* as the C-RNTI for this cell group;

1> configure lower layers in accordance with the received s*pCellConfigCommon*;

1> configure lower layers in accordance with any additional fields, not covered in the previous, if included in the received *reconfigurationWithSync.*

7.1.1.9.1.3 Test description

7.1.1.9.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0.

Table 7.1.1.9.1.3.1-1: Void

7.1.1.9.1.3.2 Test procedure sequence

Table 7.1.1.9.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0 | The SS stops the default downlink retransmission. (Note 4)  SS ignores scheduling requests and does not allocate any uplink grant until after step 3 | - | - | - | - |
| 1 | The SS transmits a MAC PDU containing one RLC SDU with P field set 0 on DRB | <-- | MAC PDU (1 RLC SDU of 40 bytes on DRB) | - | - |
| 2 | Void | - | - | - | - |
| 3 | The SS transmits NR *RRCReconfiguration* message with reconfigurationWithSync with the same SpCell. (Note 1) | <-- | RRCReconfiguration | - | - |
| 4 | The UE transmits an NR *RRCReconfigurationComplete* message. (Note 2) | --> | RRCReconfigurationComplete | - | - |
| - | EXCEPTION: UE may loop back the MAC PDU sent at step 1 depending upon UE implementation, SS waits for 1 sec for UE to loop back this data | - | - | - | - |
| 4Aa | The UE transmits a MAC PDU including one RLC SDU | --> | MAC PDU | - | - |
| 4a-5 | Void | - | - | - | - |
| 5A | The SS ignores scheduling requests and does not allocate any uplink grant. |  |  |  |  |
| 6 | The SS transmits a MAC PDU containing RLC SDU with P field set 0 on DRB. The HARQ Process and NDI on PDCCH is same as in step 1. The SS shall ensure that the HARQ process used at step 1 will not be used in between steps 3 and 5. | <-- | MAC PDU (1 RLC SDU of 40 bytes on DRB) | - | - |
| 7 | Check: Does the UE transmit a scheduling request? | --> | (SR) | 2 | P |
| - | Exception: The SS ignores following scheduling requests before step 9. | - | - | - | - |
| 8 | The SS allocates 1 UL Grant with size 384 bits and NDI indicates new transmission. (Note 5) | <-- | Uplink Grant | - | - |
| 9 | The UE transmits a MAC PDU including one RLC SDU with P field set 1. | --> | MAC PDU | - | - |
| 9A | The SS transmits a STATUS PDU on a different HARQ process than used in step 6. | <-- | STATUS PDU | - | - |
| 10-16 | Void | - | - | - | - |
| 16A | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 17 | The SS transmits a MAC PDU containing RLC SDU with P field set 0 on DRB. | <-- | MAC PDU (1 RLC SDU of 40 bytes on DRB) | - | - |
| 18 | The UE transmits a scheduling request | --> | (SR) | - | - |
|  | Exception: The SS ignores following scheduling requests before step 20. | - | - | - | - |
| 19 | The SS allocates an UL Grant with size 384 bits for one HARQ process X, and NDI indicates new transmission. (Note 5) | <-- | Uplink Grant | - | - |
| 20 | The UE transmits a MAC PDU including one RLC SDU with P field set 1. | --> | MAC PDU | - | - |
| 20A | The SS transmits a STATUS PDU on a different HARQ process than used in step 17. | <-- | STATUS PDU | - | - |
| 21 | Void |  |  |  |  |
| 22 | The SS transmits NR *RRCReconfiguration* message with reconfigurationWithSync with the same SpCell. Note 1 | <-- | RRCReconfiguration | - | - |
| 23 | The UE transmits an NR *RRCReconfigurationComplete* message. Note 2 |  | RRCReconfigurationComplete | - | - |
| 24 | Void |  |  |  |  |
| 24A | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 25 | The SS transmits a MAC PDU containing RLC SDU with P field set 0 on DRB. The HARQ Process and NDI on PDCCH is same as in step 17. The SS shall ensure that the HARQ process used at step 17 will not be used in between steps 22 and 23. | <-- | MAC PDU (1 RLC SDU of 40 bytes on DRB) | - | - |
| 26 | The UE transmits a scheduling request | --> | (SR) | - | - |
|  | Exception: The SS ignores following scheduling requests before step 28. | - | - | - | - |
| 27 | The SS allocates an UL Grant with size 384 bits corresponding to HARQ process X, with NDI not toggled compared to step 19, and NDI indicates new transmission. (Note 5) | <-- | Uplink Grant | - | - |
| 28 | Check: Does UE transmit a MAC PDU including one RLC SDU of 40 bytes on DRB and P field is set 1? | --> | MAC PDU | 4,5 | P |
| 29 | The SS transmits a STATUS PDU on a different HARQ process than used in step 25 | <-- | STATUS PDU | - | - |
| Note 1: for EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: for EN-DC the NR *RRCReconfigurationComplete* message is contained in RRCConnectionReconfigurationComplete.  Note 3: RLC re-establishment on DRB is used to make sure UE discard RLC PDU.  Note 4: The SS stops the default downlink retransmission to avoid HARQ ACK for the retransmission of DRB data at step 1.  Note 5: For pc\_supportOfRedCap\_r17=false, the UL grant of 384 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU at a time (40 bytes RLC SDU + 3 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding). For pc\_supportOfRedCap\_r17=true, the UL grant of 384 bits is chosen to allow the UE to transmit one PDU at a time (40 bytes RLC SDU + 2 bytes RLC Header + 2 bytes MAC Sub PDU header + 3 bytes for short BSR and padding or only padding). | | | | | |

7.1.1.9.1.3.3 Specific message contents

Table 7.1.1.9.1.3.3-0: SchedulingRequest-Config (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-155 | | | |
| Information Element | Value/remark | Comment | Condition |
| sr-TransMax | n64 |  |  |

Table 7.1.1.9.1.3.3-1: *RRCReconfiguration* for NR(steps 3 and 22 of Table 7.1.1.9.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig | According to Table 7.1.1.9.1.3.3-1A |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | According to Table 7.1.1.9.1.3.3-1B |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.9.1.3.3-1A: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | n entries | n is equal to the total number of DRBs established during preamble |  |
| DRB-ToAddMod[k=1..n] SEQUENCE { |  | entry (1..n) |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config | According to TS 38.508-1, Table 4.6.3-161 |  |
| } |  |  |  |
| drb-Identity | k | k=1..n |  |
| reestablishPDCP | true |  |  |
| recoverPDCP | Not present |  |  |
| pdcp-Config | PDCP-Config | According to Table 7.1.1.9.1.3.3-1C |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.9.1.3.3-1B: CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 with condition PCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 2+n entries | n is equal to the total number of DRBs established during preamble |  |
| RLC-BearerConfig[1] | RLC-BearerConfig with conditions SRB1 and Re-establish\_RLC | entry 1 |  |
| RLC-BearerConfig[2] | RLC-BearerConfig with conditions SRB2 and Re-establish\_RLC | entry 2 |  |
| RLC-BearerConfig[k+2, k=1..n] | RLC-BearerConfig with conditions AM, DRBk and Re-establish\_RLC | entry [k+2, k=1..n] |  |
| } |  |  |  |

Table 7.1.1.9.1.3.3-1C: PDCP-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| statusReportRequired | Not present |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.9.1.3.3-2: *RRCConnectionReconfiguration* for EN-DC (step 3 and 22 of Table 7.1.1.9.1.3.2-1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Derivation Path: 36.508 Table 4.6.1-8 | | | | | | |
| Information Element | | Value/remark | | Comment | | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { | |  | |  | |  |
| criticalExtensions CHOICE { | |  | |  | |  |
| c1 CHOICE{ | |  | |  | |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE { | |  | |  | |  |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nr-Config-r15 CHOICE { |  | |  | |  | |
| nr-SecondaryCellGroupConfig-r15 | OCTET STRING including the RRCReconfiguration message and the IE secondaryCellGroup according to TS 38.508-1 [67], table 4.6.1-13 with condition EN-DC\_HO | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [67], table 4.6.3-132 with conditions EN-DC\_DRB | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |

#### 7.1.1.10 Other Procedures

##### 7.1.1.10.1 DataInactivityTimer expiry

7.1.1.10.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state and *dataInactivityTimer* configured and running }

**ensure that** {

**when** { UE receives or transmits MAC SDU from DRB }

**then** { UE restarts the *dataInactivityTimer* }

}

(2)

**with** { UE in NR RRC\_CONNECTED state and *dataInactivityTimer* configured and running }

**ensure that** {

**when** { UE detecting data inactivity on expiry of DataInactivityTimer }

**then** { UE enters RRC\_IDLE state }

}

7.1.1.10.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321 clause 5.19 and TS 38.331 clause 5.3.8.5.

[TS 38.321, clause 5.19]

The UE may be configured by RRC with a Data inactivity monitoring functionality, when in RRC\_CONNECTED. RRC controls Data inactivity operation by configuring the timer *dataInactivityTimer*.

When *dataInactivityTimer* is configured, the UE shall:

1> if any MAC entity receives a MAC SDU for DTCH logical channel, DCCH logical channel, or CCCH logical channel; or

1> if any MAC entity transmits a MAC SDU for DTCH logical channel, or DCCH logical channel:

2> start or restart *dataInactivityTimer*.

1> if the *dataInactivityTimer* expires:

2> indicate the expiry of the *dataInactivityTimer* to upper layers.

[TS 38.331 clause 5.3.8.5]

Upon receiving the expiry of *DataInactivityTimer* from lower layers while in RRC\_CONNECTED, the UE shall:

1> perform the actions upon going to RRC\_IDLE as specified in 5.3.11, with release cause 'RRC connection failure'.

7.1.1.10.1.3 Test description

7.1.1.10.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1.

UE:

- None.

Preamble:

- The UE is in state 3N-A and Test Mode Activated according to 38.508-1 [4] Table 4.4A.2-1 with UE test loop mode B is established IP PDU delay set to 6 seconds.

7.1.1.10.1.3.2 Test procedure sequence

Table 7.1.1.10.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS waits (dataInactivityTimer/2 + 1) seconds | - | - | - | - |
| 2 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 3 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU. | <-- | MAC PDU | - | - |
| 4 | Void | - | - | - | - |
| 5 | Void | - | - | - | - |
| 6 | Check: Does the UE transmit a MAC PDU containing Loop backed PDU on expiry of IP PDU delay? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 1 | P |
| 7-11 | Repeat steps 1-5 | - | - | - | - |
| 12 | Check: Does the UE transmit a MAC PDU containing Loop backed PDU? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 1 | P |
| 13 | SS waits dataInactivityTimer seconds for the UE to enter RRC\_IDLE. | - |  | - | - |
| 14 | Check: Does the test result of generic test procedure in TS 38.508-1 [4] Table 4.9.5.2.2-1 indicate that the UE is in RRC\_IDLE? | - | *-* | 2 | - |

7.1.1.10.1.3.3 Specific Message Contents

Table 7.1.1.10.1.3.3-1: *MAC-CellGroupConfig* (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1[4], table 4.6.3-68 | | | |
| Information Element | Value/Remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| dataInactivityTimer | s10 |  |  |
| } |  |  |  |

Table 7.1.1.10.1.3.3-2: CLOSE UE TEST LOOP (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 36.508-1 [7] table 4.7A-3 condition UE test loop mode B | | | |
| Information Element | Value/Remark | Comment | Condition |
| UE test loop mode B LB setup |  |  |  |
| IP PDU delay | '0000 0110'B | 6 seconds |  | |

##### 7.1.1.10.2 Recommended Bit Rate

7.1.1.10.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC Connected state and MMTEL call established}

**ensure that** {

**when** { IF upper Layers requested to query the gNB for the recommended bit rate for a logical channel and for a direction and bitRateQueryProhibitTimer is not running }

**then** { UE transmits a Recommended Bit Rate Query MAC Control Element}

}

(2)

**with**(UE in RRC Connected state and MMTEL call established)

**ensure that** {

**when**{ IF upper Layers requested to query the gNB for the recommended bit rate for a logical channel and for a direction and bitRateQueryProhibitTimer is running}

**then** { UE does not transmits a Recommended Bit Rate Query MAC Control Element}

}

(3)

**with** ( UE in RRC Connected state and MMTEL call established)

**ensure that** {

**when**{ UE receives MAC PDU from the gNB for the recommended bit rate for a logical channel and for a direction }

**then** { UE sends an HARQ ACK }

}

7.1.1.10.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clauses 5.18.10 and 6.1.20. Unless otherwise stated these are Rel-15 requirements.

[TS 38.321, clause 5.18.10]

The recommended bit rate procedure is used to provide the MAC entity with information about the bit rate which the gNB recommends. The bit rate is the recommended bit rate of the physical layer. Averaging window of default value 2000 ms will apply as specified in TS 26.114 [13].

The gNB may transmit the Recommended bit rate MAC CE to the MAC entity to indicate the recommended bit rate for the UE for a specific logical channel and a specific direction (either uplink or downlink). Upon reception of a Recommended bit rate MAC CE the MAC entity shall:

- indicate to upper layers the recommended bit rate for the indicated logical channel and direction.

The MAC entity may request the gNB to indicate the recommended bit rate for a specific logical channel and a specific direction. If the MAC entity is requested by upper layers to query the gNB for the recommended bit rate for a logical channel and for a direction (i.e. for uplink or downlink), the MAC entity shall:

1> if a Recommended bit rate query for this logical channel and this direction has not been triggered:

2> trigger a Recommended bit rate query for this logical channel, direction, and desired bit rate.

If the MAC entity has UL resources allocated for new transmission the MAC entity shall:

1> for each Recommended bit rate query that the Recommended Bit Rate procedure determines has been triggered and not cancelled:

2> if *bitRateQueryProhibitTimer* for the logical channel and the direction of this Recommended bit rate query is configured, and it is not running; and

2> if the MAC entity has UL resources allocated for new transmission and the allocated UL resources can accommodate a Recommended bit rate MAC CE plus its subheader as a result of LCP as defined in clause 5.4.3.1:

3> instruct the Multiplexing and Assembly procedure to generate the Recommended bit rate MAC CE for the logical channel and the direction of this Recommended bit rate query;

3> start the *bitRateQueryProhibitTimer* for the logical channel and the direction of this Recommended bit rate query;

3> cancel this Recommended bit rate query.

[TS 38.321, clause 6.1.20]

The Recommended bit rate MAC CE is identified by a MAC subheader with LCID as specified in Tables 6.2.1-1 and 6.2.1-2 for bit rate recommendation message from the gNB to the UE and bit rate recommendation query message from the UE to the gNB, respectively. It has a fixed size and consists of two octets defined as follows (Figure 6.1.3.20-1):

- LCID: This field indicates the identity of the logical channel for which the recommended bit rate or the recommended bit rate query is applicable. The length of the field is 6 bits;

- Uplink/Downlink (UL/DL): This field indicates whether the recommended bit rate or the recommended bit rate query applies to uplink or downlink. The length of the field is 1 bit. The UL/DL field set to 0 indicates downlink. The UL/DL field set to 1 indicates uplink;

- Bit Rate: This field indicates an index to Table 6.1.3.20-1. The length of the field is 6 bits. For bit rate recommendation the value indicates the recommended bit rate. For bit rate recommendation query the value indicates the desired bit rate;

- R: reserved bit, set to 0.



Figure 6.1.3.20-1: Recommended bit rate MAC CE

Table 6.1.3.20-1: Values (kbit/s) for Bit Rate field

|  |  |  |  |
| --- | --- | --- | --- |
| Index | NR Recommended Bit Rate value [kbit/s] | Index | NR Recommended Bit Rate value [kbit/s] |
| 0 | Note 1 | 32 | 700 |
| 1 | 0 | 33 | 800 |
| 2 | 9 | 34 | 900 |
| 3 | 11 | 35 | 1000 |
| 4 | 13 | 36 | 1100 |
| 5 | 17 | 37 | 1200 |
| 6 | 21 | 38 | 1300 |
| 7 | 25 | 39 | 1400 |
| 8 | 29 | 40 | 1500 |
| 9 | 32 | 41 | 1750 |
| 10 | 36 | 42 | 2000 |
| 11 | 40 | 43 | 2250 |
| 12 | 48 | 44 | 2500 |
| 13 | 56 | 45 | 2750 |
| 14 | 72 | 46 | 3000 |
| 15 | 88 | 47 | 3500 |
| 16 | 104 | 48 | 4000 |
| 17 | 120 | 49 | 4500 |
| 18 | 140 | 50 | 5000 |
| 19 | 160 | 51 | 5500 |
| 20 | 180 | 52 | 6000 |
| 21 | 200 | 53 | 6500 |
| 22 | 220 | 54 | 7000 |
| 23 | 240 | 55 | 7500 |
| 24 | 260 | 56 | 8000 |
| 25 | 280 | 57 | Reserved |
| 26 | 300 | 58 | Reserved |
| 27 | 350 | 59 | Reserved |
| 28 | 400 | 60 | Reserved |
| 29 | 450 | 61 | Reserved |
| 30 | 500 | 62 | Reserved |
| 31 | 600 | 63 | Reserved |
| Note 1: For bit rate recommendation message this index is used for indicating that no new recommendation on bit rate is given. | | | |

7.1.1.10.2.3 Test description

7.1.1.10.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cell.

UE:

- None.

Preamble:

- The UE is in 5GS state 1N-A according to TS 38.508-1 [4], clause 4.4A.2 Table 4.4A.2-1.

7.1.1.10.2.3.2 Test procedure sequence

Table 7.1.1.10.2.3.2-2: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The procedure in table 4.9.15.2.2-1 in TS 38.508-1 [4] is performed. The bitRateQueryProhibitTimer for the Logical channel of MMTEL QoS Flow is configured as s3 (3 seconds). | - | - | - | - |
| 2 | Trigger the UE to perform Recommended Bit Rate query for direction Downlink via AT (+CGBRRREQ) or MMI command. | - | - | - | - |
| 3 | Check: Does the UE transmit a MAC PDU containing Recommended bit rate MAC CE with Uplink/Downlink (UL/DL) set as 0? | -> | MAC PDU | 1 | P |
| 4 | Trigger the UE to perform Recommended Bit Rate query for direction Uplink via AT (+CGBRRREQ) or MMI command. | - | - | - | - |
| 5 | Check: Does the UE transmit a MAC PDU containing Recommended bit rate MAC CE with Uplink/Downlink (UL/DL) set as 1? | -> | MAC PDU | 1 | P |
| 6 | SS transmits a MAC PDU containing Recommended bit rate MAC CE with Uplink/Downlink (UL/DL) set as 0 and Bit Rate same as value received in step 5. | <- | MAC PDU | - | - |
| 7 | Trigger the UE to perform Recommended Bit Rate query for direction Up Link via AT (+CGBRRREQ) or MMI command. | - | - | - | - |
| 8 | Check: Does the UE transmit a MAC PDU containing Recommended bit rate MAC CE ? | -> | MAC PDU | 2 | P |
| 9 | While bitRateQueryProhibitTimer is running (3 seconds) in UE, trigger the UE to perform Recommended Bit Rate query for direction Up Link via AT (+CGBRRREQ) or MMI command. | - | - | - | - |
| 10 | Check: While bitRateQueryProhibitTimer is running, does the UE transmit a MAC PDU containing Recommended bit rate MAC CE ? | -> | MAC PDU | 2 | F |
| 11 | Check: After bitRateQueryProhibitTimer expires, does the UE transmit a MAC PDU containing Recommended bit rate MAC CE with Uplink/Downlink (UL/DL) set as 1? | -> | MAC PDU | 2 | P |
| 12 | SS transmits a MAC PDU containing Recommended bit rate MAC CE with Uplink/Downlink (UL/DL) set as 1 and Bit Rate same as value received in step 11. | <- | MAC PDU | - | - |
| 13 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 12? | --> | HARQ ACK | 3 | P |
| Note: The bitRateQueryProhibitTimer is configured only for UL direction as per asn.1 definition. | | | | | |

7.1.1.10.2.3.3 Specific message contents

None

##### 7.1.1.10.3 NR CA / LBT failure on Scell / MAC CE indication

Editor’s Note: When UE attempts to send the data at step 6, it is necessary from the SS to have a test model (FFS) that keeps channel busy, so UE detects consistent LBT failures when channel is sensed.

7.1.1.10.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_Connected state with SCell configured in uplink and Shared Spectrum }

**ensure that** {

**when** { UE detects consistent uplink LBT failures on the SCell }

**then** { UE transmits a MAC PDU containing LBT failure MAC Control Element on PCell }

}

7.1.1.10.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clauses 5.21.1, 5.21.2 and 6.1.3.30. Unless otherwise stated these are Rel-16 requirements.

[TS 38.321, clause 5.21.1]

The lower layer may perform an LBT procedure, see TS 37.213 [18], according to which a transmission is not performed by lower layers if the channel is identified as being occupied. When lower layer performs an LBT procedure before a transmission and the transmission is not performed, an LBT failure indication is sent to the MAC entity from lower layers. Unless otherwise specified, when LBT procedure is performed for a transmission, actions as specified in this specification are performed regardless of if an LBT failure indication is received from lower layers. When LBT is not performed by the lower layers, LBT failure indication is not received from lower layers.

[TS 38.321, clause 5.21.2]

The MAC entity may be configured by RRC with a consistent LBT failure recovery procedure. Consistent LBT failure is detected per UL BWP by counting LBT failure indications, for all UL transmissions, from the lower layers to the MAC entity.

RRC configures the following parameters in the *lbt-FailureRecoveryConfig*:

- *lbt-FailureInstanceMaxCount* for the consistent LBT failure detection;

- *lbt-FailureDetectionTimer* for the consistent LBT failure detection;

The following UE variable is used for the consistent LBT failure detection procedure:

- *LBT\_COUNTER* (per Serving Cell): counter for LBT failure indication which is initially set to 0.

For each activated Serving Cell configured with *lbt-FailureRecoveryConfig*, the MAC entity shall:

1> if LBT failure indication has been received from lower layers:

2> start or restart the *lbt-FailureDetectionTimer*;

2> increment *LBT\_COUNTER* by 1;

2> if *LBT\_COUNTER* >= *lbt-FailureInstanceMaxCount*:

3> trigger consistent LBT failure for the active UL BWP in this Serving Cell;

…

The MAC entity shall:

…

1> else if consistent LBT failure has been triggered, and not cancelled, in at least one SCell:

2> if UL-SCH resources are available for a new transmission in a Serving Cell for which consistent LBT failure has not been triggered and these UL-SCH resources can accommodate the LBT failure MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the LBT failure MAC CE.

2> else:

3> trigger a Scheduling Request for LBT failure MAC CE.

1> if a MAC PDU is transmitted and LBT failure indication is not received from lower layers and this PDU includes the LBT failure MAC CE:

2> cancel all the triggered consistent LBT failure(s) in SCell(s) for which consistent LBT failure was indicated in the transmitted LBT failure MAC CE.

[TS 38.321, clause 6.1.3.30]

The LBT failure MAC CE of one octet is identified by a MAC subheader with LCID as specified in Table 6.2.1-2. It has a fixed size and consists of a single octet containing 8 C-fields as follows (Figure 6.1.3.30-1).

The LBT failure MAC CE of four octets is identified by a MAC subheader with LCID as specified in Table 6.2.1-2. It has a fixed size and consists of four octets containing 32 C-fields as follows (Figure 6.1.3.30-2).

A single octet format is used when the highest *ServCellIndex* of this MAC entity's Serving Cell for which LBT failure is detected is less than 8, otherwise four octets format is used.

- Ci: If there is a Serving Cell configured for the MAC entity with *ServCellIndex* i as specified in TS 38.331 [5] and if consistent LBT failure have been triggered and not cancelled in this Serving Cell, the field is set to 1, otherwise the field is set to 0.



Figure 6.1.3.30-1: LBT failure MAC CE of one octet



Figure 6.1.3.30-2: LBT failure MAC CE of four octets

7.1.1.10.3.3 Test description

7.1.1.10.3.3.1 Pre-test conditions

System Simulator:

- NR Cell1 is the PCell.

- NR Cell 10 is the SCell and configured to operate in Shared Spectrum.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cells.

UE:

- None.

Preamble:

- The UE is in 5GS state 3N-A according to TS 38.508-1 [4], clause 4.4A.2 Table 4.4A.2-3 and using the message condition UE TEST LOOP MODE A active.

7.1.1.10.3.3.2 Test procedure sequence

Table 7.1.1.10.3.3.2-1 illustrates the downlink power levels and other changing parameters to be applied for the cells at various time instants of the test execution. Row marked "T0" denotes the initial conditions after preamble.

Table 7.1.1.10.3.3.2-1: Cell configuration power level changes over time for conducted test environment

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 10 |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -88 |

Table 7.1.1.10.3.3.2-2: Void

Table 7.1.1.10.3.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits an RRCReconfiguration message toconfigure NR SCell (NR Cell 10). | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 2 | The UE transmits RRCReconfigurationComplete message. | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 3 | The SS transmits Activation MAC control element to activate NR SCell. | <-- | MAC PDU (SCell Activation/Deactivation MAC CE of one octet (C1=1)) | - | - |
| 4 | The SS does not allocate UL grants on NR PCell. | - | - | - | - |
| 5 | 200 ms after step 3, the SS indicates a new transmission on PDCCH of NR SCell and transmits a MAC PDU (containing an RLC PDU). | <-- | MAC PDU | - | - |
| 6 | The SS sends a periodic UL grant suitable for transmitting loop back PDU on NR SCell. | <-- | (UL Grant) | - | - |
| 7 | UE is made to detect consistent LBT failures on NR SCell while attempting to loop back the data received at step 5 [FFS] | - | - | - | - |
| 8 | The SS resumes normal UL grant allocation on NR PCell. | - | - | - | - |
| 9 | Check: Does the UE transmit a MAC PDU containing LBT failure MAC CE on NR PCell? | --> | MAC PDU (LBT failure MAC CE of one octet (C1=1)) | 1 | P |

7.1.1.10.3.3.3 Specific message contents

Table 7.1.1.10.3.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.1.10.3.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13. | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.10.3.3.3-2: CellGroupConfig (Table 7.1.1.10.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19. | | | |
| Information Element | | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { | |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxMeasId)) OF SCellConfig { | | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { | |  | entry 1 |  |
| sCellIndex | | SCellIndex as per TS 38.508-1 [4] table 4.6.3-154 |  |  |
| sCellConfigCommon | | ServingCellConfigCommon |  |  |
| sCellConfigDedicated | | ServingCellConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.10.3.3.3-3: ServingCellConfigCommon (Table 7.1.1.10.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 with conditions SCell\_add and SharedSpectrum | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| physCellId | Physical Cell Identity of NR Cell 10 |  |  |
| uplinkConfigCommon | UplinkConfigCommon as per TS 38.508-1 [4] table 4.6.3-201 |  |  |
| } |  |  |  |

Table 7.1.1.10.3.3.3-4: ServingCellConfig (Table 7.1.1.10.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-167 with condition SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkDedicated with condition SharedSpectrum |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.10.4 NTN / UE specific TA report

7.1.1.10.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_IDLE state on a cell which provides access by NR NTN and ta-Report-r17 is configured with value enabled in SIB19 }

**ensure that** {

**when** { UE initiates the Random Access procedure }

**then** { UE performs the Timing Advance reporting procedure }

}

(2)

**with** { UE in RRC\_IDLE state on a cell which provides access by NR NTN and ta-Report-r17 is not configured in SIB19 }

**ensure that** {

**when** { offsetThresholdTA-r17 is received in rrcSetup message }

**then** { UE performs the Timing Advance reporting procedure }

}

7.1.1.10.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clauses 5.4.8, 6.1.3.56 and TS 38.331, clauses 5.3.3.3, 6.3.2. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.4.8]

The Timing Advance reporting procedure is used in a non-terrestrial network to provide the gNB with an estimate of the UE's Timing Advance value (i.e., *T*TA as defined in the UE's TA formula, see TS 38.211 [8] clause 4.3.1).

RRC controls Timing Advance reporting by configuring the following parameters:

*- offsetThresholdTA*;

*- timingAdvanceSR*.

A Timing Advance report (TAR) shall be triggered if any of the following events occur:

- upon indication from upper layers to trigger a Timing Advance report;

- upon configuration of *offsetThresholdTA* by upper layers, if the UE has not previously reported Timing Advance value to current Serving Cell;

- if the variation between the current estimate of the Timing Advance value and the last reported Timing Advance value is equal to or larger than *offsetThresholdTA*, if configured.

The MAC entity shall:

1> if the Timing Advance reporting procedure determines that at least one TAR has been triggered and not cancelled:

2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the Timing Advance Report MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the Timing Advance Report MAC CE as defined in clause 6.1.3.56.

2> else

3> if *timingAdvanceSR* is configured with value *enabled*:

4> trigger a Scheduling Request.

NOTE: UL-SCH resources are considered available if the MAC entity has been configured with, receives, or determines an uplink grant. If the MAC entity has determined at a given point in time that UL-SCH resources are available, this need not imply that UL-SCH resources are available for use at that point in time.

A MAC PDU shall contain at most one Timing Advance Report MAC CE, even when multiple events have triggered a Timing Advance report. The Timing Advance Report MAC CE shall be generated based on the latest available estimate of the UE's Timing Advance value prior to the MAC PDU assembly.

All triggered Timing Advance reports shall be cancelled when a MAC PDU is transmitted and this PDU includes a Timing Advance Report MAC CE.

[TS 38.321, clause 6.1.3.56]

The Timing Advance Report MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2. It has a fixed size and consists of two octets defined as follows (Figure 6.1.3.56-1):

- R: Reserved bit, set to 0;

- Timing Advance: In FR1, the Timing Advance field indicates the least integer number of slots, using subcarrier spacing of 15 kHz, greater than or equal to the Timing Advance value (see TS 38.211 [8], clause 4.3.1). The length of the field is 14 bits.



Figure 6.1.3.56-1: Timing Advance Report MAC CE

[TS 38.331, clause 5.3.3.3]

The UE shall set the contents of *RRCSetupRequest* message as follows:

…

1> if *ta-Report* is configured with value *enabled* and the UE supports TA reporting:

2> indicate TA report initiation to lower layers;

The UE shall submit the *RRCSetupRequest* message to lower layers for transmission.

[TS 38.331, clause 6.3.2]

***offsetThresholdTA***

Offset for TA reporting as specified in TS 38.321 [3]. Network only configures this parameter for MCG.

***timingAdvanceSR***

Used to configure whether a Timing Advance report may trigger a Scheduling Request as specified in TS 38.321 [3].

…

***ta-Report***

When this field is included in SIB19, it indicates reporting of timing advanced is enabled during Random Access due to RRC connection establishment or RRC connection resume, and during RRC connection reestablishment. When this field is included in *ServingCellConfigCommon* within dedicated signalling, it indicates TA reporting is enabled during Random Access due to reconfiguration with sync (see TS 38.321 [3], clause 5.4.8).

7.1.1.10.4.3 Test description

7.1.1.10.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 as specified in TS 38.508-1 [4] Table 4.4.2.1.

- System information combination NR-28 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used.

UE:

- The UE is in Automatic PLMN selection mode.

- The pre-configured UE location is defined in TS 38.508-1 [4] Clause 4.5C.

Preamble

- The UE is in state Switched OFF (state 0N-B) as defined in TS 38.508-1 [4], subclause 4.4A on NR Cell 1.

7.1.1.10.4.3.2 Test procedure sequence

Table 7.1.1.10.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Power on the UE. | - | - | - | - |
| 2 | The UE transmits preamble on PRACH. | --> | PRACH Preamble | - | - |
| 3 | The SS transmits Random Access Response with RAPID corresponding to the transmitted preamble in step 2. | <-- | Random Access Response | - | - |
| 4 | Check: Does the UE transmit an *RRCSetupRequest* message with Timing Advance Report MAC CE included? | --> | MAC PDU (Timing Advance Report MAC CE, *RRCSetupRequest*) | 1 | P |
| 5-22 | Steps 3 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed. | - | - | - | - |
| 23 | The UE is switched off by executing generic procedure in Table 4.9.6.1-1 in TS 38.508-1 [4]. | - | - | - | - |
| 24 | SS broadcasts *SIB19 with* ta-Report-r17 not present*.* | <-- | RRC: *SIB19* | - | - |
| 25 | Power on the UE. | - | - | - | - |
| 26 | The UE transmits preamble on PRACH. | --> | PRACH Preamble | - | - |
| 27 | The SS transmits Random Access Response with RAPID corresponding to the transmitted preamble in step 26. | <-- | Random Access Response | - | - |
| 28 | The UE transmits an *RRCSetupRequest* message with no Timing Advance Report MAC CE included. | --> | MAC PDU (*RRCSetupRequest)* | - | - |
| 29 | The SS transmits an *RRCSetup* message configuring *offsetThresholdTA.* | <-- | MAC PDU(*RRCSetup)* | - | - |
| 30 | Check: Does the UE transmit an *RRCSetupComplete* message with Timing Advance Report MAC CE included? | --> | MAC PDU (Timing Advance Report MAC CE, *RRCSetupComplete)* | 2 | P |
| 31-46 | Steps 5 to 20a1 of the registration procedure described in TS 38.508-1 [4] subclause 4.5.2.2-2 are performed. | - | - | - | - |

7.1.1.10.4.3.3 Specific message contents

Table 7.1.1.10.4.3.3-1: *SIB19* (Preamble and all steps)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.2-18C | | | |
| Information Element | Value/remark | Comment | Condition |
| SIB19-r17 ::= SEQUENCE { |  |  |  |
| ntn-Config-r17 | NTN-Config with condition GSO | Table 7.1.1.10.4.3.3-2 | GSO |
|  | NTN-Config with condition NGSO | Table 7.1.1.10.4.3.3-2 | NGSO |
| } |  |  |  |

Table 7.1.1.10.4.3.3-2: NTN-Config (Table 7.1.1.10.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-84C | | | |
| Information Element | Value/remark | Comment | Condition |
| NTN-Config-r17 ::= SEQUENCE { |  |  |  |
| ta-Report-r17 | enabled |  | Preamble |
|  | Not present |  | Step 24 |
| } |  |  |  |

Table 7.1.1.10.4.3.3-3: *RRCSetup* (Step 29, Table 7.1.1.10.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCSetup ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcSetup SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig with condition SRB1 | Table 7.1.1.10.4.3.3-4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.10.4.3.3-4: CellGroupConfig (Table 7.1.1.10.4.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig | MAC-CellGroupConfig |  |  |
| } |  |  |  |

Table 7.1.1.10.4.3.3-5: *MAC-CellGroupConfig* (Table 7.1.1.10.4.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| TAR-Config-r17 ::= SEQUENCE { |  |  |  |
| offsetThresholdTA-r17 | ms15 |  |  |
| timingAdvanceSR-r17 | enabled |  |  |
| } |  |  |  |

#### 7.1.1.11 NR Dual Connectivity

##### 7.1.1.11.1 DC power headroom reporting / PSCell activation and DL pathloss change reporting

7.1.1.11.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state on Pcell and PSCell is added }

**ensure that** {

**when** { phr is configured }

**then** { UE transmits a Power Headroom Report for the PCell and PSCell }

}

(2)

**with** { UE in RRC\_CONNECTED state with PSCell and with Power headroom reporting for phr-Tx-PowerFactorChange }

**ensure that** {

**when** { the DL Pathloss has changed more than phr-Tx-PowerFactorChange dB and phr-ProhibitTimer is running }

**then** { UE does not transmit a MAC PDU containing Power Headroom MAC Control Element }

}

(3)

**with** { UE in RRC\_CONNECTED state with PSCell and with Power headroom reporting for phr-Tx-PowerFactorChange }

**ensure that** {

**when** { the phr-ProhibitTimer expires and power headroom report is triggered due to DL Pathloss change }

**then** { UE transmits a MAC PDU containing Power Headroom MAC Control Element for the Pcell and PSCell }

}

7.1.1.11.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321 clause 5.4.6

[TS 38.321, clause 5.4.6]

A Power Headroom Report (PHR) shall be triggered if any of the following events occur:

- *phr-ProhibitTimer* expires or has expired and the path loss has changed more than *phr-Tx-PowerFactorChange* dB for at least one activated Serving Cell of any MAC entity which is used as a pathloss reference since the last transmission of a PHR in this MAC entity when the MAC entity has UL resources for new transmission;

NOTE 1: The path loss variation for one cell assessed above is between the pathloss measured at present time on the current pathloss reference and the pathloss measured at the transmission time of the last transmission of PHR on the pathloss reference in use at that time, irrespective of whether the pathloss reference has changed in between.

- *phr-PeriodicTimer* expires;

- upon configuration or reconfiguration of the power headroom reporting functionality by upper layers, which is not used to disable the function;

- activation of an SCell of any MAC entity with configured uplink;

- addition of the PSCell (i.e. PSCell is newly added or changed);

- *phr-ProhibitTimer* expires or has expired, when the MAC entity has UL resources for new transmission, and the following is true for any of the activated Serving Cells of any MAC entity with configured uplink:

- there are UL resources allocated for transmission or there is a PUCCH transmission on this cell, and the required power backoff due to power management (as allowed by P-MPRc as specified in TS 38.101-1 [14], TS 38.101-2 [15], and TS 38.101-3 [16]) for this cell has changed more than *phr-Tx-PowerFactorChange* dB since the last transmission of a PHR when the MAC entity had UL resources allocated for transmission or PUCCH transmission on this cell.

NOTE 2: The MAC entity should avoid triggering a PHR when the required power backoff due to power management decreases only temporarily (e.g. for up to a few tens of milliseconds) and it should avoid reflecting such temporary decrease in the values of PCMAX,f,c/PH when a PHR is triggered by other triggering conditions.

If the MAC entity has UL resources allocated for a new transmission the MAC entity shall:

1> if it is the first UL resource allocated for a new transmission since the last MAC reset:

2> start *phr-PeriodicTimer*;

1> if the Power Headroom reporting procedure determines that at least one PHR has been triggered and not cancelled; and

1> if the allocated UL resources can accommodate the MAC CE for PHR which the MAC entity is configured to transmit, plus its subheader, as a result of LCP as defined in clause 5.4.3.1:

2> if *multiplePHR* with value *true* is configured:

3> for each activated Serving Cell with configured uplink associated with any MAC entity:

4> obtain the value of the Type 1 or Type 3 power headroom for the corresponding uplink carrier as specified in clause 7.7 of TS 38.213 [6] for NR Serving Cell and clause 5.1.1.2 of TS 36.213 [17] for E-UTRA Serving Cell;

4> if this MAC entity has UL resources allocated for transmission on this Serving Cell; or

4> if the other MAC entity, if configured, has UL resources allocated for transmission on this Serving Cell and *phr-ModeOtherCG* is set to *real* by upper layers:

5> obtain the value for the corresponding PCMAX,f,c field from the physical layer.

3> if *phr-Type2OtherCell* with value *true* is configured:

4> if the other MAC entity is E-UTRA MAC entity:

5> obtain the value of the Type 2 power headroom for the SpCell of the other MAC entity (i.e. E-UTRA MAC entity);

5> if *phr-ModeOtherCG* is set to *real* by upper layers:

6> obtain the value for the corresponding PCMAX,f,c field for the SpCell of the other MAC entity (i.e. E-UTRA MAC entity) from the physical layer.

3> instruct the Multiplexing and Assembly procedure to generate and transmit the Multiple Entry PHR MAC CE as defined in clause 6.1.3.9 based on the values reported by the physical layer.

2> else (i.e. Single Entry PHR format is used):

3> obtain the value of the Type 1 power headroom from the physical layer for the corresponding uplink carrier of the PCell;

3> obtain the value for the corresponding PCMAX,f,c field from the physical layer;

3> instruct the Multiplexing and Assembly procedure to generate and transmit the Single Entry PHR MAC CE as defined in clause 6.1.3.8 based on the values reported by the physical layer.

2> start or restart *phr-PeriodicTimer*;

2> start or restart *phr-ProhibitTimer*;

2> cancel all triggered PHR(s).

7.1.1.11.1.3 Test description

7.1.1.11.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 is the PCell and NR Cell 10 is the PSCell.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in all cells.

UE:

- None.

Preamble:

- The UE is in state NR RRC\_CONNECTED using generic procedure parameter Connectivity (*NR-DC*), Test Mode (*On*) associated with UE test loop mode A configured on NR Cell 1 according to TS 38.508-1 [4], clause 4.5.4.

7.1.1.11.1.3.2 Test procedure sequence

Table 7.1.1.11.1.3.2-0: Cell configuration power level changes over time for Conducted test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 10 | Remarks |
| **T0** | Cell-specific RS EPRE | dBm/SCS | -82 | -82 |  |
| **T1** | Cell-specific RS EPRE | dBm/SCS | -89 | -82 |  |
| **T2** | Cell-specific RS EPRE | dBm/SCS | -82 | -82 |  |
| **T3** | Cell-specific RS EPRE | dBm/SCS | -82 | -89 |  |
| **T4** | Cell-specific RS EPRE | dBm/SCS | -82 | -82 |  |

Table 7.1.1.11.1.3.2-0A: Cell configuration power level changes over time for OTA test environment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 10 | Remarks |
| **T0** | Cell-specific RS EPRE | dBm/SCS | -82 | -82 |  |
| **T1** | Cell-specific RS EPRE | dBm/SCS | n/a | n/a |  |
| **T2** | Cell-specific RS EPRE | dBm/SCS | n/a | n/a |  |
| **T3** | Cell-specific RS EPRE | dBm/SCS | -82 | -91 |  |
| **T4** | Cell-specific RS EPRE | dBm/SCS | -82 | -82 |  |

Table 7.1.1.11.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits UL grant on PCell and PSCell to the UE at every 10ms in PDCCH occasion. | <-- | - | - | - |
| 2 | SS transmits NR *RRCReconfiguration* message to configure to specific Power Headroom parameters for NR Cell | <-- | *RRCReconfiguration* | - | - |
| 3 | Check: Does the UE transmit a MAC PDU containing Multiple-Entry PHR MAC CE on PCell?  (Note 1) | --> | MAC PDU | 1 | P |
| 3A | Check: Does the UE transmit a MAC PDU containing Multiple-Entry PHR MAC CE on PSCell?  (Note 1) | --> | MAC PDU | 1 | P |
| 4 | The UE transmits an NR *RRCReconfigurationComplete* message including *nr-SCG-Response* (Note 1) | --> | *RRCReconfigurationComplete* | - | - |
| 5 | Void | - | - | - | - |
| - | EXCEPTION : Steps 6 to 12 shall be executed depending on PSCell Configuration.  (Note 3) | - | - | - | - |
| 6 | IF PSCell is configured as FR1 THEN Reduce SS power level for NR PCell so as to cause a DL\_Pathloss change at UE by 5dB, row T1 of Table 7.1.1.11.1.3.2-0. | - | - | - | - |
| 7 | Check: For 80% of *prohibitPHR-Timer* since step 3, does the UE transmit a MAC PDU containing Multiple-Entry PHR MAC CE on PCell? | --> | MAC PDU | 2 | F |
| 8 | Check: After *prohibitPHR-Timer* after step 3, does the UE transmit a MAC PDU containing Multiple-Entry PHR MAC CE on PCell? | --> | MAC PDU | 3 | P |
| 9 | Increase SS power level for NR PCell so as to cause a DL\_Pathloss change at UE by 5dB, row T2 of Table 7.1.1.11.1.3.2-0/0A. | - | - | - | - |
| 10 | Check: For 80% of *prohibitPHR-Timer* since step 8, does the UE transmit a MAC PDU containing Power Headroom MAC Control Element on PCell? | --> | MAC PDU | 2 | F |
| 11 | Check: After *prohibitPHR-Timer* after step 8, does the UE transmit a MAC PDU containing Power Headroom MAC Control Element on PCell? | --> | MAC PDU | 3 | P |
| 12 | Void | - | - | - | - |
| 13 | Reduce SS power level for NR PSCell so as to cause a DL\_Pathloss change at UE by 5dB, row T3 of Table 7.1.1.11.1.3.2-0/0A. | - | - | - | - |
| 14 | IF PSCell is configured as FR2 THEN Check: For 80% of *prohibitPHR-Timer* since step 3A, does the UE transmit a MAC PDU containing Multiple-Entry PHR MAC CE? | --> | MAC PDU | 2 | F |
| 15 | Check: Does the UE transmit a MAC PDU containing Multiple-Entry PHR MAC CE on PSCell? | --> | MAC PDU | 3 | P |
| 16 | Increase SS power level for NR PSCell so as to cause a DL\_Pathloss change at UE by 5dB, row T4 of Table 7.1.1.11.1.3.2-0/0A. | - | - | - | - |
| 17 | Check: For 80% of *prohibitPHR-Timer* since step 15, does the UE transmit a MAC PDU containing Power Headroom MAC Control Element on PSCell? | --> | MAC PDU | 2 | F |
| 18 | Check: After *prohibitPHR-Timer* after step 15, does the UE transmit a MAC PDU containing Power Headroom MAC Control Element on PSCell? | --> | MAC PDU | 3 | P |
| 19 | The SS transmits an NR *RRCReconfiguration* message to disable Power Headroom reporting | <-- | *RRCReconfiguration* | - | - |
| 20 | The UE transmits an NR *RRCReconfigurationComplete* message to confirm the disabling of Power Headroom parameters | --> | *RRCReconfigurationComplete* | - | - |
| Note 1: Steps 3 and 4 can happen in any order.  Note 2: Void.  Note 3: Steps 6 to 12 are excluded when executed with FR1+FR2 band combination due to limitation in FR1 OTA requirements specified in 38.508-1 [4] clause 6.2.2.2.3. phr-Tx-PowerFactorChange for PCell is not tested due to this limitation | | | | | |

7.1.1.11.1.3.3 Specific Message Contents

Table 7.1.1.11.1.3.3-1: RRCReconfiguration (step 2, Table 7.1.1.11.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.2.2 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| rrc-TransactionIdentifier | | RRC-TransactionIdentifier |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| radioBearerConfig | | Not present |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig-phr |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| mrdc-SecondaryCellGroupConfig CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| mrdc-ReleaseAndAdd | | Not present |  |  |
| mrdc-SecondaryCellGroup CHOICE { | |  |  |  |
| nr-SCG | | RRCReconfiguration-SCG-phr | OCTET STRING (CONTAINING RRCReconfiguration) |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.11.1.3.3-1A: RRCReconfiguration-SCG-phr (step 2, Table 7.1.1.11.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.2.2 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| rrc-TransactionIdentifier | | RRC-TransactionIdentifier |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| radioBearerConfig | | Not present |  |  |
| secondaryCellGroup | | CellGroupConfig-phr |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.11.1.3.3-2: CellGroupConfig-phr (step 2, Table 7.1.1.11.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| cellGroupConfig::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig SEQUENCE { |  |  |  |
| phr-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| phr-PeriodicTimer | infinity |  |  |
| phr-ProhibitTimer | sf500 |  |  |
| phr-Tx-PowerFactorChange | dB3 |  |  |
| multiplePHR | true |  |  |
| dummy | false |  |  |
| phr-Type2OtherCell | false |  |  |
| phr-ModeOtherCG | real |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

#### 7.1.1.12 UE power saving

##### 7.1.1.12.1 Void

##### 7.1.1.12.2 Void

##### 7.1.1.12.3 DRX adaptation / UE wakeup indication

7.1.1.12.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and long DRX is configured and [(SFN \* 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset* and DCP is configured }

**ensure that** {

**when** { a DCP indication with the value of wake-up indication 1 associated with the current DRX cycle has been received }

**then** { UE starts the drx-onDurationTimer after drx-SlotOffset from the beginning of the subframe and monitors the PDCCH }

}

(2)

**with** { UE in RRC\_CONNECTED state and long DRX is configured and [(SFN \* 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset* and DCP is configured and ps-wakeup is configured with value true }

**ensure that** {

**when** { DCP indication associated with this cycle has not been received }

**then** { UE starts the drx-onDurationTimer after drx-SlotOffset from the beginning of the subframe and monitors the PDCCH for OnDurationTimer PDCCH-Occasions }

}

(3)

**with** { UE in RRC\_CONNECTED state long DRX is configured and [(SFN \* 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset* and DCP is configured }

**ensure that** {

**when** { all DCP occasions in time domain occurred in DRX active time }

**then** { UE does not monitor PDCCH for the detection of DCI format 2\_6 and start the drx-onDurationTimer after drx-SlotOffset from the beginning of the subframe and monitors the PDCCH }

}

(4)

**with** { UE in RRC\_CONNECTED state long DRX is configured and DCP is configured }

**ensure that** {

**when** { all DCP occasions in time domain occurred during measurement gap }

**then** { UE does not monitor PDCCH for the detection of DCI format 2\_6 and start the drx-onDurationTimer after drx-SlotOffset from the beginning of the subframe and monitors the PDCCH }

}

(5)

**with** { UE in RRC\_CONNECTED state and long DRX is configured and [(SFN \* 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset* and DCP is configured }

**ensure that** {

**when** { a DCP indication with the value of wake-up indication 0 associated with the current DRX cycle has been received }

**then** { UE does not start the drx-onDurationTimer after drx-SlotOffset from the beginning of the subframe and skips monitoring the PDCCH }

}

7.1.1.12.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clause 5.7, TS 38.213, clause 10.3 and 7.3.1.3.7. Unless otherwise stated these are Rel-16 requirements.

[TS 38.321, clause 5.7]

The MAC entity may be configured by RRC with a DRX functionality that controls the UE's PDCCH monitoring activity for the MAC entity's C-RNTI, CI-RNTI, CS-RNTI, INT-RNTI, SFI-RNTI, SP-CSI-RNTI, TPC-PUCCH-RNTI, TPC-PUSCH-RNTI, TPC-SRS-RNTI, and AI-RNTI. When using DRX operation, the MAC entity shall also monitor PDCCH according to requirements found in other clauses of this specification. When in RRC\_CONNECTED, if DRX is configured, for all the activated Serving Cells, the MAC entity may monitor the PDCCH discontinuously using the DRX operation specified in this clause; otherwise the MAC entity shall monitor the PDCCH as specified in TS 38.213 [6].

NOTE 1: If Sidelink resource allocation mode 1 is configured by RRC, a DRX functionality is not configured.

RRC controls DRX operation by configuring the following parameters:

- *drx-onDurationTimer*: the duration at the beginning of a DRX Cycle;

- *drx-SlotOffset*: the delay before starting the *drx-onDurationTimer*;

- *drx-InactivityTimer*: the duration after the PDCCH occasion in which a PDCCH indicates a new UL or DL transmission for the MAC entity;

- *drx-RetransmissionTimerDL* (per DL HARQ process except for the broadcast process): the maximum duration until a DL retransmission is received;

- *drx-RetransmissionTimerUL* (per UL HARQ process): the maximum duration until a grant for UL retransmission is received;

- *drx-LongCycleStartOffset*: the Long DRX cycle and *drx-StartOffset* which defines the subframe where the Long and Short DRX Cycle starts;

- *drx-ShortCycle* (optional): the Short DRX cycle;

- *drx-ShortCycleTimer* (optional): the duration the UE shall follow the Short DRX cycle;

- *drx-HARQ-RTT-TimerDL* (per DL HARQ process except for the broadcast process): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

- *drx-HARQ-RTT-TimerUL* (per UL HARQ process): the minimum duration before a UL HARQ retransmission grant is expected by the MAC entity;

- *ps-Wakeup* (optional): the configuration to start associated *drx-onDurationTimer* in case DCP is monitored but not detected;

- *ps-TransmitOtherPeriodicCSI* (optional): the configuration to report periodic CSI that is not L1-RSRP on PUCCH during the time duration indicated by *drx-onDurationTimer* in case DCP is configured but associated *drx-onDurationTimer* is not started;

- *ps-TransmitPeriodicL1-RSRP* (optional): the configuration to transmit periodic CSI that is L1-RSRP on PUCCH during the time duration indicated by *drx-onDurationTimer* in case DCP is configured but associated *drx-onDurationTimer* is not started.

Serving Cells may be configured by RRC in two groups. When RRC does not configure a secondary DRX group, there is only one DRX group. When two DRX groups are configured each group of Serving Cells, which is called a DRX group, is configured by RRC with its own set of parameters: *drx-onDurationTimer*, *drx-InactivityTimer*. When two DRX groups are configured, the two groups share the following parameter values: *drx-SlotOffset*, *drx-RetransmissionTimerDL*, *drx-RetransmissionTimerUL*, *drx-LongCycleStartOffset*, *drx-ShortCycle* (optional), *drx-ShortCycleTimer* (optional), *drx-HARQ-RTT-TimerDL*, and *drx-HARQ-RTT-TimerUL*.

When a DRX cycle is configured, the Active Time for Serving Cells in a DRX group includes the time while:

- *drx-onDurationTimer* or *drx-InactivityTimer* configured for the DRX group is running; or

- *drx-RetransmissionTimerDL* or *drx-RetransmissionTimerUL* is running on any Serving Cell in the DRX group; or

- *ra-ContentionResolutionTimer* (as described in clause 5.1.5) or *msgB-ResponseWindow* (as described in clause 5.1.4a) is running; or

- a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4); or

- a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in clauses 5.1.4 and 5.1.4a).

When DRX is configured, the MAC entity shall:

1> if the Long DRX Cycle is used, and [(SFN × 10) + subframe number] modulo (*drx-LongCycle*) = *drx-StartOffset*:

2> if DCP monitoring is configured for the active DL BWP as specified in TS 38.213 [6], clause 10.3:

3> if DCP indication associated with the current DRX Cycle received from lower layer indicated to start *drx-onDurationTimer*, as specified in TS 38.213 [6]; or

3> if all DCP occasion(s) in time domain, as specified in TS 38.213 [6], associated with the current DRX Cycle occurred in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to start of the last DCP occasion, or within BWP switching interruption length, or during a measurement gap; or

3> if *ps-Wakeup* is configured with value *true* and DCP indication associated with the current DRX Cycle has not been received from lower layers:

4> start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe.

2> else:

3> start *drx-onDurationTimer* after *drx-SlotOffset* from the beginning of the subframe.

NOTE 2: In case of unaligned SFN across carriers in a cell group, the SFN of the SpCell is used to calculate the DRX duration.

1> if the DRX group is in Active Time:

2> monitor the PDCCH on the Serving Cells in this DRX group as specified in TS 38.213 [6];

2> if the PDCCH indicates a DL transmission:

3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;

NOTE 3: When HARQ feedback is postponed by PDSCH-to-HARQ\_feedback timing indicating a non-numerical k1 value, as specified in TS 38.213 [6], the corresponding transmission opportunity to send the DL HARQ feedback is indicated in a later PDCCH requesting the HARQ-ACK feedback.

3> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.

3> if the PDSCH-to-HARQ\_feedback timing indicate a non-numerical k1 value as specified in TS 38.213 [6]:

4> start the *drx-RetransmissionTimerDL* in the first symbol after the PDSCH transmission for the corresponding HARQ process.

2> if the PDCCH indicates a UL transmission:

3> start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process in the first symbol after the end of the first repetition of the corresponding PUSCH transmission;

3> stop the *drx-RetransmissionTimerUL* for the corresponding HARQ process.

2> if the PDCCH indicates a new transmission (DL or UL) on a Serving Cell in this DRX group:

3> start or restart *drx-InactivityTimer* for this DRX group in the first symbol after the end of the PDCCH reception.

1> if DCP monitoring is configured for the active DL BWP as specified in TS 38.213 [6], clause 10.3; and

1> if the current symbol n occurs within *drx-onDurationTimer* duration; and

1> if *drx-onDurationTimer* associated with the current DRX cycle is not started as specified in this clause:

2> if the MAC entity would not be in Active Time considering grants/assignments/DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7];

3> not report semi-persistent CSI configured on PUSCH;

3> if *ps-TransmitPeriodicL1-RSRP* is not configured with value *true*:

4> not report periodic CSI that is L1-RSRP on PUCCH.

3> if *ps-TransmitOtherPeriodicCSI* is not configured with value *true*:

4> not report periodic CSI that is not L1-RSRP on PUCCH.

1> else:

2> in current symbol n, if the DRX group would not be in Active Time considering grants/assignments scheduled on Serving Cell(s) in this DRX Group and DRX Command MAC CE/Long DRX Command MAC CE received and Scheduling Request sent until 4 ms prior to symbol n when evaluating all DRX Active Time conditions as specified in this clause:

3> not transmit periodic SRS and semi-persistent SRS defined in TS 38.214 [7] in this DRX group;

3> not report CSI on PUCCH and semi-persistent CSI configured on PUSCH in this DRX group.

…

Regardless of whether the MAC entity is monitoring PDCCH or not on the Serving Cells in this DRX group, the MAC entity transmits HARQ feedback, aperiodic CSI on PUSCH, and aperiodic SRS defined in TS 38.214 [7] on the Serving Cells in this DRX group when such is expected.

The MAC entity needs not to monitor the PDCCH if it is not a complete PDCCH occasion (e.g. the Active Time starts or ends in the middle of a PDCCH occasion).

[TS 38.213, clause 10.3]

A UE configured with DRX mode operation [11, TS 38.321] can be provided the following for detection of a DCI format 2\_6 in a PDCCH reception on the PCell or on the SpCell [12, TS 38.331]

- a PS-RNTI for DCI format 2\_6 by *ps-RNTI*

- a number of search space sets, by *dci-Format2-6*, to monitor PDCCH for detection of DCI format 2\_6 on the active DL BWP of the PCell or of the SpCell according to a common search space as described in clause 10.1

- a payload size for DCI format 2\_6 by *sizeDCI-2-6*

- a location in DCI format 2\_6 of a Wake-up indication bit by *ps-PositionDCI-2-6*

- a '0' value for the Wake-up indication bit, when reported to higher layers, indicates to not start the *drx-onDurationTimer* for the next long DRX cycle [11, TS 38.321]

- a '1' value for the Wake-up indication bit, when reported to higher layers, indicates to start the *drx-onDurationTimer* for the next long DRX cycle [11, TS 38.321]

- a bitmap, when the UE is provided a number of groups of configured SCells by *dormancyGroupOutsideActiveTime*, where

- the bitmap location is immediately after the Wake-up indication bit location

- the bitmap size is equal to the number of groups of configured SCells where each bit of the bitmap corresponds to a group of configured SCells from the number of groups of configured SCells

- a '0' value for a bit of the bitmap indicates an active DL BWP, provided by *dormantBWP-Id*, for the UE [11, TS38.321] for each activated SCell in the corresponding group of configured SCells

- a '1' value for a bit of the bitmap indicates

- an active DL BWP, provided by *firstOutsideActiveTimeBWP-Id*, for the UE for each activated SCell in the corresponding group of configured SCells, if a current active DL BWP is the dormant DL BWP

- a current active DL BWP, for the UE for each activated SCell in the corresponding group of configured SCells, if the current active DL BWP is not the dormant DL BWP

- the UE sets the active DL BWP to the indicated active DL BWP

- an offset by *ps-Offset* indicating a time, where the UE starts monitoring PDCCH for detection of DCI format 2\_6 according to the number of search space sets, prior to a slot where the *drx-onDurationTimer* would start on the PCell or on the SpCell [11, TS 38.321]

- for each search space set, the PDCCH monitoring occasions are the ones in the first slots indicated by *duration*, or slot if *duration* is not provided, starting from the first slot of the first slots and ending prior to the start of *drx-onDurationTimer*.

On PDCCH monitoring occasions associated with a same long DRX Cycle, a UE does not expect to detect more than one DCI format 2\_6 with different values of the Wake-up indication bit for the UE or with different values of the bitmap for the UE.

The UE does not monitor PDCCH for detecting DCI format 2\_6 during Active Time [11, TS 38.321].

If a UE reports for an active DL BWP a *MinTimeGap* value that is X slots prior to the beginning of a slot where the UE would start the *drx-onDurationTimer*, the UE is not required to monitor PDCCH for detection of DCI format 2\_6 during the X slots, where X corresponds to the *MinTimeGap* value of the SCS of the active DL BWP in Table 10.3-1.

Table 10.3-1: Minimum time gap value X

|  |  |  |
| --- | --- | --- |
| SCS (kHz) | Minimum Time Gap X (slots) | |
| Value 1 | Value 2 |
| 15 | 1 | 3 |
| 30 | 1 | 6 |
| 60 | 1 | 12 |
| 120 | 2 | 24 |
| 480 | 8 | 96 |
| 960 | 16 | 192 |

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE detects DCI format 2\_6, the physical layer of a UE reports the value of the Wake-up indication bit for the UE to higher layers [11, TS 38.321] for the next long DRX cycle.

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE does not detect DCI format 2\_6, the physical layer of the UE does not report a value of the Wake-up indication bit to higher layers for the next long DRX cycle.

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE

- is not required to monitor PDCCH for detection of DCI format 2\_6, as described in clauses 10, 11.1, 12, and in clause 5.7 of [11, TS 38.321] for all corresponding PDCCH monitoring occasions outside Active Time prior to a next long DRX cycle, or

- does not have any PDCCH monitoring occasions for detection of DCI format 2\_6 outside Active Time of a next long DRX cycle

the physical layer of the UE reports a value of 1 for the Wake-up indication bit to higher layers for the next long DRX cycle.

[TS 38.212, clause 7.3.1.3.7]

DCI format 2\_6 is used for notifying the power saving information outside DRX Active Time for one or more UEs.

The following information is transmitted by means of the DCI format 2\_6 with CRC scrambled by PS-RNTI:

- block number 1, block number 2,…, block number *N*

where the starting position of a block is determined by the parameter *PSPositionDCI2-6* provided by higher layers for the UE configured with the block.

If the UE is configured with higher layer parameter *PS-RNTI* and *dci-Format2-6*, one block is configured for the UE by higher layers, with the following fields defined for the block:

- Wake-up indication - 1 bit

- SCell dormancy indication – 0 bit if higher layer parameter *Scell-groups-for-dormancy-outside-active-time* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to higher layer parameter *Scell-groups-for-dormancy-outside-active-time,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *Scell-groups-for-dormancy-outside-active-time,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group.

The size of DCI format 2\_6 is indicated by the higher layer parameter *SizeDCI\_2-6*, according to Clause 10.3 of [5, TS 38.213].

7.1.1.12.3.3 Test description

7.1.1.12.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that set to return no data in uplink.

7.1.1.12.3.3.2 Test procedure sequence

Table 7.1.1.12.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits RRCReconfiguration to configure specific DCP parameters. (Note 1) | <-- | *RRCReconfiguration* | - | - |
| 2 | The UE transmits RRCReconfigurationComplete. (Note 2) | --> | *RRCReconfigurationComplete* | - | - |
| 3 | Wait 1280ms to ensure UE is out DRX active time. | - | - | - | - |
| 3A | The SS transmits DCI 2-6 on the PDCCH within the PS-offset time before the start of next long DRX drx-onDurationTimer and the DCI 2-6 indicates not to start the next Drx-onDurationTimer. | <-- | (PDCCH (DCI 2-6)) | - | - |
| 3B | In a PDCCH occasion the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 3C | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 3B? | --> | HARQ ACK | 5 | F |
| 4 | The SS transmits DCI 2-6 on the PDCCH within the PS-offset time before the start of next long DRX drx-onDurationTimer and the DCI 2-6 indicates to start the next Drx-onDurationTimer. | <-- | (PDCCH (DCI 2-6)) | - | - |
| 5 | In the first PDCCH occasion when the Drx-onDurationTimer is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 6 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 5? | --> | HARQ ACK | 1 | P |
| 7 | The SS transmits RRCReconfiguration to configure ps-wakeup with value true. (Note 1) | <-- | *RRCReconfiguration* | - | - |
| 8 | The UE transmits RRCReconfigurationComplete. (Note 2) | --> | *RRCReconfigurationComplete* | - | - |
| 9 | Wait 1280ms to ensure UE is out DRX active time. | - | - | - | - |
| 10 | In the first PDCCH occasion when the *Drx-onDurationTimer* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 11 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 10? | --> | HARQ ACK | 2 | P |
| 12 | SS transmits RRCReconfiguration to configure specific DCP parameters. (Note 1) | <-- | *RRCReconfiguration* | - | - |
| 13 | The UE transmits RRCReconfigurationComplete. (Note 2) | --> | *RRCReconfigurationComplete* | - | - |
| 14 | Wait 400ms to ensure UE is out DRX active time. | - | - | - | - |
| 15 | The SS transmits DCI 2-6 on the PDCCH within the PS-offset time before the start of next long DRX drx-onDurationTimer and the DCI 2-6 indicates to start the next Drx-onDurationTimer. | <-- | (PDCCH (DCI 2-6)) | - | - |
| 16 | In the last PDCCH occasion when the *Drx-onDurationTimer* is running, the SS indicates the transmission of an invalid DL MAC PDU on the PDCCH. | <-- | Invalid MAC PDU | - | - |
| 17 | The UE transmits a HARQ NACK for the DL MAC PDU in Step 16. | --> | HARQ NACK | - | - |
| 17A | The SS transmits DCI 2-6 on the PDCCH within the PS-offset time before the start of next long DRX drx-onDurationTimer and the DCI 2-6 indicates not to start the next Drx-onDurationTimer. | <-- | (PDCCH (DCI 2-6)) | - | - |
| 18 | In the PDCCH occasion when the next *Drx-onDurationTimer* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 19 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 18? | --> | HARQ ACK | 3 | P |
| 19A | The SS transmits DCI 2-6 on the PDCCH within the PS-offset time before the start of next long DRX drx-onDurationTimer and the DCI 2-6 indicates to start the next Drx-onDurationTimer. | <-- | (PDCCH (DCI 2-6)) | - | - |
| 20 | The SS transmits RRCReconfiguration to configure specific measonfig parameters. (Note 1) | <-- | *RRCReconfiguration* | - | - |
| 21 | The UE transmits RRCReconfigurationComplete. (Note 2) | --> | *RRCReconfigurationComplete* | - | - |
| 22 | Wait 10ms to ensure UE is out DRX active time. | - | - | - | - |
| 22A | The SS transmits DCI 2-6 on the PDCCH within the PS-offset time before the start of next long DRX drx-onDurationTimer and the DCI 2-6 indicates not to start the next Drx-onDurationTimer. | <-- | (PDCCH (DCI 2-6)) | - | - |
| 23 | In the first PDCCH occasion when the *Drx-onDurationTimer* is running, the SS indicates the transmission of a DL MAC PDU on the PDCCH. | <-- | MAC PDU | - | - |
| 24 | Check: Does the UE transmit a HARQ ACK for the DL MAC PDU in Step 23? | --> | HARQ ACK | 4 | P |
| Note 1: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.In addition to this, for Step 20, the specific message contents in Table 7.1.1.12.3.3.3-9 for RRC Connection Reconfiguration is used  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete. | | | | | |

7.1.1.12.3.3.3 Specific message contents

Table 7.1.1.12.3.3.3-1: RRCReconfiguration (steps 1, 7 and 12, Table 7.1.1.12.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| secondaryCellGroup | | CellGroupConfig |  | EN-DC |
| nonCriticalExtension | | Not present |  | EN-DC |
| nonCriticalExtension SEQUENCE { | |  |  | NR |
| masterCellGroup | | CellGroupConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.12.3.3.3-2: CellGroupConfig (Table 7.1.1.12.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| spCellConfigDedicated | ServingCellConfig |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.12.3.3.3-3: ServingCellConfig (Table 7.1.1.13.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.3-167 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP ::= SEQUENCE { |  |  |  |
| pdcch-Config CHOICE { |  |  | Step 1, Step 7, Step 12, Step 20 |
| setup | PDCCH-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.12.3.3.3-4: PDCCH-Config (Table 7.1.1.12.3.3.3-3)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-95 with condition DCI\_2\_6 |

Table 7.1.1.12.3.3.3-5: CellGroupConfig (Table 7.1.1.13.3.3.3-1: RRCReconfiguration step 7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| physicalCellGroupConfig::= SEQUENCE { |  |  |  |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-WakeUp-r16 | true |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.12.3.3.3-6: CellGroupConfig (Table 7.1.1.13.3.3.3-1: RRCReconfiguration step 12)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig ::= SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { | ms10 |  |  |
| milliSeconds | ms10 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms6 |  |  |
| drx-HARQ-RTT-TimerDL | 56 |  |  |
| drx-HARQ-RTT-TimerUL | 56 |  |  |
| drx-RetransmissionTimerDL | sl320 |  |  |
| drx-RetransmissionTimerUL | sl320 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms20 | 0 |  |  |
| } |  |  |  |
| shortDRX | Not present |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| physicalCellGroupConfig::= SEQUENCE { |  |  |  |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 40 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.12.3.3.3-7: RRCReconfiguration (step 20, Table 7.1.1.12.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| secondaryCellGroup | | CellGroupConfig |  | EN-DC |
| measConfig ::= SEQUENCE { | |  |  |  |
| measObjectToAddModList SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasObjectToAddMod { | | 2 entries |  |  |
| MeasObjectToAddMod[1] SEQUENCE { | |  | entry 1 |  |
| measObjectId | | 1 |  |  |
| measObject CHOICE { | |  |  |  |
| measObjectNR SEQUENCE { | |  |  |  |
| ssbFrequency | | ARFCN-ValueNR for SSB of NR Cell 1 |  |  |
| absThreshSS-BlocksConsolidation | | Not present |  |  |
| nrofSS-BlocksToAverage | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| MeasObjectToAddMod[2] SEQUENCE { | |  |  |  |
| measObjectId | | 2 |  |  |
| measObject CHOICE { | |  |  |  |
| measObjectNR SEQUENCE { | |  |  |  |
| ssbFrequency | | ARFCN-ValueNR for SSB of NR Cell 3 |  |  |
| absThreshSS-BlocksConsolidation | | Not present |  |  |
| nrofSS-BlocksToAverage | | Not present |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| reportConfigToAddModList SEQUENCE(SIZE (1..maxReportConfigId)) OF ReportConfigToAddMod { | | 1 entry |  |  |
| ReportConfigToAddMod[1] SEQUENCE { | |  | entry 1 |  |
| reportConfigId | | 1 |  |  |
| reportConfig CHOICE { | |  |  |  |
| reportConfigNR SEQUENCE { | |  |  |  |
| reportType CHOICE { | |  |  |  |
| eventTriggered SEQUENCE { | |  |  |  |
| eventId CHOICE { | |  |  |  |
| eventA3 SEQUENCE { | |  |  |  |
| a3-Offset CHOICE { | |  |  |  |
| rsrp | | 2 | 1 dB (2\*0.5 dB) |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| reportAmount | | infinity |  |  |
| reportQuantityCell SEQUENCE { | |  |  |  |
| rsrp | | true |  |  |
| rsrq | | false |  |  |
| sinr | | false |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| measIdToAddModList SEQUENCE (SIZE (1..maxNrofMeasId)) OF MeasIdToAddMod { | | 1 entry |  |  |
| MeasIdToAddMod[1] SEQUENCE { | |  | entry 1 |  |
| measId | | 1 |  |  |
| measObjectId | | 2 |  |  |
| reportConfigId | | 1 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| measGapConfig ::= SEQUENCE { | |  |  |  |
| gapUE CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| gapOffset | | 34 |  |  |
| mgl | | ms6 |  |  |
| mgrp | | ms40 |  |  |
| mgta | | ms0 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| nonCriticalExtension SEQUENCE { | |  |  | NR |
| masterCellGroup | | CellGroupConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.12.3.3.3-8: CellGroupConfig (Table 7.1.1.12.3.3.3-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| mac-CellGroupConfig ::= SEQUENCE { |  |  |  |
| drx-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms10 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms5 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms40 | 39 |  |  |
| } |  |  |  |
| shortDRX | Not present |  |  |
| drx-SlotOffset | ms0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| physicalCellGroupConfig::= SEQUENCE { |  |  |  |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 32 |  |  |
| ps-PositionDCI-2-6-r16 | 5 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.12.3.3.3-9: *RRCConnectionReconfiguration* (Step 20)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 36.508 table 4.6.1-8 | | | |
| Information Element | Value/Remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE{ |  |  |  |
| rrcConnectionReconfiguration-r8 SEQUENCE { |  |  |  |
| measConfig SEQUENCE { |  |  |  |
| measGapConfig CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| gapOffset CHOICE { |  |  |  |
| gp0 | 34 | MGRP = 40 ms |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.12.4 DRX adaptation / SCell dormancy indication

###### 7.1.1.12.4.1 DRX adaptation / SCell dormancy indication / Intra-band Contiguous CA

7.1.1.12.4.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with SCell configured and long DRX is configured and DCP is configured }

**ensure that** {

**when** { UE is outside DRX active time and receives the PDCCH indicating entering dormant BWP for SCell }

**then** { UE activates the BWP indicated by dormantBWP-Id and stops monitoring the PDCCH }

}

(2)

**with** { UE in RRC\_CONNECTED state with SCell configured and long DRX is configured and DCP is configured }

**ensure that** {

**when** { UE is outside DRX active time and the active DL BWP is dormant BWP and receives the PDCCH indicating leaving dormant BWP from SCell }

**then** { UE activates the BWP indicated by firstOutsideActiveTimeBWP-Id and starts normal MAC operation on the new BWP }

}

7.1.1.12.4.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.212, clause 7.3.1.3.7, TS 38.213, clause 10.3, TS 38.321, clause 5.15.1 and 5.9. Unless otherwise stated these are Rel-16 requirements.

[TS 38.212, clause 7.3.1.3.7]

DCI format 2\_6 is used for notifying the power saving information outside DRX Active Time for one or more UEs.

The following information is transmitted by means of the DCI format 2\_6 with CRC scrambled by PS-RNTI:

- block number 1, block number 2,…, block number *N*

where the starting position of a block is determined by the parameter *ps-PositionDCI-2-6* provided by higher layers for the UE configured with the block.

If the UE is configured with higher layer parameter *ps-RNTI* and *dci-Format2-6*, one block is configured for the UE by higher layers, with the following fields defined for the block:

- Wake-up indication - 1 bit

- SCell dormancy indication – 0 bit if higher layer parameter *dormancyGroupOutsideActiveTime* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to higher layer parameter *dormancyGroupOutsideActiveTime,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *dormancyGroupOutsideActiveTime,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group.

The size of DCI format 2\_6 is indicated by the higher layer parameter *sizeDCI-2-6*, according to Clause 10.3 of [5, TS 38.213].

[TS 38.213, clause 10.3]

A UE configured with DRX mode operation [11, TS 38.321] can be provided the following for detection of a DCI format 2\_6 in a PDCCH reception on the PCell or on the SpCell [12, TS 38.331]

- a PS-RNTI for DCI format 2\_6 by *ps-RNTI*

- a number of search space sets, by *dci-Format2-6*, to monitor PDCCH for detection of DCI format 2\_6 on the active DL BWP of the PCell or of the SpCell according to a common search space as described in Clause 10.1

- a payload size for DCI format 2\_6 by *sizeDCI\_2-6*

- a location in DCI format 2\_6 of a Wake-up indication bit by *psPositionDCI-2-6*

- a '0' value for the Wake-up indication bit, when reported to higher layers, indicates to not start the *drx-onDurationTimer* for the next long DRX cycle [11, TS 38.321]

- a '1' value for the Wake-up indication bit, when reported to higher layers, indicates to start the *drx-onDurationTimer* for the next long DRX cycle [11, TS 38.321]

- a bitmap, when the UE is provided a number of groups of configured SCells by *dormancyGroupOutsideActiveTime*, where

- the bitmap location is immediately after the Wake-up indication bit location

- the bitmap size is equal to the number of groups of configured SCells where each bit of the bitmap corresponds to a group of configured SCells from the number of groups of configured SCells

- a '0' value for a bit of the bitmap indicates an active DL BWP, provided by *dormantBWP-Id*, for the UE [11, TS38.321] for each activated SCell in the corresponding group of configured SCells

- a '1' value for a bit of the bitmap indicates

- an active DL BWP, provided by *firstOutsideActiveTimeBWP-Id*, for the UE for each activated SCell in the corresponding group of configured SCells, if a current active DL BWP is the dormant DL BWP

- a current active DL BWP, for the UE for each activated SCell in the corresponding group of configured SCells, if the current active DL BWP is not the dormant DL BWP

- an offset by *ps-Offset* indicating a time, where the UE starts monitoring PDCCH for detection of DCI format 2\_6 according to the number of search space sets, prior to a slot where the *drx-onDuarationTimer* would start on the PCell or on the SpCell [11, TS 38.321]

- for each search space set, the PDCCH monitoring occasions are the ones in the first slots indicated by *duration*, or slot if *duration* is not provided, starting from the first slot of the first slots and ending prior to the start of *drx-onDurationTimer*.

On PDCCH monitoring occasions associated with a same long DRX Cycle, a UE does not expect to detect more than one DCI format 2\_6 with different values of the Wake-up indication bit for the UE or with different values of the bitmap for the UE.

The UE does not monitor PDCCH for detecting DCI format 2\_6 during Active Time [11, TS 38.321].

If a UE reports for an active DL BWP a requirement of X slots prior to the beginning of a slot where the UE would start the *drx-onDurationTimer*, the UE is not required to monitor PDCCH for detection of DCI format 2\_6 during the X slots, where X corresponds to the requirement of the SCS of the active DL BWP in Table 10.3-1.

Table 10.3-1: Minimum time gap value X

|  |  |  |
| --- | --- | --- |
| SCS (kHz) | Minimum Time Gap X (slots) | |
| Value 1 | Value 2 |
| 15 | 1 | 3 |
| 30 | 1 | 6 |
| 60 | 1 | 12 |
| 120 | 2 | 24 |

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE detects DCI format 2\_6, the physical layer of a UE reports the value of the Wake-up indication bit for the UE to higher layers [11, TS 38.321] for the next long DRX cycle.

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE does not detect DCI format 2\_6, the physical layer of the UE does not report a value of the Wake-up indication bit to higher layers for the next long DRX cycle.

If a UE is provided search space sets to monitor PDCCH for detection of DCI format 2\_6 in the active DL BWP of the PCell or of the SpCell and the UE

- is not required to monitor PDCCH for detection of DCI format 2\_6, as described in Clauses 10, 11.1, 12, and in Clause 5.7 of [11, TS 38.321] for all corresponding PDCCH monitoring occasions outside Active Time prior to a next long DRX cycle, or

- does not have any PDCCH monitoring occasions for detection of DCI format 2\_6 outside Active Time of a next long DRX cycle

the physical layer of the UE reports a value of 1 for the Wake-up indication bit to higher layers for the next long DRX cycle.

…

If an active DL BWP provided by *dormantBWP-Id* for a UE on an activated SCell is not a default DL BWP for the UE on the activated SCell, as described in Clause 12, the BWP inactivity timer is not used for transitioning from the active DL BWP provided by *dormantBWP-Id* to the default DL BWP on the activated SCell.

[TS 38.321, clause 5.15.1]

In addition to clause 12 of TS 38.213 [6], this clause specifies requirements on BWP operation.

A Serving Cell may be configured with one or multiple BWPs, and the maximum number of BWP per Serving Cell is specified in TS 38.213 [6].

The BWP switching for a Serving Cell is used to activate an inactive BWP and deactivate an active BWP at a time. The BWP switching is controlled by the PDCCH indicating a downlink assignment or an uplink grant, by the *bwp-InactivityTimer*, by RRC signalling, or by the MAC entity itself upon initiation of Random Access procedure or upon detection of consistent LBT failure on SpCell. Upon RRC (re-)configuration of *firstActiveDownlinkBWP-Id* and/or *firstActiveUplinkBWP-Id* for SpCell or activation of an SCell, the DL BWP and/or UL BWP indicated by *firstActiveDownlinkBWP-Id* and/or *firstActiveUplinkBWP-Id* respectively (as specified in TS 38.331 [5]) is active without receiving PDCCH indicating a downlink assignment or an uplink grant. The active BWP for a Serving Cell is indicated by either RRC or PDCCH (as specified in TS 38.213 [6]). For unpaired spectrum, a DL BWP is paired with a UL BWP, and BWP switching is common for both UL and DL.

For each SCell a dormant BWP may be configured with *dormantBWP-Id* by RRC signalling as described in TS 38.331 [5]. Entering or leaving dormant BWP for SCells is done by BWP switching per SCell or per dormancy SCell group based on instruction from PDCCH (as specified in TS 38.213 [6]). The dormancy SCell group configurations are configured by RRC signalling as described in TS 38.331 [5]. Upon reception of the PDCCH indicating leaving dormant BWP, the DL BWP indicated by *firstOutsideActiveTimeBWP-Id* or by *firstWithinActiveTimeBWP-Id* (as specified in TS 38.331 [5] and TS 38.213 [6]) is activated. Upon reception of the PDCCH indicating entering dormant BWP, the DL BWP indicated by *dormantBWP-Id* (as specified in TS 38.331 [5]) is activated. The dormant BWP configuration for SpCell or PUCCH SCell is not supported.

For each activated Serving Cell configured with a BWP, the MAC entity shall:

1> if a BWP is activated and the active DL BWP for the Serving Cell is not the dormant BWP:

2> transmit on UL-SCH on the BWP;

2> transmit on RACH on the BWP, if PRACH occasions are configured;

2> monitor the PDCCH on the BWP;

2> transmit PUCCH on the BWP, if configured;

2> report CSI for the BWP;

2> transmit SRS on the BWP, if configured;

2> receive DL-SCH on the BWP;

2> (re-)initialize any suspended configured uplink grants of configured grant Type 1 on the active BWP according to the stored configuration, if any, and to start in the symbol according to rules in clause 5.8.2;

2> if *lbt-FailureRecoveryConfig* is configured:

3> stop the *lbt-FailureDetectionTimer*, if running;

3> set *LBT\_COUNTER* to 0;

3> monitor LBT failure indications from lower layers as specified in clause 5.21.2.

1> if a BWP is activated and the active DL BWP for the Serving Cell is dormant BWP:

2> stop the *bwp-InactivityTimer* of this Serving Cell, if running.

2> not monitor the PDCCH on the BWP;

2> not monitor the PDCCH for the BWP;

2> not receive DL-SCH on the BWP;

2> not report CSI on the BWP, report CSI except aperiodic CSI for the BWP;

2> not transmit SRS on the BWP;

2> not transmit on UL-SCH on the BWP;

2> not transmit on RACH on the BWP;

2> not transmit PUCCH on the BWP.

2> clear any configured downlink assignment and any configured uplink grant Type 2 associated with the SCell respectively;

2> suspend any configured uplink grant Type 1 associated with the SCell;

2> if configured, perform beam failure detection and beam failure recovery for the SCell if beam failure is detected.

1> if a BWP is deactivated:

2> not transmit on UL-SCH on the BWP;

2> not transmit on RACH on the BWP;

2> not monitor the PDCCH on the BWP;

2> not transmit PUCCH on the BWP;

2> not report CSI for the BWP;

2> not transmit SRS on the BWP;

2> not receive DL-SCH on the BWP;

2> clear any configured downlink assignment and configured uplink grant of configured grant Type 2 on the BWP;

2> suspend any configured uplink grant of configured grant Type 1 on the inactive BWP.

Upon initiation of the Random Access procedure on a Serving Cell, after the selection of carrier for performing Random Access procedure as specified in clause 5.1.1, the MAC entity shall for the selected carrier of this Serving Cell:

1> if PRACH occasions are not configured for the active UL BWP:

2> switch the active UL BWP to BWP indicated by *initialUplinkBWP*;

2> if the Serving Cell is an SpCell:

3> switch the active DL BWP to BWP indicated by *initialDownlinkBWP*.

1> else:

2> if the Serving Cell is an SpCell:

3> if the active DL BWP does not have the same *bwp-Id* as the active UL BWP:

4> switch the active DL BWP to the DL BWP with the same *bwp-Id* as the active UL BWP.

1> stop the *bwp-InactivityTimer* associated with the active DL BWP of this Serving Cell, if running.

1> if the Serving Cell is SCell:

2> stop the *bwp-InactivityTimer* associated with the active DL BWP of SpCell, if running.

1> perform the Random Access procedure on the active DL BWP of SpCell and active UL BWP of this Serving Cell.

If the MAC entity receives a PDCCH for BWP switching of a Serving Cell, the MAC entity shall:

1> if there is no ongoing Random Access procedure associated with this Serving Cell; or

1> if the ongoing Random Access procedure associated with this Serving Cell is successfully completed upon reception of this PDCCH addressed to C-RNTI (as specified in clauses 5.1.4, 5.1.4a, and 5.1.5):

2> cancel, if any, triggered consistent LBT failure for this Serving Cell;

2> perform BWP switching to a BWP indicated by the PDCCH.

If the MAC entity receives a PDCCH for BWP switching for a Serving Cell(s) or a dormancy SCell group(s) while a Random Access procedure associated with that Serving Cell is ongoing in the MAC entity, it is up to UE implementation whether to switch BWP or ignore the PDCCH for BWP switching, except for the PDCCH reception for BWP switching addressed to the C-RNTI for successful Random Access procedure completion (as specified in clauses 5.1.4, 5.1.4a, and 5.1.5) in which case the UE shall perform BWP switching to a BWP indicated by the PDCCH. Upon reception of the PDCCH for BWP switching other than successful contention resolution, if the MAC entity decides to perform BWP switching, the MAC entity shall stop the ongoing Random Access procedure and initiate a Random Access procedure after performing the BWP switching; if the MAC decides to ignore the PDCCH for BWP switching, the MAC entity shall continue with the ongoing Random Access procedure on the Serving Cell.

…

1> if a PDCCH for BWP switching is received, and the MAC entity switches the active DL BWP:

2> if the *defaultDownlinkBWP-Id* is configured, and the MAC entity switches to the DL BWP which is not indicated by the *defaultDownlinkBWP-Id* and is not indicated by the *dormantBWP-Id* if configured; or

2> if the *defaultDownlinkBWP-Id* is not configured, and the MAC entity switches to the DL BWP which is not the *initialDownlinkBWP* and is not indicated by the *dormantBWP-Id* if configured:

3> start or restart the *bwp-InactivityTimer* associated with the active DL BWP.

[TS 38.321, clause 5.9]

If the MAC entity is configured with one or more SCells, the network may activate and deactivate the configured SCells. Upon configuration of an SCell, the SCell is deactivated unless the parameter *sCellState* is set to *activated* for the SCell by upper layers.

The configured SCell(s) is activated and deactivated by:

- receiving the SCell Activation/Deactivation MAC CE described in clause 6.1.3.10;

- configuring *sCellDeactivationTimer* timer per configured SCell (except the SCell configured with PUCCH, if any): the associated SCell is deactivated upon its expiry;

- configuring *sCellState* per configured SCell: if configured, the associated SCell is activated upon SCell configuration.

The MAC entity shall for each configured SCell:

1> if an SCell is configured with *sCellState* set to *activated* upon SCell configuration, or an SCell Activation/Deactivation MAC CE is received activating the SCell:

2> if the SCell was deactivated prior to receiving this SCell Activation/Deactivation MAC CE; or

2> if the SCell is configured with *sCellState* set to *activated* upon SCell configuration:

3> if *firstActiveDownlinkBWP-Id* is not set to dormant BWP:

4> activate the SCell according to the timing defined in TS 38.213 [6]; i.e. apply normal SCell operation including:

5> SRS transmissions on the SCell;

5> CSI reporting for the SCell;

5> PDCCH monitoring on the SCell;

5> PDCCH monitoring for the SCell;

5> PUCCH transmissions on the SCell, if configured.

3> else (i.e. *firstActiveDownlinkBWP-Id* is set to dormant BWP):

4> stop the *bwp-InactivityTimer* of this Serving Cell, if running.

3> activate the DL BWP and UL BWP indicated by *firstActiveDownlinkBWP-Id* and *firstActiveUplinkBWP-Id* respectively.

2> start or restart the *sCellDeactivationTimer* associated with the SCell according to the timing defined in TS 38.213 [6];

2> if the active DL BWP is not the dormant BWP:

3> (re-)initialize any suspended configured uplink grants of configured grant Type 1 associated with this SCell according to the stored configuration, if any, and to start in the symbol according to rules in clause 5.8.2.2;

3> trigger PHR according to clause 5.4.6.

1> else if an SCell Activation/Deactivation MAC CE is received deactivating the SCell; or

1> if the *sCellDeactivationTimer* associated with the activated SCell expires:

2> deactivate the SCell according to the timing defined in TS 38.213 [6];

2> stop the *sCellDeactivationTimer* associated with the SCell;

2> stop the *bwp-InactivityTimer* associated with the SCell;

2> deactivate any active BWP associated with the SCell;

2> clear any configured downlink assignment and any configured uplink grant Type 2 associated with the SCell respectively;

2> clear any PUSCH resource for semi-persistent CSI reporting associated with the SCell;

2> suspend any configured uplink grant Type 1 associated with the SCell;

2> flush all HARQ buffers associated with the SCell;

2> cancel, if any, triggered consistent LBT failure for the SCell.

1> if PDCCH on the activated SCell indicates an uplink grant or downlink assignment; or

1> if PDCCH on the Serving Cell scheduling the activated SCell indicates an uplink grant or a downlink assignment for the activated SCell; or

1> if a MAC PDU is transmitted in a configured uplink grant and LBT failure indication is not received from lower layers; or

1> if a MAC PDU is received in a configured downlink assignment:

2> restart the *sCellDeactivationTimer* associated with the SCell.

1> if the SCell is deactivated:

2> not transmit SRS on the SCell;

2> not report CSI for the SCell;

2> not transmit on UL-SCH on the SCell;

2> not transmit on RACH on the SCell;

2> not monitor the PDCCH on the SCell;

2> not monitor the PDCCH for the SCell;

2> not transmit PUCCH on the SCell.

HARQ feedback for the MAC PDU containing SCell Activation/Deactivation MAC CE shall not be impacted by PCell, PSCell and PUCCH SCell interruptions due to SCell activation/deactivation in TS 38.133 [11].

When SCell is deactivated, the ongoing Random Access procedure on the SCell, if any, is aborted.

7.1.1.12.4.1.3 Test description

7.1.1.12.4.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.1.0 except that Test loop function(*Off*) System information combination NR-4 and in addition NR Cell 3 is configured as NR Active SCell.

7.1.1.12.4.1.3.2 Test procedure sequence

Table 7.1.1.12.4.1.3.2-1: Cell configuration power level changes over time for FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | Remarks |
| **T0** | Cell-specific RS EPRE | dBm/SCS | -88 | off | NR cell 1 is available and NR cell 3 is not available |
| **T1** | Cell-specific RS EPRE | dBm/SCS | -88 | -88 | NR cell 1 and NR cell 3 are available |

Table 7.1.1.12.4.1.3.2-2: Cell configuration power level changes over time for FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Parameter | Unit | NR Cell 1 | NR Cell 3 | Remarks |
| **T0** | Cell-specific RS EPRE | dBm/SCS | -82 | off | NR cell 1 is available and NR cell 3 is not available |
| **T1** | Cell-specific RS EPRE | dBm/SCS | -82 | -82 | NR cell 1 and NR cell 3 are available |

Table 7.1.1.12.4.1.3.2-3: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0 | Set the power levels according to “T1” as per Table 7.1.1.12.4.1.3.2-1/2. |  | - | - | - |
| 1 | SS transmits an *RRCReconfiguration* message. (Note 1) | <-- | - | - | - |
| 2 | The UE transmits *RRCReconfigurationComplete* message. (Note 2) | --> | - | - | - |
| 3 | The SS transmits a SCell Activation MAC-CE to activate SCell (NR Cell 3). | <-- | MAC PDU (SCell Activation/Deactivation MAC CE of one octet (C1=1)) | - | - |
| 4 | The SS transmits DCI 2-6 within ps-Offset time before the start of next long DRX drx-onDurationTimer on NR Cell 1. (Note 3) | <-- | (PDCCH (DCI 2-6)) | - | - |
| 5 | The SS indicates a new transmission on PDCCH of SCell and transmits a MAC PDU on the initial BWP (BWP#0) when the Drx-onDurationTimer is running. | <-- | MAC PDU | - | -- |
| 6 | Check: Does the UE transmit a HARQ ACK on the PCell for the DL MAC PDU in Step 5 within 5 seconds? | --> |  | 1 | F |
| 7 | The SS transmits DCI 2-6 within the ps-offset time before the start of next long DRX drx-onDurationTimer on NR Cell 1. (Note 4) | <-- | (PDCCH (DCI 2-6)) | - | - |
| 8 | The SS indicates a new transmission on PDCCH of SCell and transmits a MAC PDU on the active BWP (BWP#0) when the Drx-onDurationTimer is running. | <-- | MAC PDU | - | - |
| 9 | Check: Does the UE transmit a HARQ ACK on the PCell NR Cell 1 for the DL MAC PDU in Step 8? | --> | HARQ ACK | 2 | P |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration* TS 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 3: The Wake-up indication is value 1 and the SCell dormancy indication is value 0 in the DCI 2-6.  Note 4: The Wake-up indication is value 1 and the SCell dormancy indication is value 1 in the DCI 2-6. | | | | | |

7.1.1.12.4.1.3.3 Specific message contents

Table 7.1.1.12.4.1.3.3-1: RRCReconfiguration (step 1, Table 7.1.1.12.4.1.3.2-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.1-13 | | | |
| **Information Element** | | **Value/remark** | **Comment** | **Condition** |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| secondaryCellGroup | | CellGroupConfig |  | EN-DC |
|  | | Not present |  | NR |
| nonCriticalExtension | | Not present |  | EN-DC |
| nonCriticalExtension SEQUENCE { | |  |  | NR |
| masterCellGroup | | CellGroupConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.12.4.1.3.3-2: CellGroupConfig (Table 7.1.1.12.4.1.3.3-1: RRCReconfiguration)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition SCell\_add | | | |
| Information Element | | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { | |  |  |  |
| cellGroupId | | CellGroupId | TS 38.508-1 default value |  |
| mac-CellGroupConfig ::= SEQUENCE { | |  |  |  |
| drx-Config CHOICE { | |  |  |  |
| setup | | DRX-Config | TS 38.508-1 default value |  |
| } | |  |  |  |
| } | |  |  |  |
| physicalCellGroupConfig::= SEQUENCE { | |  |  |  |
| dcp-Config-r16 CHOICE { | |  |  |  |
| setup | | DCP-Config-r16 | TS 38.508-1 default value |  |
| } | |  |  |  |
| } | |  |  |  |
| spCellConfig SEQUENCE { | |  |  |  |
| spCellConfigDedicated SEQUENCE { | |  |  |  |
| servingCellConfig SEQUENCE { | |  |  |  |
| initialDownlinkBWP SEQUENCE { | |  |  |  |
| pdcch-Config CHOICE { | |  |  |  |
| setup | | PDCCH-Config |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxMeasId)) OF SCellConfig { | | 1 entry |  |  |
| SCellConfig[1] SEQUENCE { | |  | entry 1 |  |
| sCellIndex | | SCellIndex as per TS 38.508-1 [4] table 4.6.3-154 |  |  |
| sCellConfigCommon | | ServingCellConfigCommon |  |  |
| sCellConfigDedicated | | ServingCellConfig |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.1.12.4.1.3.3-3: PDCCH-Config (Table 7.1.1.12.4.1.3.3-2: CellGroupConfig)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-95 with condition DCI\_2\_6 |

Table 7.1.1.12.4.1.3.3-4: ServingCellConfigCommon (Table 7.1.1.12.4.1.3.3-2: CellGroupConfig)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 with conditions No\_UL and SCell\_add. | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| physCellId | Physical Cell Identity of NR Cell 3 |  |  |
| } |  |  |  |

Table 7.1.1.12.4.1.3.3-5: ServingCellConfig (Table 7.1.1.12.4.1.3.3-2: CellGroupConfig)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-167 with conditions No\_UL and SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| downlinkBWP-ToAddModList SEQUENCE (SIZE (1..maxNrofBWPs)) BWP-Downlink { |  |  |  |
| BWP-Downlink | BWP-Downlink |  |  |
| } |  |  |  |
| firstActiveDownlinkBWP-Id | 0 |  |  |
| dormantBWP-Config-r16 ::= SEQUENCE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| dormantBWP-Id-r16 | 1 |  |  |
| outsideActiveTimeConfig-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| firstOutsideActiveTimeBWP-Id-r16 | 0 |  |  |
| dormancyGroupOutsideActiveTime-r16 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.12.4.1.3.3-6: BWP-Downlink (Table 7.1.1.12.4.1.3.3-5: ServingCellConfig)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-Downlink ::= SEQUENCE { |  |  |  |
| bwp-Common SEQUENCE { |  |  |  |
| pdcch-ConfigCommon | Not present |  |  |
| } |  |  |  |
| bwp-Dedicated SEQUENCE { |  |  |  |
| pdcch-Config CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet | TS 38.508-1 default value |  |
| } |  |  |  |
| controlResourceSetToReleaseList | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

###### 7.1.1.12.4.2 DRX adaptation / SCell dormancy indication / Intra-band non Contiguous CA

The scope and description of the present TC is the same as test case 7.1.1.12.4.1 with the following differences:

- CA configuration: Intra-band non-Contiguous CA replaces Intra-band Contiguous CA

###### 7.1.1.12.4.3 DRX adaptation / SCell dormancy indication / Inter-band CA

The scope and description of the present TC is the same as test case 7.1.1.12.4.1 with the following differences:

- CA configuration: Inter-band CA replaces Intra-band Contiguous CA

- Cells configuration: NR Cell 10 replaces NR Cell 3

#### 7.1.1.13 Small Data Transmission (SDT)

##### 7.1.1.13.1 RA Based SDT / 2-step RACH / Successful

7.1.1.13.1.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for 2-step RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal to sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold }

**then** { UE shall initiate 2-step RA based SDT procedure }

}

(2)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for 2-step RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is greater than sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold }

**then** { UE shall not initiate RA based SDT procedure and starts normal RRC Resume procedure }

}

(3)

with { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for RA-SDT is configured }

ensure that {

when { UE initiates RA based SDT procedure }

then { UE is successfully able to send and receive subsequent SDT data }

}

(4)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for 2-step RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal sdt-DataVolumeThreshold and RSRP is below the configured sdt-RSRP-Threshold }

**then** { UE shall not initiate RA based SDT procedure and starts normal RRC Resume procedure }

}

7.1.1.13.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321, clause 5.1.1b, 5.1.1c and 5.27. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.1.1b]

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with MSG3 repetition indication and set(s) of Random Access resources without MSG3 repetition indication and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with MSG3 repetition indication:

2> assume MSG3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume MSG3 repetition is not applicable for the current Random Access procedure.

NOTE 1: Void.

1> if contention-free Random Access Resources have not been provided for this Random Access procedure and one or more of the features including RedCap and/or a specific NSAG(s) and/or SDT and/or MSG3 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of specific NSAG(s) is determined by upper layers when the Random Access procedure is initiated. The applicability of RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and RedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with RedCap indication:

2> select this set of Random Access resources for this Random Access procedure.

1> else:

2> select the set of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

[TS 38.321, clause 5.1.1c]

The MAC entity shall for each set of configured Random Access resources for 4-step RA type and for each set of configured Random Access resources for 2-step RA type:

1> if redCap is set to true for a set of Random Access resources:

2> consider the set of Random Access resources as not available for a Random Access procedure for which RedCap is not applicable.

1> if smallData is set to true for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure which is not triggered for RA-SDT.

1> if NSAG-List is configured for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure unless it is triggered for any one of the NSAG-ID(s) in the NSAG-List.

1> if msg3-Repetitions is set to true for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure if Msg3 repetition is not applicable.

1> if a set of Random Access resources is not configured with FeatureCombination:

2> consider the set of Random Access resources to not associated with any feature.

[TS 38.321, clause 5.27]

The MAC entity may be configured by RRC with SDT and the SDT procedure may be initiated by RRC layer. The SDT procedure can be performed either by Random Access procedure with 2-step RA type or 4-step RA type (i.e., RA-SDT) or by configured grant Type 1 (i.e., CG-SDT).…

If RA-SDT is selected above and after the Random Access procedure is successfully completed (see clause 5.1.6), the UE monitors PDCCH addressed to C-RNTI received in random access response until the RA-SDT procedure is terminated. If CG-SDT is selected above and after the initial transmission for CG-SDT is performed, the UE monitors PDCCH addressed to C-RNTI as stored in UE Inactive AS context as specified in TS 38.331 [5] and CS-RNTI until the CG-SDT procedure is terminated.

7.1.1.13.1.3 Test description

7.1.1.13.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1.

UE:

- None.

Preamble:

- The UE is in state 3N-A and Test Mode Activated according to TS 38.508-1 [4] Table 4.4A.2-3 with UE test loop mode B is established with IP PDU delay set to 6 seconds. IF pc\_logicalChannelSR\_DelayTimer the DRB is configured according to Table 7.1.1.13.1.3.1-1 for SDT operation.

Table 7.1.1.13.1.3.1-1: Logical Channel Configuration Settings

|  |  |
| --- | --- |
| Parameter | SDT DRB |
| logicalChannelSR-DelayTimerApplied | True |
| logicalChannelSR-DelayTimer | sf512 |

7.1.1.13.1.3.2 Test procedure sequence

Table 7.1.1.13.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 1 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 2 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data > sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 3 | The SS transmits an *RRCRelease* message including sdt-Config-r17 in s*uspendConfig*. | <-- | NR RRC: *RRCRelease* | - | - |
| 4 | Check: Does UE transmit MSGA using preamble on PRACH after IP PDU Delay expires? | --> | MAC PDU (including  NR RRC: *RRCResumeRequest*  ) | 2 | P |
| 5 | The SS transmits a MSGB including a successRAR MAC subPDU containing matching Contention Resolution Identity,C-RNTI and Timing Advance Command. | <-- | MAC PDU(successRAR) | - | - |
| 6 | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| - | Exception: Steps 7 and 8 can happen in any order | - | - | - | - |
| 7 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 8 | Check: Does the UE transmit a MAC PDU containing Loop backed PDU? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 2 | P |
| 9 | The SS transmits an OPEN UE TEST LOOP message. | <-- | TC: OPEN UE TEST LOOP | - | - |
| 10 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 11 | SS transmits a CLOSE UE TEST LOOP message. | <-- | TC: CLOSE UE TEST LOOP | - | - |
| 12 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 13 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 14 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT( SDT Data < sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 15 | The SS transmits an *RRCRelease* message including sdt-Config-r17 in s*uspendConfig*. | <-- | NR RRC: *RRCRelease* | - | - |
| 16 | Check: Does UE transmit MSGA using preamble on PRACH and associated PUSCH resource containing RLC PDU on DRB with SDT configured after IP PDU Delay expires? | --> | MAC PDU (including  NR RRC: *RRCResumeRequest,*  *RLC PDU on DRB with SDT configured*) | 1 | P |
| 17 | The SS transmits a MSGB including a successRAR MAC subPDU containing matching Contention Resolution Identity,C-RNTI and Timing Advance Command. | <-- | MAC PDU(successRAR) | - | - |
| - | EXCEPTION: Steps 17a1 to 17a3 describe behaviour that depends on the UE capability. | - | - | - | - |
| 17a1 | IF pc\_logicalChannelSR\_DelayTimer THEN SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data <= sdt-DataVolumeThreshold). | <-- | MAC PDU |  |  |
| 17a2 | SS transmits an UL Grant, allowing the UE to return the RLC SDU as received in step 17a1, on PDCCH with the C-RNTI assigned to the UE. | <-- | (UL Grant (C-RNTI)) | - | - |
| 17a3 | Check: Does the UE transmit a MAC PDU including one RLC SDU? | --> | MAC PDU | 3 | P |
| 17A | The SS transmits an *RRCResume* message to bring UE to RRC\_CONNECTED State. | <-- | NR RRC: *RRCResume* | - | - |
| 17B | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 18 | The SS changes the parameter ‘sdt-RSRP-Threshold-r17’ in SIB1 of NR Cell 1 to 76 and starts broadcasting updated SIB1.  Note: This value should result in meeting condition ‘RSRP is below the configured sdt-RSRP-Threshold’ | - | - | - | - |
| 19 | The SS transmits an OPEN UE TEST LOOP message. | <-- | TC: OPEN UE TEST LOOP | - | - |
| 20 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 21 | SS transmits a CLOSE UE TEST LOOP message. | <-- | TC: CLOSE UE TEST LOOP | - | - |
| 22 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 23 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 24 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data > sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 25 | The SS transmits an RRCRelease message including sdt-Config-r17 in suspendConfig. | <-- | NR RRC: RRCRelease | - | - |
| 26 | Check: Does UE transmit MSGA using preamble on PRACH after IP PDU Delay expires? | --> | MAC PDU (including  NR RRC: RRCResumeRequest) | 4 | P |
| 27 | The SS transmits a MSGB including a successRAR MAC subPDU containing matching Contention Resolution Identity,C-RNTI and Timing Advance Command. | <-- | MAC PDU(successRAR) | - | - |
| 28 | The SS transmits an RRCResume message. | <-- | NR RRC: RRCResume | - | - |
| 29 | Exception: Steps 30 and 31 can happen in any order | - | - | - | - |
| 30 | The UE transmits an RRCResumeComplete message. | --> | NR RRC: RRCResumeComplete | - | - |
| 31 | Check: Does the UE transmit a MAC PDU containing Loop backed PDU? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 4 | P |
| 32 | The SS transmits an RRCRelease message. | <-- | NR RRC: RRCRelease | - | - |

7.1.1.13.1.3.3 Specific message contents

Table 7.1.1.13.1.3.3-1: CLOSE UE TEST LOOP (Steps 11, 21 and preamble Table 7.1.1.13.1.3.2-1 )

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508-1 [7] table 4.7A-3 condition UE test loop mode B | | | |
| Information Element | Value/Remark | Comment | Condition |
| UE test loop mode B LB setup |  |  |  |
| IP PDU delay | '0000 0110'B | 6 seconds |  | |

Table 7.1.1.13.1.3.3-2: SIB1 (preamble and step 18, Table 7.1.1.13.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.6.1-28 with Condition SDT | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| servingCellConfigCommon | ServingCellConfigCommon | Table 7.1.1.13.1.3.3-3 |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| sdt-ConfigCommon-r17 SEQUENCE { |  |  |  |
| sdt-RSRP-Threshold-r17 | 66 (-90dBm) |  | Preamble |
|  | 76 (-80dBm) |  | Step 18 |
| sdt-LogicalChannelSR-DelayTimer-r17 | sf512 |  |  |
| sdt-DataVolumeThreshold-r17 | byte32 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-3: ServingCellConfigCommon (7.1.1.13.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkCommon | Table 7.1.1.13.1.3.3-4 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-4: BWP-UplinkCommon(Table 7.1.1.13.1.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 |  |  |  |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| AdditionalRACH-ConfigList-r17 SEQUENCE { |  |  |  |
| AdditionalRACH-Config-r17 SEQUENCE { |  |  |  |
| rach-ConfigCommon-r17 | Not present |  |  |
| msgA-ConfigCommon-r17 | MsgA-ConfigCommon-r16 | Table 7.1.1.13.1.3.3-5 |  |
| ) |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-5: MsgA-ConfigCommon-r16 (Table 7.1.1.13.1.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-81A | | | |
| Information Element | Value/remark | Comment | Condition |
| MsgA-ConfigCommon-r16 :: = SEQUENCE { |  |  |  |
| rach-ConfigCommonTwoStepRA-r16 | RACH-ConfigCommonTwoStepRA-r16 | Table 7.1.1.13.1.3.3-6 |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-6: RACH-ConfigCommonTwoStepRA-r16 (Table 7.1.1.13.1.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-128A | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommonTwoStepRA-r16 ::= SEQUENCE { |  |  |  |
| featureCombinationPreamblesList-r17 SEQUENCE { |  |  |  |
| FeatureCombinationPreambles-r17 | FeatureCombinationPreambles | Table 7.1.1.13.1.3.3-7 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-7: FeatureCombinationPreambles(Table 7.1.1.13.1.3.3-6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| FeatureCombinationPreambles-r17 ::= SEQUENCE { |  |  |  |
| featureCombination-r17 ::= SEQUENCE { |  |  |  |
| smallData-r17 | true |  |  |
| } |  |  |  |
| startPreambleForThisPartition-r17 | 8 | Randomly selected |  |
| numberOfPreamblesPerSSB-ForThisPartition-r17 | 12 |  |  |
| ssb-SharedRO-MaskIndex-r17 | Not present |  |  |
| groupBconfigured-r17 | Not present |  |  |
| separateMsgA-PUSCH-Config-r17 | *MsgA-PUSCH-Config* | Table 7.1.1.13.1.3.3-8 |  |
| msgA-RSRP-Threshold-r17 | 57 | -100 dBm |  |
| rsrp-ThresholdSSB-r17 | RSRP-Range | TS 38.508-1 [4] table 4.6.3-152 |  |
| deltaPreamble-r17 | Not present |  |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-8: *MsgA-PUSCH-Config* (Table 7.1.1.13.1.3.3-6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-81B | | | |
| Information Element | Value/remark | Comment | Condition |
| MsgA-PUSCH-Config-r16 ::= SEQUENCE { |  |  |  |
| msgA-PUSCH-ResourceGroupA-r16 SEQUENCE { |  |  |  |
| msgA-MCS-r16 | 1 |  |  |
| nrofPRBs-PerMsgA-PO-r16 | 15 |  |  |
| } |  |  |  |

Table 7.1.1.13.1.3.3-9: RRCRelease (Steps 3, 15 and 25 Table 7.1.1.13.2.3.2-1 )

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.1-16 with condition NR\_RRC\_INACTIVE and SDT | | | |
| RRCRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| suspendConfig SEQUENCE { |  |  |  |
| sdt-DRB-List-r17 SEQUENCE (SIZE (0..maxDRB)) OF DRB-Identity { | 1 entry |  |  |
| DRB-Identity[1] | DRB-Identity using condition DRBj | Entry 1  j is the ID of the DRB established during the preamble which is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| sdt-SRB2-Indication-r17 | Not present |  |  |
| sdt-MAC-PHY-CG-Config-r17 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.13.2 RA Based SDT / 4-step RACH / Successful

7.1.1.13.2.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal to sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold }

**then** { UE shall initiate 4-step RA based SDT procedure }

}

(2)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is greater than sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold }

**then** { UE shall not initiate RA based SDT procedure and starts normal RRC Resume procedure }

}

(3)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is configured and Random Access resources for RA-SDT is configured }

**ensure** **that** {

**when** { UE initiates RA based SDT procedure }

**then** { UE is successfully able to send and receive subsequent SDT data }

}

(4)

with { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured and Random Access resources for RA-SDT is configured }  
ensure that {  
  when { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal to sdt-DataVolumeThreshold and RSRP is below the configured sdt-RSRP-Threshold }  
    then { UE shall not initiate RA based SDT procedure and starts normal RRC Resume procedure }  
 }

7.1.1.13.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321, clause 5.1.1b, 5.1.1c, 5.4.4 and 5.27. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.1.1b]

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with MSG3 repetition indication and set(s) of Random Access resources without MSG3 repetition indication and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with MSG3 repetition indication:

2> assume MSG3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume MSG3 repetition is not applicable for the current Random Access procedure.

NOTE 1: Void.

1> if contention-free Random Access Resources have not been provided for this Random Access procedure and one or more of the features including RedCap and/or a specific NSAG(s) and/or SDT and/or MSG3 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of specific NSAG(s) is determined by upper layers when the Random Access procedure is initiated. The applicability of RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and RedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with RedCap indication:

2> select this set of Random Access resources for this Random Access procedure.

1> else:

2> select the set of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

[TS 38.321, clause 5.1.1c]

The MAC entity shall for each set of configured Random Access resources for 4-step RA type and for each set of configured Random Access resources for 2-step RA type:

1> if *redCap* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for a Random Access procedure for which RedCap is not applicable.

1> if *smallData* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure which is not triggered for RA-SDT.

1> if *NSAG-List* is configured for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure unless it is triggered for any one of the *NSAG-ID*(s) in the *NSAG-List*.

1> if *msg3-Repetitions* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure if Msg3 repetition is not applicable.

1> if a set of Random Access resources is not configured with *FeatureCombination*:

2> consider the set of Random Access resources to not associated with any feature.

[TS 38.321, clause 5.27]

The MAC entity may be configured by RRC with SDT and the SDT procedure may be initiated by RRC layer. The SDT procedure can be performed either by Random Access procedure with 2-step RA type or 4-step RA type (i.e., RA-SDT) or by configured grant Type 1 (i.e., CG-SDT).

…

If RA-SDT is selected above and after the Random Access procedure is successfully completed (see clause 5.1.6), the UE monitors PDCCH addressed to C-RNTI received in random access response until the RA-SDT procedure is terminated. If CG-SDT is selected above and after the initial transmission for CG-SDT is performed, the UE monitors PDCCH addressed to C-RNTI as stored in UE Inactive AS context as specified in TS 38.331 [5] and CS-RNTI until the CG-SDT procedure is terminated.

7.1.1.13.2.3 Test description

7.1.1.13.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1.

UE:

- None.

Preamble:

- The UE is in state 3N-A and Test Mode Activated according to TS 38.508-1 [4] Table 4.4A.2-3 with UE test loop mode B is established IP PDU delay set to 6 seconds. IF pc\_logicalChannelSR\_DelayTimer the DRB is configured for SDT operation according to Table 7.1.1.13.2.3.1-1.

Table 7.1.1.13.2.3.1-1: Logical Channel Configuration Settings

|  |  |
| --- | --- |
| Parameter | SDT DRB |
| logicalChannelSR-DelayTimerApplied | True |
| logicalChannelSR-DelayTimer | sf512 |

7.1.1.13.2.3.2 Test procedure sequence

Table 7.1.1.13.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 1 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 2 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data > sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 3 | The SS transmits an *RRCRelease* message including sdt-Config-r17 in s*uspendConfig*. | <-- | NR RRC: *RRCRelease* | - | - |
| 4 | Check: Does the UE transmit a preamble on PRACH using a preamble outside of the SmallData FeatureCombinationPreambles? | --> | PRACH Preamble | 2 | P |
| 5 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 5, including TC-RNTI and not including Backoff Indicator subheader. | <-- | Random Access Response | - | - |
| 6 | Check: Does the UE transmit a MAC PDU containing an *RRCResumeRequest message*? | --> | MAC PDU (  NR RRC: *RRCResumeRequest*) | 2 | P |
| 7 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| 8 | The SS transmits a *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| - | EXCEPTION: Steps 9 and 10 can happen in any order | - | - | - | - |
| 9 | The UE transmits a *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 10 | Check: Does the UE transmit a MAC PDU containing Loop backed PDU? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 2 | P |
| 11 | The SS transmits an OPEN UE TEST LOOP message. | <-- | TC: OPEN UE TEST LOOP | - | - |
| 12 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 13 | SS transmits a CLOSE UE TEST LOOP message. | <-- | TC: CLOSE UE TEST LOOP | - | - |
| 14 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 15 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 16 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT( SDT Data < sdt-DataVolumeThreshold).. | <-- | MAC PDU | - | - |
| 17 | The SS transmits a *RRCRelease* message including sdt-Config-r17 in s*uspendConfig*. | <-- | NR RRC: *RRCRelease* | - | - |
| 18 | Check: Does the UE transmit a preamble on PRACH using a preamble in the SmallData FeatureCombinationPreambles? | --> | PRACH Preamble | 1 | P |
| 19 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 19, including TC-RNTI and not including Backoff Indicator subheader. | <-- | Random Access Response | - | - |
| 20 | Check: Does the UE transmit a MAC PDU containing an *RRCResumeRequest message and RLC PDU on DRB with SDT configured*? | --> | MAC PDU (  NR RRC: *RRCResumeRequest, RLC PDU on DRB with SDT configured*) | 1 | P |
| 21 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| - | EXCEPTION: Steps 22a1-22a3 describe behaviour that depends on UE configuration; the "lower case letter" identifies a step sequence that takes place if pc\_logicalChannelSR\_DelayTimer is configured | - | - | - | - |
| 22a1 | IF pc\_logicalChannelSR\_DelayTimer THEN SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data <= sdt-DataVolumeThreshold). | <-- | MAC PDU |  |  |
| 22a2 | SS transmits an UL Grant, allowing the UE to return the RLC SDU as received in step 22a1, on PDCCH with the C-RNTI assigned to the UE. | <-- | (UL Grant (C-RNTI)) | - | - |
| 22a3 | Check: Does the UE transmit a MAC PDU including one RLC SDU? | --> | MAC PDU | 3 | P |
| 23 | The SS transmits an RRCResume message to bring UE to RRC\_CONNECTED State. | <-- | NR RRC: RRCResume | - | - |
| 24 | The UE transmits an RRCResumeComplete message. | --> | NR RRC: RRCResumeComplete | - | - |
| 25 | The SS changes the parameter ‘sdt-RSRP-Threshold-r17’ in SIB1 of NR Cell 1 to 76 and starts broadcasting updated SIB1.  Note: This value should result in meeting condition ‘RSRP is below the configured sdt-RSRP-Threshold’ | - | - | - | - |
| 26 | The SS transmits an OPEN UE TEST LOOP message. | <-- | TC: OPEN UE TEST LOOP | - | - |
| 27 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 28 | SS transmits a CLOSE UE TEST LOOP message. | <-- | TC: CLOSE UE TEST LOOP | - | - |
| 29 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 30 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 31 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data > sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 32 | The SS transmits a RRCRelease message including sdt-Config-r17 in suspendConfig. | <-- | NR RRC: RRCRelease | - | - |
| 33 | The UE transmits a preamble on PRACH | --> | PRACH Preamble | - | - |
| 34 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 5, including TC-RNTI and not including Backoff Indicator subheader. | <-- | Random Access Response | - | - |
| 35 | Check: Does the UE transmit a MAC PDU containing an RRCResumeRequest message? | --> | MAC PDU (  NR RRC: RRCResumeRequest) | 4 | P |
| 36 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| 37 | The SS transmits a RRCResume message. | <-- | NR RRC: RRCResume | - | - |
| - | EXCEPTION: Steps 41 and 42 can happen in any order | - | - | - | - |
| 38 | The UE transmits a RRCResumeComplete message. | --> | NR RRC: RRCResumeComplete | - | - |
| 39 | Check: Does the UE transmit a MAC PDU containing Loop backed PDU? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 2 | P |
| 40 | The SS transmits a RRCRelease message | <-- | NR RRC: RRCRelease | - | - |

7.1.1.13.2.3.3 Specific message contents

Table 7.1.1.13.2.3.3-1: CLOSE UE TEST LOOP (Steps 13, 28 and preamble Table 7.1.1.13.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7] table 4.7A-3 condition UE test loop mode B | | | |
| Information Element | Value/Remark | Comment | Condition |
| UE test loop mode B LB setup |  |  |  |
| IP PDU delay | '0000 0110'B | 6 seconds |  | |

Table 7.1.1.13.2.3.3-2: SIB1 (preamble and step 25, Table 7.1.1.13.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.6.1-28 with condition SDT | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| servingCellConfigCommon | ServingCellConfigCommon | Table 7.1.1.13.2.3.3-3 |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| sdt-ConfigCommon-r17 SEQUENCE { |  |  |  |
| sdt-RSRP-Threshold-r17 | 66 (-90dBm) |  | Preamble |
|  | 76 (-80dBm) |  | Step 23 |
| sdt-LogicalChannelSR-DelayTimer-r17 | sf512 |  |  |
| sdt-DataVolumeThreshold-r17 | byte32 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-3: ServingCellConfigCommon (7.1.1.13.2.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| downlinkConfigCommon | DownlinkConfigCommon | Table 7.1.1.13.2.3.3-7 |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkCommon | Table 7.1.1.13.2.3.3-4 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-4: BWP-UplinkCommon(Table 7.1.1.13.2.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 |  |  |  |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| AdditionalRACH-ConfigList-r17 SEQUENCE (SIZE(1..maxAdditionalRACH-r17)) OF AdditionalRACH-Config-r17 { | 1 entry |  |  |
| AdditionalRACH-Config-r17[1] SEQUENCE { |  | Entry 1 |  |
| rach-ConfigCommon-r17 | RACH-ConfigCommon | Table 7.1.1.13.2.3.3-5 |  |
| msgA-ConfigCommon-r17 | Not present |  |  |
| ) |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-5: RACH-ConfigCommon *(*Table 7.1.1.13.2.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon::= SEQUENCE { |  |  |  |
| featureCombinationPreamblesList-r17 SEQUENCE { |  |  |  |
| FeatureCombinationPreambles-r17 | FeatureCombinationPreambles | Table 7.1.1.13.2.3.3-6 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-6: FeatureCombinationPreambles(Table 7.1.1.13.2.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-56E | | | |
| Information Element | Value/remark | Comment | Condition |
| FeatureCombinationPreambles-r17 ::= SEQUENCE { |  |  |  |
| featureCombination-r17 ::= SEQUENCE { |  |  |  |
| smallData-r17 | true |  |  |
| } |  |  |  |
| startPreambleForThisPartition-r17 | 8 | Randomly selected |  |
| numberOfPreamblesPerSSB-ForThisPartition-r17 | 12 |  |  |
| ssb-SharedRO-MaskIndex-r17 | Not present |  |  |
| groupBconfigured-r17 | Not present |  |  |
| separateMsgA-PUSCH-Config-r17 | Not present |  |  |
| msgA-RSRP-Threshold-r17 | Not present |  |  |
| rsrp-ThresholdSSB-r17 | Not present |  |  |
| deltaPreamble-r17 | Not present |  |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-7: *DownlinkConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.3-52 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| DownlinkConfigCommon ::= SEQUENCE { |  |  |  |
| initialDownlinkBWP | BWP-DownlinkCommon | Table 7.1.1.13.2.3.3-8 |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-8: *BWP-DownlinkCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.3-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-DownlinkCommon ::= SEQUENCE { |  |  |  |
| pdcch-ConfigCommon CHOICE { |  |  |  |
| setup | PDCCH-ConfigCommon with condition SDT |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.2.3.3-9: RRCRelease (Steps 3, 17 and 32 Table 7.1.1.13.2.3.2-1 )

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.1-16 with condition NR\_RRC\_INACTIVE and SDT | | | |
| RRCRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| suspendConfig SEQUENCE { |  |  |  |
| sdt-DRB-List-r17 SEQUENCE (SIZE (0..maxDRB)) OF DRB-Identity { | 1 entry |  |  |
| DRB-Identity[1] | DRB-Identity using condition DRBj | Entry 1  j is the ID of the DRB established during the preamble which is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| sdt-SRB2-Indication-r17 | Not present |  |  |
| sdt-MAC-PHY-CG-Config-r17 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.13.3 RA Based SDT / 2-step RACH / not complete / RA\_TYPE to 4-stepRA

7.1.1.13.3.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is not configured, UE has small data to transmit and initiated 2-step RA based SDT procedure and transmitted MSGA }

**ensure that** {

**when** { UE receives the MSGB containing a fallbackRAR MAC subPDU }

**then** { UE shall fallback to 4-step RA based SDT procedure and initiate msg3 transmission }

}

7.1.1.13.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321, clause 5.1.1b, 5.1.1c. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.1.1b]

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with MSG3 repetition indication and set(s) of Random Access resources without MSG3 repetition indication and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with MSG3 repetition indication:

2> assume MSG3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume MSG3 repetition is not applicable for the current Random Access procedure.

NOTE 1: Void.

1> if contention-free Random Access Resources have not been provided for this Random Access procedure and one or more of the features including RedCap and/or a specific NSAG(s) and/or SDT and/or MSG3 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of specific NSAG(s) is determined by upper layers when the Random Access procedure is initiated. The applicability of RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and RedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with RedCap indication:

2> select this set of Random Access resources for this Random Access procedure.

1> else:

2> select the set of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

[TS 38.321, clause 5.1.1c]

The MAC entity shall for each set of configured Random Access resources for 4-step RA type and for each set of configured Random Access resources for 2-step RA type:

1> if *redCap* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for a Random Access procedure for which RedCap is not applicable.

1> if *smallData* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure which is not triggered for RA-SDT.

1> if *NSAG-List* is configured for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure unless it is triggered for any one of the *NSAG-ID*(s) in the *NSAG-List*.

1> if *msg3-Repetitions* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure if Msg3 repetition is not applicable.

1> if a set of Random Access resources is not configured with *FeatureCombination*:

2> consider the set of Random Access resources to not associated with any feature.

[TS 38.321, clause 5.1.4a]

1> start the *msgB-ResponseWindow* at the PDCCH occasion as specified in TS 38.213 [6], clause 8.2A;

1> monitor the PDCCH of the SpCell for a Random Access Response identified by MSGB-RNTI while the *msgB-ResponseWindow* is running;

1> if C-RNTI MAC CE was included in the MSGA:

2> monitor the PDCCH of the SpCell for Random Access Response identified by the C-RNTI while the *msgB-ResponseWindow* is running.

1> if notification of a reception of a PDCCH transmission of the SpCell is received from lower layers:

2> if the C-RNTI MAC CE was included in MSGA:

…

2> if a valid (as specified in TS 38.213 [6]) downlink assignment has been received on the PDCCH for the MSGB-RNTI and the received TB is successfully decoded:

3> if the MSGB contains a MAC subPDU with Backoff Indicator:

4> set the *PREAMBLE\_BACKOFF* to value of the BI field of the MAC subPDU using Table 7.2-1, multiplied with *SCALING\_FACTOR\_BI*.

3> else:

4> set the *PREAMBLE\_BACKOFF* to 0 ms.

3> if the MSGB contains a fallbackRAR MAC subPDU; and

3> if the Random Access Preamble identifier in the MAC subPDU matches the transmitted *PREAMBLE\_INDEX* (see clause 5.1.3a):

4> consider this Random Access Response reception successful;

4> apply the following actions for the SpCell:

5> process the received Timing Advance Command (see clause 5.2);

5> indicate the *msgA-PreambleReceivedTargetPower* and the amount of power ramping applied to the latest Random Access Preamble transmission to lower layers (i.e. (*PREAMBLE\_POWER\_RAMPING\_COUNTER* – 1) × *PREAMBLE\_POWER\_RAMPING\_STEP*);

5> if the Random Access Preamble was not selected by the MAC entity among the contention-based Random Access Preamble(s):

6> consider the Random Access procedure successfully completed;

6> process the received UL grant value and indicate it to the lower layers.

5> else:

6> set the *TEMPORARY\_C-RNTI* to the value received in the Random Access Response;

6> if the Msg3 buffer is empty:

7> obtain the MAC PDU to transmit from the MSGA buffer and store it in the Msg3 buffer;

6> process the received UL grant value and indicate it to the lower layers and proceed with Msg3 transmission.

7.1.1.13.3.3 Test description

7.1.1.13.3.3.1 Pre-test conditions

System Simulator:

- NR Cell 1.

UE:

- None.

Preamble:

- The UE is in state 3N-A and Test Mode Activated according to TS 38.508-1 [4] Table 4.4A.2-3 with UE test loop mode B is established IP PDU delay set to 6 seconds, the DRB is configured for SDT operation.

7.1.1.13.3.3.2 Test procedure sequence

Table 7.1.1.13.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 1 | SS transmits a downlink assignment including the C-RNTI assigned to the UE. |  | (PDCCH (C-RNTI)) | - | - |
| 2 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT( SDT Data < sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 3 | The SS transmits an *RRCRelease* message including sdt-Config-r17 in s*uspendConfig*. | <-- | NR RRC: *RRCRelease* | - | - |
| 4 | The UE transmit MSGA using preamble on PRACH after IP PDU Delay expires. | --> | MAC PDU (including  NR RRC: *RRCResumeRequest,*  *RLC PDU on DRB with SDT configured*) | - | - |
| 5 | The SS schedules PDCCH transmission addressed to MSGB-RNTI to transmit a valid MSGB DL MAC PDU containing a fallbackRAR MAC subPDU. | <-- | MAC PDU  (fallbackRAR MAC subPDU) | - | - |
| 6 | Check: Does the UE transmit a MAC PDU containing an *RRCResumeRequest* message and RLC PDU on DRB with SDT configured? | --> | MAC PDU (  NR RRC: *RRCResumeRequest,*  RLC PDU on DRB with SDT configured) | 1 | P |
| 7 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| 8 | The SS transmits a *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 9 | The UE transmits a *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 10 | The SS transmits a *RRCRelease* message. | <-- | NR RRC: *RRCRelease* | - | - |

7.1.1.13.3.3.3 Specific message contents

Table 7.1.1.13.3.3.3-0: *MAC-CellGroupConfig* (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| tag-Config SEQUENCE { |  |  |  |
| tag-ToAddModList SEQUENCE (SIZE (1..maxNrofTAGs)) OF TAG { | 1 entry |  |  |
| TAG[1] SEQUENCE { |  | entry 1 |  |
| timeAlignmentTimer | ms750 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.3.3.3-1: CLOSE UE TEST LOOP (Preamble Table 7.1.1.13.3.3.2-1 )

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508-1 [7] table 4.7A-3 condition UE test loop mode B | | | |
| Information Element | Value/Remark | Comment | Condition |
| UE test loop mode B LB setup |  |  |  |
| IP PDU delay | '0000 0110'B | 6 seconds | preamble | |

Table 7.1.1.13.3.3.3-2: *FeatureCombinationPreambles (Preamble)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-56E | | | |
| Information Element | Value/remark | Comment | Condition |
| FeatureCombinationPreambles-r17 ::= SEQUENCE { |  |  |  |
| featureCombination-r17 ::= SEQUENCE { |  |  |  |
| smallData-r17 | true |  |  |
| } |  |  |  |
| startPreambleForThisPartition-r17 | 8 | Randomly selected |  |
| numberOfPreamblesPerSSB-ForThisPartition-r17 | 12 |  |  |
| ssb-SharedRO-MaskIndex-r17 | Not present |  |  |
| groupBconfigured-r17 | Not present |  |  |
| separateMsgA-PUSCH-Config-r17 | *MsgA-PUSCH-Config* | TS 38.508-1 [4] table 4.6.3-81B |  |
| msgA-RSRP-Threshold-r17 | 57 | -100 dBm |  |
| rsrp-ThresholdSSB-r17 | RSRP-Range | TS 38.508-1 [4] table 4.6.3-152 |  |
| deltaPreamble-r17 | Not present |  |  |
| } |  |  |  |

Table 7.1.1.13.3.3.3-3: SIB 1 (preamble Table 7.1.1.13.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.6.1-28 with Condition SDT | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| servingCellConfigCommon | ServingCellConfigCommon | Table 7.1.1.13.3.3.3-4 |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| sdt-ConfigCommon-r17 SEQUENCE { |  |  |  |
| sdt-DataVolumeThreshold-r17 | byte32 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.3.3.3-4: ServingCellConfigCommon (Table 7.1.1.13.3.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkCommon | Table 7.1.1.13.3.3.3-5 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.3.3.3-5: BWP-UplinkCommon(Table 7.1.1.13.3.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 |  |  |  |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| AdditionalRACH-ConfigList-r17 SEQUENCE { |  |  |  |
| AdditionalRACH-Config-r17 SEQUENCE { |  |  |  |
| rach-ConfigCommon-r17 | RACH-ConfigCommon | Table 7.1.1.13.3.3.3-6 |  |
| msgA-ConfigCommon-r17 | Not present |  |  |
| ) |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.3.3.3-6: RACH-ConfigCommon *(*Table 7.1.1.13.3.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon::= SEQUENCE { |  |  |  |
| featureCombinationPreamblesList-r17 SEQUENCE { | 1 entry |  |  |
| FeatureCombinationPreambles-r17[1] | FeatureCombinationPreambles | Entry 1Table 7.1.1.13.3.3.3-2 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.3.3.3-7: RRCRelease (Step 3 Table 7.1.1.13.3.3.2-1 )

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.1-16 with condition NR\_RRC\_INACTIVE and SDT | | | |
| RRCRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| suspendConfig SEQUENCE { |  |  |  |
| sdt-DRB-List-r17 SEQUENCE (SIZE (0..maxDRB)) OF DRB-Identity { | 1 entry |  |  |
| DRB-Identity[1] | DRB-Identity using condition DRBj | Entry 1  j is the ID of the DRB established during the preamble which is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| sdt-SRB2-Indication-r17 | Not present |  |  |
| sdt-MAC-PHY-CG-Config-r17 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.13.4 RA Based SDT / 4-step RA based SDT / Time Alignment Timer expiry

7.1.1.13.4.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state with *TimeAlignmentTimer expired* and SDT-CG-Config-r17 is not configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal to sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold }

**then** { UE shall initiate 4-step RA based SDT procedure }

}

7.1.1.13.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.321, clause 5.1.1b, 5.1.1c. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321, clause 5.1.1b]

The MAC entity shall:

1> if the BWP selected for Random Access procedure is configured with both set(s) of Random Access resources with MSG3 repetition indication and set(s) of Random Access resources without MSG3 repetition indication and the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdMsg3*; or

1> if the BWP selected for Random Access procedure is only configured with the set(s) of Random Access resources with MSG3 repetition indication:

2> assume MSG3 repetition is applicable for the current Random Access procedure.

1> else:

2> assume MSG3 repetition is not applicable for the current Random Access procedure.

NOTE 1: Void.

1> if contention-free Random Access Resources have not been provided for this Random Access procedure and one or more of the features including RedCap and/or a specific NSAG(s) and/or SDT and/or MSG3 repetition is applicable for this Random Access procedure:

NOTE 2: The applicability of SDT is determined by MAC entity according to clause 5.27. The applicability of specific NSAG(s) is determined by upper layers when the Random Access procedure is initiated. The applicability of RedCap is also determined by upper layers when Random Access procedure is initiated and it is applicable to the Random Access procedures initiated by PDCCH orders and any Random Access procedure initiated by the MAC entity.

2> if none of the sets of Random Access resources are available for any feature applicable to the current Random Access procedure (as specified in clause 5.1.1c):

3> select the set(s) of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for this Random Access procedure.

2> else if there is one set of Random Access resources available which can be used for indicating all features triggering this Random Access procedure:

3> select this set of Random Access resources for this Random Access procedure.

2> else (i.e. there are one or more sets of Random Access resources available that are configured with indication(s) for a subset of all features triggering this Random Access procedure):

3> select a set of Random Access resources from the available set(s) of Random Access resources based on the priority order indicated by upper layers as specified in clause 5.1.1d for this Random Access Procedure.

1> else if contention-free Random Access Resources have been provided for this Random Access procedure and RedCap is applicable for the current Random Access procedure and there is one set of Random Access resources available that is only configured with RedCap indication:

2> select this set of Random Access resources for this Random Access procedure.

1> else:

2> select the set of Random Access resources that are not associated with any feature indication (as specified in clause 5.1.1c) for the current Random Access procedure.

[TS 38.321, clause 5.1.1c]

The MAC entity shall for each set of configured Random Access resources for 4-step RA type and for each set of configured Random Access resources for 2-step RA type:

1> if *redCap* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for a Random Access procedure for which RedCap is not applicable.

1> if *smallData* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure which is not triggered for RA-SDT.

1> if *NSAG-List* is configured for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure unless it is triggered for any one of the *NSAG-ID*(s) in the *NSAG-List*.

1> if *msg3-Repetitions* is set to *true* for a set of Random Access resources:

2> consider the set of Random Access resources as not available for the Random Access procedure if Msg3 repetition is not applicable.

1> if a set of Random Access resources is not configured with *FeatureCombination*:

2> consider the set of Random Access resources to not associated with any feature.

[TS 38.321, clause 5.2]

The MAC entity shall:

1> when a Timing Advance Command MAC CE is received, and if an NTA (as defined in TS 38.211 [8]) has been maintained with the indicated TAG:

2> apply the Timing Advance Command for the indicated TAG;

2> if *inactivePosSRS-TimeAlignmentTimer* is configured and there is ongoing Positioning SRS Transmission in RRC\_INACTIVE as in clause 5.26:

3> start or restart the *inactivePosSRS-TimeAlignmentTimer* associated with the indicated TAG.

2> if CG-SDT procedure triggered as in clause 5.27 is ongoing:

3> start or restart the *cg-SDT-TimeAlignmentTimer* associated with the indicated TAG.

2> else:

3> start or restart the *timeAlignmentTimer* associated with the indicated TAG.

…

1> when a *timeAlignmentTimer* expires:

2> if the *timeAlignmentTimer* is associated with the PTAG:

3> flush all HARQ buffers for all Serving Cells;

3> notify RRC to release PUCCH for all Serving Cells, if configured;

3> notify RRC to release SRS for all Serving Cells, if configured;

3> clear any configured downlink assignments and configured uplink grants;

3> clear any PUSCH resource for semi-persistent CSI reporting;

3> consider all running *timeAlignmentTimer*s as expired;

3> maintain NTA (defined in TS 38.211 [8]) of all TAGs.

7.1.1.13.4.3 Test description

7.1.1.13.4.3.1 Pre-test conditions

System Simulator:

- NR Cell 1.

UE:

- None.

Preamble:

- The UE is in state 3N-A and Test Mode Activated according to TS 38.508-1 [4] Table 4.4A.2-3 with UE test loop mode B is established IP PDU delay set to 6 seconds, the DRB is configured for SDT operation.

7.1.1.13.4.3.2 Test procedure sequence

Table 7.1.1.13.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 1 | SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 2 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data < sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 3 | The SS transmits an *RRCRelease* message including sdt-Config-r17 in s*uspendConfig*. | <-- | NR RRC: *RRCRelease* | - | - |
| 4 | The UE transmits a preamble on PRACH. | --> | PRACH Preamble | - | - |
| 5 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 4, including TC-RNTI and not including Backoff Indicator subheader.  *TimeAlignmentTimer* is started in UE*.* | <-- | Random Access Response | - | - |
| 6 | The UE transmits a MAC PDU containing an *RRCResumeRequest* message and RLC PDU on DRB with SDT configured. | --> | MAC PDU (  NR RRC: *RRCResumeRequest,* RLC PDU on DRB with SDT configured) | - | - |
| 7 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| 8 | The SS transmits a *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| 9 | The UE transmits a *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 10 | The SS transmits an OPEN UE TEST LOOP message. | <-- | TC: OPEN UE TEST LOOP | - | - |
| 11 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 12 | SS transmits a CLOSE UE TEST LOOP message. | <-- | TC: CLOSE UE TEST LOOP | - | - |
| 13 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 14 | SS transmits Timing Advance SS does not send any subsequent timing alignments. *TimeAlignmentTimer* is re-started in UE. | <-- | MAC PDU (Timing Advance  Command MAC Control Element) | - | - |
| 15 | The SS transmits a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data < sdt-DataVolumeThreshold). | <-- | MAC PDU | - | - |
| 16 | Check: Does the UE transmit a preamble on PRACH? | --> | PRACH Preamble | 1 | P |
| 17 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 16, including TC-RNTI and not including Backoff Indicator subheader. | <-- | Random Access Response | - | - |
| 18 | Check: Does the UE transmit a MAC PDU containing RLC PDU on DRB with SDT configured? | --> | MAC PDU (  RLC PDU on DRB with SDT configured) | 1 | P |
| 19 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| 20 | The SS transmits a *RRCRelease* message | <-- | NR RRC: *RRCRelease* | - | - |

7.1.1.13.4.3.3 Specific message contents

Table 7.1.1.13.4.3.3-0: *MAC-CellGroupConfig* (preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| tag-Config SEQUENCE { |  |  |  |
| tag-ToAddModList SEQUENCE (SIZE (1..maxNrofTAGs)) OF TAG { | 1 entry |  |  |
| TAG[1] SEQUENCE { |  | entry 1 |  |
| timeAlignmentTimer | ms750 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.4.3.3-1: CLOSE UE TEST LOOP (Step 12, Preamble Table 7.1.1.13.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508-1 [7] table 4.7A-3 condition UE test loop mode B | | | |
| Information Element | Value/Remark | Comment | Condition |
| UE test loop mode B LB setup |  |  |  |
| IP PDU delay | '0000 0110'B | 6 seconds | preamble | |
| IP PDU delay | '0000 0010'B | 2 seconds > *TimeAlignmentTimer* | Step 12 | |

Table 7.1.1.13.4.3.3-2: *FeatureCombinationPreambles (Table 7.1.1.13.4.3.3-6)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-56E | | | |
| Information Element | Value/remark | Comment | Condition |
| FeatureCombinationPreambles-r17 ::= SEQUENCE { |  |  |  |
| featureCombination-r17 SEQUENCE { |  |  |  |
| smallData-r17 | true |  |  |
| } |  |  |  |
| startPreambleForThisPartition-r17 | 8 | Randomly selected |  |
| numberOfPreamblesPerSSB-ForThisPartition-r17 | 12 |  |  |
| ssb-SharedRO-MaskIndex-r17 | Not present |  |  |
| groupBconfigured-r17 | Not present |  |  |
| separateMsgA-PUSCH-Config-r17 | Not present |  |  |
| msgA-RSRP-Threshold-r17 | Not present |  |  |
| rsrp-ThresholdSSB-r17 | Not present |  |  |
| deltaPreamble-r17 | Not present |  |  |
| } |  |  |  |

Table 7.1.1.13.4.3.3-3: SIB 1 (preamble Table 7.1.1.13.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: TS 38.508-1 [4] Table 4.6.1-28 with condition SDT | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| servingCellConfigCommon | ServingCellConfigCommon | Table 7.1.1.13.4.3.3-4 |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| sdt-ConfigCommon-r17 SEQUENCE { |  |  |  |
| sdt-DataVolumeThreshold-r17 | byte32 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.4.3.3-4: ServingCellConfigCommon (Table 7.1.1.13.4.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| uplinkConfigCommon SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkCommon | Table 7.1.1.13.4.3.3-5 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.4.3.3-5: BWP-UplinkCommon(Table 7.1.1.13.4.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 |  |  |  |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| AdditionalRACH-ConfigList-r17 SEQUENCE { |  |  |  |
| AdditionalRACH-Config-r17 SEQUENCE { |  |  |  |
| rach-ConfigCommon-r17 | RACH-ConfigCommon | Table 7.1.1.13.4.3.3-6 |  |
| ) |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.4.3.3-6: RACH-ConfigCommon *(*Table 7.1.1.13.4.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon::= SEQUENCE { |  |  |  |
| featureCombinationPreamblesList-r17 SEQUENCE { | 1 entry |  |  |
| FeatureCombinationPreambles-r17[1] | FeatureCombinationPreambles | entry 1Table 7.1.1.13.4.3.3-2 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.4.3.3-7: RRCRelease (Step 3 Table 7.1.1.13.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.1-16 with condition NR\_RRC\_INACTIVE and SDT | | | |
| RRCRelease ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| suspendConfig SEQUENCE { |  |  |  |
| sdt-DRB-List-r17 SEQUENCE (SIZE (0..maxDRB)) OF DRB-Identity { | 1 entry |  |  |
| DRB-Identity[1] | DRB-Identity using condition DRBj | Entry 1  j is the ID of the DRB established during the preamble which is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| sdt-SRB2-Indication-r17 | Not present |  |  |
| sdt-MAC-PHY-CG-Config-r17 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.1.13.5 RA Based SDT / CG Based SDT/ cg-SDT-TimeAlignmentTimer

7.1.1.13.5.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is configured and Random Access resources for RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal to sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold and at least one SSB configured for CG-SDT with SS-RSRP above cg-SDT-RSRP-ThresholdSSB and cg-SDT-TimeAlignmentTimer is running}

**then** { UE shall initiate CG based SDT procedure}

}

(2)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is configured and Random Access resources for RA-SDT is configured }

**ensure that** {

**when** { UE has small data to transmit and the data volume of the pending UL data across all RBs configured for SDT is less than or equal to sdt-DataVolumeThreshold and RSRP is above the configured sdt-RSRP-Threshold and at least one SSB configured for CG-SDT with SS-RSRP above cg-SDT-RSRP-ThresholdSSB and cg-SDT-TimeAlignmentTimer expires }

**then** { UE shall initiate RA based SDT procedure}

}

(3)

**with** { UE in NR RRC\_INACTIVE state and CG-SDT is ongoing}

**ensure that** {

**when** { cg-SDT-TimeAlignmentTimer expires before receiving network response for the UL CG-SDT transmission with CCCH message }

**then** { UE consider ongoing CG-SDT procedure as terminated and perform the actions upon going to RRC\_IDLE with release cause 'RRC Resume failure'}

}

(4)

**with** { UE in NR RRC\_INACTIVE state and CG-SDT is ongoing}

**ensure that** {

**when** { cg-SDT-TimeAlignmentTimer expires after receiving network response for the UL CG-SDT transmission with CCCH message }

**then** { UE does not consider ongoing CG-SDT procedure as terminated and UE shall perform uplink transmission using legacy Random Access }

}

(5)

**with** { UE in NR RRC\_INACTIVE state and SDT-CG-Config-r17 is configured and Random Access resources for RA-SDT is configured }

**ensure that** {

**when** { UE initiates RA based SDT procedure }

**then** { UE is successfully able to send and receive subsequent SDT data}

}

7.1.1.13.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321, clauses 5.2, 5.27.1 and 5.27.2; TS 38.331, clauses 5.3.13.5. Unless otherwise stated these are Rel-17 requirements.

[TS 38.321 clause 5.2]

RRC configures the following parameters for the maintenance of UL time alignment:

…

- *cg-SDT-TimeAlignmentTimer* which controls how long the MAC entity considers the uplink transmission for CG-SDT to be uplink time aligned.

The MAC entity shall:

…

1> when the *cg-SDT-TimeAlignmentTimer* expires:

2> clear any configured uplink grants;

2> if a PDCCH addressed to the MAC entity's C-RNTI after initial transmission for the CG-SDT with CCCH message has not been received:

3> consider ongoing CG-SDT procedure as terminated;

3> indicate the expiry of *cg-SDT-TimeAlignmentTimer* to the upper layer.

2> flush all HARQ buffers;

2> maintain NTA (defined in TS 38.211 [8]) of this TAG.

…

The MAC entity shall not perform any uplink transmission on a Serving Cell except the Random Access Preamble and MSGA transmission when the *timeAlignmentTimer* associated with the TAG to which this Serving Cell belongs is not running, CG-SDT procedure is not ongoing or SRS transmission in RRC\_INACTIVE as in clause 5.26 is not on-going. Furthermore, when the *timeAlignmentTimer* associated with the PTAG is not running, CG-SDT procedure is not ongoing and SRS transmission in RRC\_INACTIVE as in clause 5.26 is not ongoing, the MAC entity shall not perform any uplink transmission on any Serving Cell except the Random Access Preamble and MSGA transmission on the SpCell. The MAC entity shall not perform any uplink transmission except the Random Access Preamble and MSGA transmission when the *cg-SDT-TimeAlignmentTimer* is not running during the ongoing CG-SDT procedure as triggered in clause 5.27. The MAC entity shall not perform any uplink transmission except the Random Access Preamble and MSGA transmission when *inactivePosSRS-TimeAlignmentTimer* is not running during the procedure for SRS transmission in RRC\_INACTIVE as in clause 5.26.

[TS 38.321 clause 5.27.1]

The MAC entity shall, if initiated by the upper layers for SDT procedure:

1> if the data volume of the pending UL data across all RBs configured for SDT is less than or equal to *sdt-DataVolumeThreshold*; and

NOTE: For SDT procedure, the MAC entity also considers the suspended RBs configured with SDT for data volume calculation. It is up to the UE's implementation how the UE calculates the data volume for the suspended RBs. Size of the CCCH message is not considered for data volume calculation

1> if the RSRP of the downlink pathloss reference is higher than *sdt-RSRP-Threshold*; or

1> if *sdt-RSRP-Threshold* is not configured:

2> if the Serving Cell is configured with supplementary uplink as specified in TS 38.331 [5]; and

2> if the RSRP of the downlink pathloss reference is less than *rsrp-ThresholdSSB-SUL*:

3> select the SUL carrier.

2> else:

3> select the NUL carrier.

2> if CG-SDT is configured on the selected UL carrier, and TA for CG-SDT is valid according to clause 5.27.2 in the first available CG occasion for initial CG-SDT transmission with CCCH message according to clause 5.8.2; and

2> if, for each RB having data available for transmission, *configuredGrantType1Allowed*, if configured, is configured with value *true* for the corresponding logical channel; and

2> if at least one SSB configured for CG-SDT with SS-RSRP above *cg-SDT-RSRP-ThresholdSSB* is available:

3> indicate to the upper layers that the conditions for initiating SDT procedure are fulfilled;

3> perform CG-SDT procedure on the selected UL carrier according to clause 5.8.2.

2> else if a set of Random Access resources for performing RA-SDT are selected according to clause 5.1.1b on the selected UL carrier:

3> if *cg-SDT-TimeAlignmentTimer* is running, consider *cg-SDT-TimeAlignmentTimer* as expired and perform the corresponding actions in clause 5.2;

3> indicate to the upper layers that the conditions for initiating SDT procedure are fulfilled.

[TS 38.321 clause 5.27.2]

The MAC entity shall consider the TA of the initial CG-SDT transmission with CCCH message to be valid when the following conditions are fulfilled:

1> The RSRP values for the stored downlink pathloss reference and the current downlink pathloss reference are valid according to TS 38.133 [11]; and

1> Compared to the stored downlink pathloss reference RSRP value, the current RSRP value of the downlink pathloss reference calculated as specified in TS 38.133 [11] has not increased/decreased by more than *cg-SDT-RSRP-ChangeThreshold*, if configured; and

1> *cg-SDT-TimeAlignmentTimer* is running.

[TS 38.331 clause 5.3.13.5]

The UE shall:

…

1> else if indication from the MCG RLC that the maximum number of retransmissions has been reached is received while SDT procedure is ongoing; or

1> if random access problem indication is received from MCG MAC while SDT procedure is ongoing; or

1> if the lower layers indicate that *cg*-*SDT*-*TimeAlignmentTimer* or the *configuredGrantTimer* expired before receiving network response for the UL CG-SDT transmission with CCCH message while SDT procedure is ongoing; or

1> if T319a expires:

2> consider SDT procedure is not ongoing;

2> perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with release cause 'RRC Resume failure'.

7.1.1.13.5.3 Test description

7.1.1.13.5.3.1 Pre-test conditions

System Simulator:

- NR Cell 1

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cell.

UE:

None.

Preamble:

- The UE is in 5GS state 3N-A according to TS 38.508-1 [4], clause 4.4A.2 Table 4.4A.2-3 and Test Loop Function (On) with UE test loop mode B is established, if pc\_logicalChannelSR\_DelayTimer=True the DRB is configured according to Table 7.1.1.13.5.3.1-1 for SDT operation.

Table 7.1.1.13.5.3.1-1: Logical Channel Configuration Settings

|  |  |
| --- | --- |
| Parameter | SDT DRB |
| logicalChannelSR-DelayTimerApplied | True |
| logicalChannelSR-DelayTimer | sf512 |

7.1.1.13.5.3.2 Test procedure sequence

Table 7.1.1.13.5.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 2 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT. (Note 1) | <-- | MAC PDU | - | - |
| 3 | The SS transmits an *RRCRelease* message including *SDT-CG-Config-r17* in s*uspendConfig*. The *cg-SDT-TimeAlignmentTimer* is configured to 5120ms. | <-- | NR RRC: *RRCRelease* | - | - |
| 4 | The SS is configured on NR Cell 1 not to send RLC acknowledgement (RLC ACK) to the next received RLC SDU to the UE (Note 2) | - | - | - | - |
| 5 | Check: The UE transmits a MAC PDU containing an *RRCResumeRequest* message and RLC PDU on DRB with SDT configuredin a CG PUSCH occasion? | --> | MAC PDU (  NR RRC: *RRCResumeRequest,*  RLC PDU on DRB with SDT configured) | 1 | P |
| 6 | The SS waits 6s from step 3 to ensure that *cg-SDT-TimeAlignmentTimer* expired and then transmits Paging message including *ng-5G-S-TMSI.* (Note 3) | <-- | NR RRC: *Paging* | - | - |
| 7 | Check: Does the UE transmit an *RRCSetupRequest* message? | --> | NR RRC: *RRCSetupRequest* | 3 | P |
| 8-13 | Steps 3 to 8 of the NR RRC\_CONNECTED procedure in TS 38.508-1 [4] Table 4.5.4.2-3 are executed to successfully complete the service request procedure. | - | - | - | - |
| 14 | The SS transmits an OPEN UE TEST LOOP message. | <-- | NR RRC: *DLInformationTransfer*  TC: OPEN UE TEST LOOP | - | - |
| 15 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | NR RRC: *ULInformationTransfer*  TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 16 | The SS transmits a CLOSE UE TEST LOOP message. | <-- | NR RRC: *DLInformationTransfer*  TC: CLOSE UE TEST LOOP | - | - |
| 17 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | NR RRC: *ULInformationTransfer*  TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 18 | The SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 19 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT. (Note 1) | <-- | MAC PDU | - | - |
| 20 | The SS transmits an *RRCRelease* message including *SDT-CG-Config-r17* in s*uspendConfig*. The *cg-SDT-TimeAlignmentTimer* is configured to 5120ms. | <-- | NR RRC: *RRCRelease* | - | - |
| 21 | The SS is configured on NR Cell 1 not to send RLC acknowledgement (RLC ACK) to the next received RLC SDU to the UE. (Note 2) | - | - | - | - |
| 22 | Check: The UE transmits a MAC PDU containing an *RRCResumeRequest* message and RLC PDU on DRB with SDT configuredin a CG PUSCH occasion? | --> | MAC PDU (  NR RRC: *RRCResumeRequest,*  RLC PDU on DRB with SDT configured) | 1 | P |
| 23 | The SS waits 6s from step 20 to ensure that *cg-SDT-TimeAlignmentTimer* expired and then transmits Paging message including matched *fullI-RNTI.* (Note 3) | <-- | NR RRC: *Paging* | - | - |
| 24 | Check: Does the UE transmit an *RRCResumRequest* message within 10s? | --> | NR RRC: *RRCResumeRequest* | 3 | F |
| 25-32 | The test steps 1 to 8 of generic test procedure in TS 38.508-1 [4] Table 4.5.4.2-3 are performed on NR Cell 1. | - | - | - | - |
| 33 | The SS transmits an OPEN UE TEST LOOP message. | <-- | NR RRC: *DLInformationTransfer*  TC: OPEN UE TEST LOOP | - | - |
| 34 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | NR RRC: *ULInformationTransfer*  TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 35 | The SS transmits a CLOSE UE TEST LOOP message. | <-- | NR RRC: *DLInformationTransfer*  TC: CLOSE UE TEST LOOP | - | - |
| 36 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | NR RRC: *ULInformationTransfer*  TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 37 | The SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 38 | SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT. (Note 1) | <-- | MAC PDU | - | - |
| 39 | The SS transmits an *RRCRelease* message including *SDT-CG-Config-r17* in s*uspendConfig*. The *cg-SDT-TimeAlignmentTimer* is configured to 5120ms. | <-- | NR RRC: *RRCRelease* | - | - |
| 40 | Check: The UE transmits a MAC PDU containing an *RRCResumeRequest* message and RLC PDU on DRBin a CG PUSCH occasion? | --> | MAC PDU (  NR RRC: *RRCResumeRequest,*  RLC PDU on DRB) | 1 | P |
| 41 | The SS waits 6s from step 39 to ensure that *cg-SDT-TimeAlignmentTimer* expired and then transmits a RLC PDU in a MAC PDU on the DRB configured with SDT*.* | <-- | MAC PDU | - | - |
| 42 | Check: Does the UE transmit a preamble on PRACH with *ra-PreambleIndex* range from 0 to 7 for FR1 and from 0 to 3 for FR2? | --> | PRACH Preamble | 4 | P |
| 43 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 42, including TC-RNTI and not including Back off Indicator subheader. | <-- | Random Access Response | - | - |
| 44 | Check: Does the UE transmit an *RRCResumeRequest* message? | --> | MAC PDU (  NR RRC: *RRCResumeRequest*) | 4 | P |
| 45 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| 46 | The SS transmits an *RRCResume* message. | <-- | NR RRC: *RRCResume* | - | - |
| - | Exception: Step 47 and 48 can happen in any order | - | - | - | - |
| 47 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 48 | Check: Does the UE transmits a MAC PDU containing Loop backed PDU? | --> | MAC PDU (containing 1 MAC sub PDU containing RLC SDU) | 4 | P |
| - | EXCEPTION: Steps 49a1-49a11 describe behaviour that depends on UE configuration; the "lower case letter" identifies a step sequence that takes place if pc\_ra\_SDT\_r17 is configured | - | - | - | - |
| 49a1 | IF pc\_ra\_SDT\_r17 THEN the SS transmits an OPEN UE TEST LOOP message. | <-- | NR RRC: *DLInformationTransfer*  TC: OPEN UE TEST LOOP | - | - |
| 49a2 | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | NR RRC: *ULInformationTransfer*  TC: OPEN UE TEST LOOP COMPLETE | - | - |
| 49a3 | The SS transmits a CLOSE UE TEST LOOP message. | <-- | NR RRC: *DLInformationTransfer*  TC: CLOSE UE TEST LOOP | - | - |
| 49a4 | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | NR RRC: *ULInformationTransfer*  TC: CLOSE UE TEST LOOP COMPLETE | - | - |
| 49a5 | The SS transmits a downlink assignment including the C-RNTI assigned to the UE | <-- | (PDCCH (C-RNTI)) | - | - |
| 49a6 | The SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT( SDT Data < sdt-DataVolumeThreshold).(Note 1) | <-- | MAC PDU | - | - |
| 49a7 | The SS transmits an *RRCRelease* message including *SDT-CG-Config-r17* in s*uspendConfig*. The *cg-SDT-TimeAlignmentTimer* is configured to 5120ms. | <-- | NR RRC: *RRCRelease* | - | - |
| 49a8 | Check: Does the UE transmit a preamble on PRACH with *ra-PreambleIndex* range from 8 to 15? | --> | PRACH Preamble | 2 | P |
| 49a9 | The SS transmits Random Access Response with RAPID corresponding to the transmitted Preamble in step 49a8, including TC-RNTI and not including Back off Indicator subheader. | <-- | Random Access Response | - | - |
| 49a10 | Check: The UE transmits a MAC PDU containing an *RRCResumeRequest* message and RLC PDU on DRB with SDT configured? | --> | MAC PDU (  NR RRC: *RRCResumeRequest,* RLC PDU on DRB with SDT configured) | 2 | P |
| 49a11 | The SS schedules PDCCH transmission addressed to TC-RNTI to transmit a valid MAC PDU containing ‘UE Contention Resolution Identity’ MAC control element with matched ‘Contention Resolution Identity’. | <-- | MAC PDU  (UE Contention Resolution Identity MAC CE) | - | - |
| - | EXCEPTION: Steps 49a12a1-49a12a3 describe behaviour that depends on UE configuration; the "lower case letter" identifies a step sequence that takes place if pc\_logicalChannelSR\_DelayTimer is configured | - | - | - | - |
| 49a12a1 | IF pc\_logicalChannelSR\_DelayTimer THEN SS transmits in the indicated downlink assignment a RLC PDU in a MAC PDU on the DRB configured with SDT (SDT Data <= sdt-DataVolumeThreshold) (Note 1) | <-- | MAC PDU | - | - |
| 49a12a2 | SS transmits an UL Grant, allowing the UE to return the RLC SDU as received in step 17a, on PDCCH with the C-RNTI assigned to the UE. | <-- | (UL Grant (C-RNTI)) | - | - |
| 49a12a3 | Check: Does the UE transmit a MAC PDU including one RLC SDU? | --> | MAC PDU | 5 | P |
| 50 | The SS transmits a *RRCRelease* message | <-- | NR RRC: *RRCRelease* | - | - |
| Note 1: RLC PDU is 97 bytes (RLC SDU is 94 bytes for 3 bytes RLC header and 95 bytes for 2 bytes RLC header) and sdt-DataVolumeThreshold is 100 bytes. Therefore the size of RLC SDU is less than the sdt-DataVolumeThreshold.  Note 2: This step is used to ensure UE could not receive PDCCH addressed to the MAC entity's C-RNTI after initial transmission for the CG-SDT with CCCH message.  Note 3: After cg-SDT-TimeAlignmentTimer expired, UE consider ongoing CG-SDT procedure as terminated and perform the actions upon going to RRC\_IDLE. Therefore UE could receive CN Paging using 5G-S-TMSI and could not receive RAN Paging using fullI-RNTI. | | | | | |

7.1.1.13.5.3.3 Specific message contents

Table 7.1.1.13.5.3.3-1: CLOSE UE TEST LOOP (Preamble and all steps, Table 7.1.1.13.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 36.508-1 [7] table 4.7A-3 condition UE test loop mode B | | | |
| Information Element | Value/Remark | Comment | Condition |
| UE test loop mode B LB setup |  |  |  |
| IP PDU delay | '0000 0100'B | 4 seconds | Preamble, Step16, Step35 | |
|  | '0000 1000'B | 8 seconds | Step49a3 | |

Table 7.1.1.13.5.3.3-2: *SIB1* (Preamble and all steps, Table 7.1.1.13.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.1-28 | | | |
| Information Element | Value/Remark | Comment | Condition |
| SIB1 ::= SEQUENCE { |  |  |  |
| servingCellConfigCommon | ServingCellConfigCommonSIB | Table 7.1.1.13.5.3.3-3 |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| sdt-ConfigCommon-r17 SEQUENCE { |  |  |  |
| sdt-RSRP-Threshold-r17 | 60 | (IE value – 156) dBm = - 96 dBm |  |
| sdt-LogicalChannelSR-DelayTimer-r17 | sf512 |  |  |
| sdt-DataVolumeThreshold-r17 | byte100 |  |  |
| t319a-r17 | ms4000 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.5.3.3-3: *ServingCellConfigCommonSIB* (Table 7.1.1.13.5.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-169 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| uplinkConfigCommon | UplinkConfigCommonSIB | Table 7.1.1.13.5.3.3-4 |  |
| } |  |  |  |

Table 7.1.1.13.5.3.3-4: *UplinkConfigCommonSIB* (Table 7.1.1.13.5.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-202 | | | |
| Information Element | Value/remark | Comment | Condition |
| UplinkConfigCommonSIB ::= SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkCommon | Table 7.1.1.13.5.3.3-5 |  |
| } |  |  |  |

Table 7.1.1.13.5.3.3-5: *BWP-UplinkCommon* (Table 7.1.1.13.5.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| rach-ConfigCommon CHOICE { |  |  |  |
| setup | RACH-ConfigCommon | Table 7.1.1.13.5.3.3-6 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.5.3.3-6: *RACH-ConfigCommon* (Table 7.1.1.13.5.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon ::= SEQUENCE { |  |  |  |
| featureCombinationPreamblesList-r17 SEQUENCE (SIZE(1..maxFeatureCombPreamblesPerRACHResource-r17)) OF FeatureCombinationPreambles-r17 { | 1 entry |  |  |
| FeatureCombinationPreambles-r17[1] SEQUENCE { |  | entry 1 |  |
| featureCombination-r17 SEQUENCE { |  |  |  |
| smallData-r17 | True |  |  |
| } |  |  |  |
| startPreambleForThisPartition-r17 | 8 |  |  |
| numberOfPreamblesPerSSB-ForThisPartition-r17 | 8 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.5.3.3-7: *RRCRelease* (steps 3, 20, 39 and 49a7, Table 7.1.1.13.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-16 with condition NR\_RRC\_INACTIVE and SDT | | | |
| Information Element | Value/Remark | Comment | Condition |
| RRCRelease ::= SEQUENCE { |  |  |  |
| rrc-TransactionIdentifier | RRC-TransactionIdentifier |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcRelease SEQUENCE { |  |  |  |
| suspendConfig SEQUENCE { |  |  |  |
| sdt-Config-r17 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| sdt-MAC-PHY-CG-Config-r17 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| cg-SDT-ConfigInitialBWP-NUL-r17 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| pusch-Config-r17 CHOICE { |  |  |  |
| setup | PUSCH-Config |  |  |
| } |  |  |  |
| configuredGrantConfigToAddModList-r17 SEQUENCE (SIZE (1..maxNrofConfiguredGrantConfig-r16)) OF ConfiguredGrantConfig { |  |  |  |
| ConfiguredGrantConfig[1] | ConfiguredGrantConfig | Table 7.1.1.13.5.3.3-8 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| cg-SDT-ConfigInitialBWP-SUL-r17 | Not present |  |  |
| cg-SDT-ConfigInitialBWP-DL-r17 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| pdcch-Config-r17 CHOICE { |  |  |  |
| setup | PDCCH-Config |  |  |
| } |  |  |  |
| pdsch-Config-r17 CHOICE { |  |  |  |
| setup | PDSCH-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| cg-SDT-TimeAlignmentTimer-r17 | ms5120 | TimeAlignmentTimer(5.12s) |  |
| cg-SDT-RSRP-ThresholdSSB-r17 | 60 | (IE value – 156) dBm = - 96 dBm |  |
| cg-SDT-TA-ValiditationConfig-r17 | Not present | UE does not perform RSRP based TA validation |  |
| } |  |  |  |
| cg-SDT-CS-RNTI-r17 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.1.13.5.3.3-8: *ConfiguredGrantConfig* (Table 7.1.1.13.5.3.3-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.3-26, condition CG\_Config\_Type1 | | | |
| Information Element | Value/Remark | Comment | Condition |
| ConfiguredGrantConfig ::= SEQUENCE { |  |  |  |
| rrc-ConfiguredUplinkGrant SEQUENCE{ |  |  |  |
| frequencyDomainAllocation | BIT STRING (SIZE(18) | Equals to  NBWPsize \* (NBWPsize – LRB + 1) + (NBWPsize -1 - RBstart), where  LRB = 24 PRB,  RBstart = 0,  NBWPsize is the size [PRBs] of the carrier bandwidth and contained in TS.38.508-1 [4] clause 6.2.3.1 | SCS15 AND CBW5, SCS30 AND CBW10 |
|  | BIT STRING (SIZE(18) | Equal to  NBWPsize \* (LRB-1) + RBstart), where  LRB = 24 PRB,  RBstart = 0,  NBWPsize is the size [PRBs] of the carrier bandwidth and contained in TS.38.508-1 [4] clause 6.2.3.1 |  |
| dmrs-SeqInitialization | 0 |  |  |
| mcsAndTBS | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| Note : Configured UL grant for CG-SDT is 888 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to enable UE to transmit RRCResumeRequest and Loop backed RLC PDU in a MAC PDU ( 97 bytes for Loop backed RLC PDU + 2 bytes for MAC Sub Header + 6 bytes for RRCResumeRequest message + 2 bytes for MAC Sub Header + 4 bytes for BSR and Padding ) | | | |

Table 7.1.1.13.5.3.3-9: *RRCResumeRequest* (steps 5, 22, 40 and 49a10, Table 7.1.1.13.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCResumeRequest ::= SEQUENCE { |  |  |  |
| rrcResumeRequest SEQUENCE { |  |  |  |
| resumeCause | mo-data |  |  |
| } |  |  |  |
| } |  |  |  |

### 7.1.2 RLC

#### 7.1.2.1 Default Pre-Test Conditions for all RLC test cases

The following pre-test conditions shall be applied in all RLC test cases until the test case explicitly over writes these conditions.

##### 7.1.2.1.1 Default Pre-Test Conditions for AM RLC test cases

System Simulator:

- The SS configures the test environment in accordance to the execution conditions in Table 7.1.2.1.1-1.

UE:

- None

Preamble:

- The SS performs the generic procedure in [4] to get UE in state RRC\_CONNECTED in accordance to the execution conditions in Table 7.1.2.1.1-2 and the message condition UE TEST LOOP MODE A to return one UL PDCP SDU per DL PDCP SDU.

Table 7.1.2.1.1-1: Test environment

|  |  |  |
| --- | --- | --- |
| Execution Condition | Cell configuration | System Information Combination |
| IF pc\_NG\_RAN\_NR | NR Cell 1 | NR: System information Combination NR-1 |
| ELSE IF pc\_EN\_DC | E-UTRA Cell 1 is PCell,  NR Cell 1 is PSCell | EUTRA: System information Combination 1  NR: N/A |
| ELSE IF pc\_NGEN\_DC | NG-RAN E-UTRA Cell 1 is PCell,  NR Cell 1 is PSCell | EUTRA: System information Combination 1  NR: N/A |

Table 7.1.2.1.1-2: Preamble parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Execution Condition | Multi-PDN / Multi-PDU Sessions Condition | Generic Procedure Parameters | Primary DRB used for Data testing |
| IF pc\_NG\_RAN\_NR | FALSE | Connectivity(*NR*),  Test loop function(*On*)  One DRB | Default DRB of the first PDU session on NR Cell |
| TRUE | Connectivity(*NR*),  Test loop function(*On*)  *N* DRBs (*N* ≥ 2) |  |
| ELSE IF pc\_EN\_DC | FALSE | Connectivity(*EN-DC*),  DC bearer(One MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) | SN Terminated SCG bearer unless explicitly specified in test case |
| TRUE | Connectivity(*EN-DC*),  DC bearer(Two MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) |
| ELSE IF pc\_NGEN\_DC | FALSE | Connectivity(*NGEN-DC*),  DC bearer(One MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) | SN Terminated SCG bearer unless explicitly specified in test case |
| TRUE | Connectivity(*EN-DC*),  DC bearer(Two MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) |

Table 7.1.2.1.1-3: Message conditions

|  |  |
| --- | --- |
| Execution Condition | Message condition exceptions |
| IF pc\_NG\_RAN\_NR | Message with condition AM is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_EN\_DC | Message condition MCG\_and\_SCG with condition SCG-DRB(1,0) is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_NGEN\_DC | Message condition MCG\_and\_SCG with condition SCG-DRB(1,0) is used for step 7 in 4.5.4.2 according to [4] |

##### 7.1.2.1.2 Default Pre-Test Conditions for UM RLC test cases

Same Pre-test conditions as in clause 7.1.2.1.1 with the exceptions in Table 7.1.2.1.2-1.

Table 7.1.2.1.2-1: Message conditions

|  |  |
| --- | --- |
| Execution Condition | Message condition exceptions |
| IF pc\_NG\_RAN\_NR | Message with condition UM is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_EN\_DC | Message condition MCG\_and\_SCG with condition SCG-DRB(0,1) is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_NGEN\_DC | Message condition MCG\_and\_SCG with condition SCG-DRB(0,1) is used for step 7 in 4.5.4.2 according to [4] |

#### 7.1.2.2 RLC Unacknowledged mode

##### 7.1.2.2.1 UM RLC / Segmentation and reassembly / 6-bit SN / Segmentation Info (SI) field

7.1.2.2.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE receives UMD PDU containing a SI field set to 00 }

**then** { UE correctly decodes the received UMD PDU }

}

(2)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE receives a 6 bit SN configured UMD PDU containing a SI field set to 01 }

**then** { UE correctly decodes the received UMD PDU }

}

(3)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE receives a 6 bit SN configured UMD PDU containing a SI field set to 11 and SO field }

**then** { UE correctly decodes the received UMD PDU }

}

(4)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE receives a 6 bit SN configured UMD PDU containing a SI field set to 10 and SO field }

**then** { UE correctly decodes the received UMD PDU }

}

(5)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is sufficient to send whole SDU in one PDU }

**then** { UE transmits RLC SDU containing a SI field set to 00 }

}

(6)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is not sufficient to send whole SDU in one PDU }

**then** { UE transmits first RLC SDU segment containing a SI field set to 01 and including 6 bit SN }

}

(7)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is not sufficient to send whole SDU in one PDU }

**then** { UE transmits middle RLC SDU segment containing a SI field set to 11, including SO field and including 6 bit SN }

}

(8)

**with** { UE in RRC\_CONNECTED state configured for 6 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is not sufficient to send whole SDU in one PDU }

**then** { UE transmits last RLC SDU segment containing a SI field set to 10, including SO field and including 6 bit SN }

}

7.1.2.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.2.2.2.1, 5.2.2.2.2, 6.2.3.4 and 6.2.2.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.2.2.2.1]

The receiving UM RLC entity shall maintain a reassembly window according to state variable RX\_Next\_Highest as follows:

- a SN falls within the reassembly window if (RX\_Next\_Highest – UM\_Window\_Size) <= SN <RX\_Next\_Highest;

- a SN falls outside of the reassembly window otherwise.

When receiving an UMD PDU from lower layer, the receiving UM RLC entity shall:

- either deliver the UMD PDU after removing the RLC header, discard the received UMD PDU, or place it in the reception buffer (see sub clause 5.2.2.2.2);

- if the received UMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop *t-Reassembly* as needed (see sub clause 5.2.2.2.3).

When *t-Reassembly* expires, the receiving UM RLC entity shall:

- update state variables, discard RLC SDU segments and start *t-Reassembly* as needed (see sub clause 5.2.2.2.4).

[TS 38.322, clause 5.2.2.2.2]

When an UMD PDU is received from lower layer, the receiving UM RLC entity shall:

- if the UMD PDU header does not contain an SN:

- remove the RLC header and deliver the RLC SDU to upper layer.

- else if (RX\_Next\_Highest – UM\_Window\_Size) <= SN < RX\_Next\_Reassembly:

- discard the received UMD PDU.

- else:

- place the received UMD PDU in the reception buffer.

[TS 38.322, clause 6.2.2.3]

UMD PDU consists of a Data field and an UMD PDU header. The UMD PDU header is byte aligned

When an UMD PDU contains a complete RLC SDU, the UMD PDU header only contains the SI and R fields.

An UM RLC entity is configured by RRC to use either a 6 bit SN or a 12 bit SN. An UMD PDU header contains the SN field only when the corresponding RLC SDU is segmented. An UMD PDU carrying the first segment of an RLC SDU does not carry the SO field in its header. The length of the SO field is 16 bits.



Figure 6.2.2.3-1: UMD PDU containing a complete RLC SDU



Figure 6.2.2.3-2: UMD PDU with 6 bit SN (No SO)



Figure 6.2.2.3-3: UMD PDU with 12 bit SN (No SO)



Figure 6.2.2.3-4: UMD PDU with 6 bit SN and with SO



Figure 6.2.2.3-5: UMD PDU with 12 bit SN and with SO

[TS 38.322, clause 6.2.3.4]

Length: 2 bits.

The SI field indicates whether a RLC PDU contains a complete RLC SDU or the first, middle, last segment of a RLC SDU.

Table 6.2.2.6-1: SI field interpretation

|  |  |
| --- | --- |
| Value | Description |
| 00 | Data field contains all bytes of a RLC SDU |
| 01 | Data field contains the first segment of a RLC SDU |
| 10 | Data field contains the last segment of a RLC SDU |
| 11 | Data field contains neither the first nor last segment of a RLC SDU |

7.1.2.2.1.3 Test description

7.1.2.2.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception for the UM DRB is configured according to Table 7.1.2.2.1.3.1-1.

Table 7.1.2.2.1.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink UM RLC sn-FieldLength | size6 |
| Downlink UM RLC sn-FieldLength | size6 |

7.1.2.2.1.3.2 Test procedure sequence

Table 7.1.2.2.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0 | The SS stops allocating any UL grant. | - | - | - | - |
| 1 | The SS transmits UMD PDU#1 containing a complete RLC SDU#1 (SI field = 00). | <-- | UMD PDU#1 | - | - |
| 2 | SS allocates an UL grant sufficient to loop back RLC SDU#1 in one RLC/MAC PDU | <-- | UL Grant | - | - |
| 3 | Check: Does the UE transmit RLC SDU#1? | --> | (RLC SDU#1) | 1,5 | P |
| 4 | The SS transmits UMD PDU#2 containing the first segment of RLC SDU#2 (SI field = 01). Note 3 | <-- | UMD PDU#2 | - | - |
| 5 | The SS transmits UMD PDU#3 containing the second segment of RLC SDU#2 (SI field = 11) and including SO field. Note 3 | <-- | UMD PDU#3 | - | - |
| 6 | The SS transmits UMD PDU#4 containing the last segment of RLC SDU#2 (SI field = 10) and including SO field. Note 3 | <-- | UMD PDU#4 | - | - |
| 7 | SS allocates 3 UL grants at an interval of 20 ms so as to loop back RLC SDU#2 in 3 RLC/MAC PDUs. Note 1 & 2 | <-- | UL Grants | - | - |
| 8 | Check: Does the UE transmit UMD PDU#2 containing the first segment of RLC SDU#2 (SI field = 01)? | --> | (RLC SDU#2, first segment) | 2,3,4,6 | P |
| 9 | Check: Does the UE transmit UMD PDU#3 containing the second segment of RLC SDU#2 (SI field = 11) and including SO field? | --> | (RLC SDU#2, second segment) | 2,3,4,7 | P |
| 10 | Check: Does the UE transmit UMD PDU#4 containing the last segment of RLC SDU#2 (SI field = 10) and including SO field? | --> | (RLC SDU#2, last segment) | 2,3,4,8 | P |
| Note 1: The UL grants for step 8,9,10 are sufficiently small (240 bits, LRBs & IMCS as per 38.523-3[3] annex B) that UE transmits RLC SDU#2 in 3 UL RLC PDUs by segmenting.  Note 2: The RLC PDU containing a segment shall be of size 208 bits resp. 224 bits and a MAC sub PDU header of 16 bits and a 16-bit MAC BSR CE included in step 8 resulting in a MAC PDU of size 240 bits.  Note 3: The data part in step 4 first segment not including SO is 200 bits (25 bytes). Step 5, second segment SO=25 and data is 200 bits (25 bytes). Step 6, third segment SO=25+25=50 and data is 200 bits (25 bytes). | | | | | |

7.1.2.2.1.3.3 Specific message contents

None.

##### 7.1.2.2.2 UM RLC / Segmentation and reassembly / 12-bit SN / Segmentation Info (SI) field

7.1.2.2.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE receives UMD PDU containing a SI field set to 00 }

**then** { UE correctly decodes the received UMD PDU }

}

(2)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE receives a 12 bit SN configured UMD PDU containing a SI field set to 01 }

**then** { UE correctly decodes the received UMD PDU }

}

(3)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE receives a 12 bit SN configured UMD PDU containing a SI field set to 11 and SO field }

**then** { UE correctly decodes the received UMD PDU }

}

(4)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE receives a 12 bit SN configured UMD PDU containing a SI field set to 10 and SO field }

**then** { UE correctly decodes the received UMD PDU }

}

(5)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is sufficient to send whole SDU in one PDU }

**then** { UE transmits RLC SDU containing a SI field set to 00 }

}

(6)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is not sufficient to send whole SDU in one PDU }

**then** { UE transmits first RLC SDU segment containing a SI field set to 01 and including 12 bit SN}

}

(7)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is not sufficient to send whole SDU in one PDU }

**then** { UE transmits middle RLC SDU segment containing a SI field set to 11, including SO field and including 12 bit SN }

}

(8)

**with** { UE in RRC\_CONNECTED state configured for 12 bit SN in RLC UM }

**ensure that** {

**when** { UE has UL SDU to send and UL grant available is not sufficient to send whole SDU in one PDU }

**then** { UE transmits last RLC SDU segment containing a SI field set to 10, including SO field and including 12 bit SN }

}

7.1.2.2.2.2 Conformance requirements

Same conformance requirements as clause 7.1.2.2.1.2

7.1.2.2.2.3 Test description

7.1.2.2.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception for the UM DRB is configured according to Table 7.1.2.2.2.3.1-1.

Table 7.1.2.2.2.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink UM RLC sn-FieldLength | size12 |
| Downlink UM RLC sn-FieldLength | size12 |

7.1.2.2.2.3.2 Test procedure sequence

Same test procedure sequence as 7.1.2.2.1.3.2 except that RLC UM SN is 12 bit and the data part in step 4 first segment not including SO is 192 bits (24 Bytes). Step 5, second segment SO=24 and data is 192 bits (24 bytes). Step 6, third segment SO=24+24=48 and data is 192 bits (24 bytes).

7.1.2.2.2.3.3 Specific message contents

None.

##### 7.1.2.2.3 UM RLC / 6-bit SN / Correct use of sequence numbering

7.1.2.2.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with UM RLC 6 bit SN }

**ensure that** {

**when** { UE transmits the first PDU which is segmented }

**then** { UE includes the SN field equal to 0 in each RLC segment }

}

(2)

**with** { UE in RRC\_CONNECTED state with UM RLC 6 bit SN }

**ensure that** {

**when** { UE transmit subsequent segmented PDUs }

**then** { UE includes the SN field incremented by 1 for each segmented PDU of one RLC SDU }

}

(3)

**with** { UE in RRC\_CONNECTED state with UM RLC 6 bit SN }

**ensure that** {

**when** { UE transmit segments belonging to more than 64 SDUs }

**then** { UE wraps the SN after transmitting the segments of 64 SDUs }

}

(4)

**with** { UE in RRC\_CONNECTED state with UM RLC 6 bit SN }

**ensure that** {

**when** { segments of more than 64 SDUs are sent to UE }

**then** { UE accepts PDUs with SNs that wrap around every 64 segmented SDUs }

}

7.1.2.2.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.322, clause 5.2.2.1.1, 5.2.2.2, 6.2.2.3, 6.2.3.3 and 7.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.2.2.1.1]

When submitting a UMD PDU to lower layer, the transmitting UM RLC entity shall:

- if the UMD PDU contains a segment of an RLC SDU, set the SN of the UMD PDU to TX\_Next;

- if the UMD PDU contains a segment that maps to the last byte of an RLC SDU, then increment TX\_Next by one.

[TS 38.322, clause 5.2.2.2]

The receiving UM RLC entity shall maintain a reassembly window according to state variable RX\_Next\_Highest as follows:

- a SN falls within the reassembly window if (RX\_Next\_Highest – UM\_Window\_Size) <= SN <RX\_Next\_Highest;

- a SN falls outside of the reassembly window otherwise.

When receiving an UMD PDU from lower layer, the receiving UM RLC entity shall:

- either deliver the UMD PDU after removing the RLC header, discard the received UMD PDU, or place it in the reception buffer (see sub clause 5.2.2.2.2);

- if the received UMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop *t-Reassembly* as needed (see sub clause 5.2.2.2.3).

…

When an UMD PDU is received from lower layer, the receiving UM RLC entity shall:

- if the UMD PDU header does not contain an SN:

- remove the RLC header and deliver the RLC SDU to upper layer.

- else if (RX\_Next\_Highest – UM\_Window\_Size) <= SN < RX\_Next\_Reassembly:

- discard the received UMD PDU.

- else:

- place the received UMD PDU in the reception buffer.

…

When an UMD PDU with SN = x is placed in the reception buffer, the receiving UM RLC entity shall:

- if all byte segments with SN = x are received:

- reassemble the RLC SDU from all byte segments with SN = x, remove RLC headers and deliver the reassembled RLC SDU to upper layer;

- if x = RX\_Next\_Reassembly:

- update RX\_Next\_Reassembly to the SN of the first SN > current RX\_Next\_Reassembly that has not been reassembled and delivered to upper layer.

- else if x falls outside of the reassembly window:

- update RX\_Next\_Highest to x + 1;

- discard any UMD PDUs with SN that falls outside of the reassembly window;

- if RX\_Next\_Reassembly falls outside of the reassembly window:

- set RX\_Next\_Reassembly to the SN of the first SN >= (RX\_Next\_Highest – UM\_Window\_Size) that has not been reassembled and delivered to upper layer.

[TS 38.322, clause 6.2.2.3]

An UM RLC entity is configured by RRC to use either a 6 bit SN or a 12 bit SN. An UMD PDU header contains the SN field only when the corresponding RLC SDU is segmented.

[TS 38.322, clause 6.2.3.3]

The SN field indicates the sequence number of the corresponding RLC SDU. …. For RLC UM, the sequence number is incremented by one for every segmented RLC SDU..

[TS 38.322, clause 7.1]

All state variables and all counters are non-negative integers.

…

All state variables related to UM data transfer can take values from 0 to 63 for 6 bit SN or from 0 to 4095 for 12 bit SN. All arithmetic operations contained in the present document on state variables related to UM data transfer are affected by the UM modulus (i.e. final value = [value from arithmetic operation] modulo 64 for 6 bit SN and 4096 for 12 bit SN).

…

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables and constant:

b) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0.

c) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

d) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0.

7.1.2.2.3.3 Test description

7.1.2.2.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception for the UM DRB is configured according to Table 7.1.2.2.3.3.1-1.

Table 7.1.2.2.3.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink UM RLC sn-FieldLength | size6 |
| Downlink UM RLC sn-FieldLength | size6 |

7.1.2.2.3.3.2 Test procedure sequence

Table 7.1.2.2.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 0 | The SS stops allocating any UL grant. | - | - | - | - |
| 1 | The SS transmits UMD PDU#1 with 6 bit SN = 0 containing the first segment of RLC SDU#1 (SI field = 01). | <-- | UMD PDU#1 | - | - |
| 2 | The SS transmits UMD PDU#2 with 6 bit SN=0 containing the last segment of RLC SDU#1 (SI field = 10) and including SO field. | <-- | UMD PDU#2 | - | - |
| 3 | SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#1 in 2 RLC/MAC PDUs. (Note 1) | <-- | UL Grants | - | - |
| 4 | Check: Does the UE transmit UMD PDU#1 with 6 bit SN = 0 containing the first segment of RLC SDU#1 (SI field = 01)? | --> | (RLC SDU#1, first segment) | 1 | P |
| 5 | Check: Does the UE transmit UMD PDU#2 with 6 bit SN = 0 containing the last segment of RLC SDU#1 (SI field = 10)? | --> | (RLC SDU#1, last segment) | 1 | P |
| - | EXCEPTION: Steps 6 to 10 are executed 63 times, the initial value of k = 1, it is incremented by one for each iteration. | - | - | - | - |
| 6 | The SS transmits UMD PDU#(2\*k+1) with 6 bit SN = k containing the first segment of RLC SDU#(k+1) (SI field = 01). | <-- | UMD PDU#(2\*k+1) | - | - |
| 7 | The SS transmits UMD PDU#(2\*(k+1)) with 6 bit SN=k containing the last segment of RLC SDU#(k+1) (SI field = 10) | <-- | UMD PDU#(2\*(k+1)) | - | - |
| 8 | SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#(k+1) in 2 RLC/MAC PDUs. (Note 1) | <-- | UL Grants | - | - |
| 9 | Check: Does the UE transmit UMD PDU#(2\*k+1) with 6 bit SN = k containing the first segment of RLC SDU#(k+1) (SI field = 01)? (Note 2) | --> | (RLC SDU#(k+1), first segment) | 2 | P |
| 10 | Check: Does the UE transmit UMD PDU#(2\*(k+1)) with 6 bit SN = k containing the last segment of RLC SDU#(k+1) (SI field = 10) and including SO field? (Note 2) | --> | (RLC SDU#(k+1), last segment) | 2 | P |
| 11 | The SS transmits UMD PDU#129 with 6 bit SN = 0 containing the first segment of RLC SDU#65 (SI field = 01). | <-- | UMD PDU#129 | - | - |
| 12 | The SS transmits UMD PDU#130 with 6 bit SN= 0 containing the last segment of RLC SDU#65 (SI field = 10) and including SO field | <-- | UMD PDU#130 | - | - |
| 13 | SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#65 in 2 RLC/MAC PDUs. (Note 1) | <-- | UL Grants | - | - |
| 14 | Check: Does the UE transmit UMD PDU#129 with 6 bit SN = 0 containing the first segment of RLC SDU#65 (SI field = 01)? | --> | (RLC SDU#65, first segment) | 3.4 | P |
| 15 | Check: Does the UE transmit UMD PDU#130 with 6 bit SN = 0 containing the last segment of RLC SDU#65 (SI field = 10) and including SO field? | --> | (RLC SDU#65, last segment) | 3,4 | P |
| Note 1: The RLC SDU size shall be 12 octets which are segmented into 6 and 6 octets. With 2 octets of MAC header, 2 octets of Short BSR and 1 octet of RLC header (without SO) the first segment consists of 88 bits and a TBS of this size shall be allocated. With 2 octets of MAC header and 3 octets of RLC header (with SO) the second segment consists of 88 bits and a TBS of this size shall be allocated. (LRBs & IMCS as per 38.523-3[3] annex B)  Note 2: The verdict shall be provided each time (SN+1) mod 16 = 0. | | | | | |

7.1.2.2.3.3.3 Specific message contents

None.

##### 7.1.2.2.4 UM RLC / 12-bit SN / Correct use of sequence numbering

7.1.2.2.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with UM RLC 12 bit SN }

**ensure that** {

**when** { UE transmits the first PDU which is segmented }

**then** { UE includes the SN field equal to 0 in each RLC segment }

}

(2)

**with** { UE in RRC\_CONNECTED state with UM RLC 12 bit SN }

**ensure that** {

**when** { UE transmit subsequent segmented PDUs }

**then** { UE includes the SN field incremented by 1 for each segmented PDU of one RLC SDU}

}

(3)

**with** { UE in RRC\_CONNECTED state with UM RLC 12 bit SN }

**ensure that** {

**when** { UE transmit segments belonging to more than 4096 SDUs }

**then** { UE wraps the SN after transmitting the segments of 4096 SDUs }

}

(4)

**with** { UE in RRC\_CONNECTED state with UM RLC 12 bit SN }

**ensure that** {

**when** { segments of more than 4096 SDUs are sent to UE }

**then** { UE accepts PDUs with SNs that wrap around every 4096 segmented SDUs }

}

7.1.2.2.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.322, clause 5.2.2.1.1, 5.2.2.2, 6.2.2.3, 6.2.3.3 and 7.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.2.2.1.1]

When submitting a UMD PDU to lower layer, the transmitting UM RLC entity shall:

- if the UMD PDU contains a segment of an RLC SDU, set the SN of the UMD PDU to TX\_Next;

- if the UMD PDU contains a segment that maps to the last byte of an RLC SDU, then increment TX\_Next by one.

[TS 38.322, clause 5.2.2.2]

The receiving UM RLC entity shall maintain a reassembly window according to state variable RX\_Next\_Highest as follows:

- a SN falls within the reassembly window if (RX\_Next\_Highest – UM\_Window\_Size) <= SN <RX\_Next\_Highest;

- a SN falls outside of the reassembly window otherwise.

When receiving an UMD PDU from lower layer, the receiving UM RLC entity shall:

- either deliver the UMD PDU after removing the RLC header, discard the received UMD PDU, or place it in the reception buffer (see sub clause 5.2.2.2.2);

- if the received UMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop *t-Reassembly* as needed (see sub clause 5.2.2.2.3).

…

When an UMD PDU is received from lower layer, the receiving UM RLC entity shall:

- if the UMD PDU header does not contain an SN:

- remove the RLC header and deliver the RLC SDU to upper layer.

- else if (RX\_Next\_Highest – UM\_Window\_Size) <= SN < RX\_Next\_Reassembly:

- discard the received UMD PDU.

- else:

- place the received UMD PDU in the reception buffer.

…

When an UMD PDU with SN = x is placed in the reception buffer, the receiving UM RLC entity shall:

- if all byte segments with SN = x are received:

- reassemble the RLC SDU from all byte segments with SN = x, remove RLC headers and deliver the reassembled RLC SDU to upper layer;

- if x = RX\_Next\_Reassembly:

- update RX\_Next\_Reassembly to the SN of the first SN > current RX\_Next\_Reassembly that has not been reassembled and delivered to upper layer.

- else if x falls outside of the reassembly window:

- update RX\_Next\_Highest to x + 1;

- discard any UMD PDUs with SN that falls outside of the reassembly window;

- if RX\_Next\_Reassembly falls outside of the reassembly window:

- set RX\_Next\_Reassembly to the SN of the first SN >= (RX\_Next\_Highest – UM\_Window\_Size) that has not been reassembled and delivered to upper layer.

[TS 38.322, clause 6.2.2.3]

An UM RLC entity is configured by RRC to use either a 6 bit SN or a 12 bit SN. An UMD PDU header contains the SN field only when the corresponding RLC SDU is segmented.

[TS 38.322, clause 6.2.3.3]

The SN field indicates the sequence number of the corresponding RLC SDU. … For RLC UM, the sequence number is incremented by one for every segmented RLC SDU.

[TS 38.322, clause 7.1]

All state variables and all counters are non-negative integers.

…

All state variables related to UM data transfer can take values from 0 to 63 for 6 bit SN or from 0 to 4095 for 12 bit SN. All arithmetic operations contained in the present document on state variables related to UM data transfer are affected by the UM modulus (i.e. final value = [value from arithmetic operation] modulo 64 for 6 bit SN and 4096 for 12 bit SN).

…

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables and constant:

b) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0.

c) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

d) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0.

7.1.2.2.4.3 Test description

7.1.2.2.4.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception for the UM DRB is configured according to Table 7.1.2.2.4.3.1-1.

Table 7.1.2.2.4.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink RLC sn-FieldLength | size12 |
| Downlink RLC sn-FieldLength | size12 |

7.1.2.2.4.3.2 Test procedure sequence

Table 7.1.2.2.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 1 | The SS transmits UMD PDU#1 with 12 bit SN = 0 containing the first segment of RLC SDU#1 (SI field = 01). | <-- | UMD PDU#1 | - | - |
| 2 | The SS transmits UMD PDU#2 with 12 bit SN=0 containing the last segment of RLC SDU#1 (SI field = 10) and including SO field | <-- | UMD PDU#2 | - | - |
| 3 | SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#1 in 2 RLC/MAC PDUs. (Note 1) | <-- | UL Grants | - | - |
| 4 | Check: Does the UE transmit UMD PDU#1 with 12 bit SN = 0 containing the first segment of RLC SDU#1 (SI field = 01)? | --> | (RLC SDU#1, first segment) | 1 | P |
| 5 | Check: Does the UE transmit UMD PDU#2 with 12 bit SN = 0 containing the last segment of RLC SDU#1 (SI field = 10)? | --> | (RLC SDU#1, last segment) | 1 | P |
| - | EXCEPTION: Steps 6 to 10 are executed 4095 times, the initial value of k = 1, it is incremented by one for each iteration. | - | - | - | - |
| 6 | The SS transmits UMD PDU#(2\*k+1) with 12 bit SN = k containing the first segment of RLC SDU#(k+1) (SI field = 01). | <-- | UMD PDU#(2\*k+1) | - | - |
| 7 | The SS transmits UMD PDU#(2\*(k+1)) with 12 bit SN=k containing the last segment of RLC SDU#(k+1) (SI field = 10) | <-- | UMD PDU#(2\*(k+1)) | - | - |
| 8 | SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#(k+1) in 2 RLC/MAC PDUs. (Note 1) | <-- | UL Grants | - | - |
| 9 | Check: Does the UE transmit UMD PDU#(2\*k+1) with 12 bit SN = k containing the first segment of RLC SDU#(k+1) (SI field = 01)? (Note 2) | --> | (RLC SDU#(k+1), first segment) | 2 | P |
| 10 | Check: Does the UE transmit UMD PDU#(2\*(k+1)) with 12 bit SN = k containing the last segment of RLC SDU#(k+1) (SI field = 10) and including SO field? (Note 2) | --> | (RLC SDU#(k+1), last segment) | 2 | P |
| 11 | The SS transmits UMD PDU#8193 with 12 bit SN = 0 containing the first segment of RLC SDU#4097 (SI field = 01). | <-- | UMD PDU#8193 | - | - |
| 12 | The SS transmits UMD PDU#8194 with 12 bit SN= 0 containing the last segment of RLC SDU#4097 (SI field = 10) and including SO field | <-- | UMD PDU#8194 | - | - |
| 13 | SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#4097 in 2 RLC/MAC PDUs. (Note 1) | <-- | UL Grants | - | - |
| 14 | Check: Does the UE transmit UMD PDU#8193 with 12 bit SN = 0 containing the first segment of RLC SDU#4097 (SI field = 01)? | --> | (RLC SDU#4097, first segment) | 3.4 | P |
| 15 | Check: Does the UE transmit UMD PDU#8194 with 12 bit SN = 0 containing the last segment of RLC SDU#4097 (SI field = 10) and including SO field? | --> | (RLC SDU#4097, last segment) | 3,4 | P |
| Note 1: The RLC SDU size shall be 10 octets which are segmented into 5 and 5 octets. With 2 octets of MAC header, 2 octets of Short BSR and 2 octets of RLC header (without SO) the first segment consists of 88 bits and a TBS of this size shall be allocated. With 2 octets of MAC header and 4 octets of RLC header (with SO) the second segment consists of 88 bits and a TBS of this size shall be allocated. (LRBs & IMCS as per 38.523-3[3] annex B)  Note 2: The verdict shall be provided each time (SN+1) mod 256 = 0. | | | | | |

7.1.2.2.4.3.3 Specific message contents

None.

##### 7.1.2.2.5 UM RLC / Receive Window operation and t-Reassembly expiry

7.1.2.2.5.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and using UM RLC }

**ensure that** {

**when** { UE receives a RLC PDU including SN and '(RX\_Next\_Highest – UM\_Window\_Size) <= SN < RX\_Next\_Highest }

**then** { UE discards any UMD PDUs with SN that falls outside of the reassembly window }

}

(2)

**with** { UE in RRC\_CONNECTED state and using UM RLC }

**ensure that** {

**when** { UE receives a RLC PDU including SN and '(RX\_Next\_Highest – UM\_Window\_Size) > SN or SN >= RX\_Next\_Reassembly' }

**then** { UE stores the PDU in receive buffer }

}

(3)

**with** { UE in RRC\_CONNECTED state and using UM RLC }

**ensure that** {

**when** { UE places a RLC PDU including SN into the reception buffer and all byte segments with that SN are received }

**then** { UE delivers the reassembled SDU to upper layers }

}

(4)

**with** { UE in RRC\_CONNECTED state and using UM RLC }

**ensure that** {

**when** { t-Reassembly expires }

**then** { UE updates RX\_Next\_Reassembly and discards all segments with SN < updated RX\_Next\_Reassembly }

}

7.1.2.2.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.2.2.2.1, 5.2.2.2.2, 5.2.2.2.3, 5.2.2.2.4 and 7.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.2.2.2.1]

The receiving UM RLC entity shall maintain a reassembly window according to state variable RX\_Next\_Highest as follows:

- a SN falls within the reassembly window if (RX\_Next\_Highest – UM\_Window\_Size) <= SN <RX\_Next\_Highest;

- a SN falls outside of the reassembly window otherwise.

When receiving an UMD PDU from lower layer, the receiving UM RLC entity shall:

- either deliver the UMD PDU to upper layer after removing the RLC header, discard the received UMD PDU, or place it in the reception buffer (see sub clause 5.2.2.2.2);

- if the received UMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop *t-Reassembly* as needed (see sub clause 5.2.2.2.3).

When *t-Reassembly* expires, the receiving UM RLC entity shall:

- update state variables, discard RLC SDU segments and start *t-Reassembly* as needed (see sub clause 5.2.2.2.4).

[TS 38.322, clause 5.2.2.2.2]

When an UMD PDU is received from lower layer, the receiving UM RLC entity shall:

- if the UMD PDU header does not contain an SN:

- remove the RLC header and deliver the RLC SDU to upper layer.

- else if (RX\_Next\_Highest – UM\_Window\_Size) <= SN < RX\_Next\_Reassembly:

- discard the received UMD PDU.

- else:

- place the received UMD PDU in the reception buffer.

[TS 38.322, clause 5.2.2.2.3]

When an UMD PDU with SN = x is placed in the reception buffer, the receiving UM RLC entity shall:

- if all byte segments with SN = x are received:

- reassemble the RLC SDU from all byte segments with SN = x, remove RLC headers and deliver the reassembled RLC SDU to upper layer;

- if x = RX\_Next\_Reassembly:

- update RX\_Next\_Reassembly to the SN of the first SN > current RX\_Next\_Reassembly that has not been reassembled and delivered to upper layer.

- else if x falls outside of the reassembly window:

- update RX\_Next\_Highest to x + 1;

- discard any UMD PDUs with SN that falls outside of the reassembly window;

- if RX\_Next\_Reassembly falls outside of the reassembly window:

- set RX\_Next\_Reassembly to the SN of the first SN >= (RX\_Next\_Highest – UM\_Window\_Size) that has not been reassembled and delivered to upper layer.

- if *t-Reassembly* is running:

- if RX\_Timer\_Trigger <= RX\_Next\_Reassembly; or

- if RX\_Timer\_Trigger falls outside of the reassembly window and RX\_Timer\_Trigger is not equal to RX\_Next\_Highest; or

- if RX\_Next\_Highest = RX\_Next\_Reassembly + 1 and there is no missing byte segment of the RLC SDU associated with SN = RX\_Next\_Reassembly before the last byte of all received segments of this RLC SDU:

- stop and reset *t-Reassembly*.

- if *t-Reassembly* is not running (includes the case when *t-Reassembly* is stopped due to actions above):

- if RX\_Next\_Highest > RX\_Next\_Reassembly + 1; or

- if RX\_Next\_Highest = RX\_Next\_Reassembly + 1 and there is at least one missing byte segment of the RLC SDU associated with SN = RX\_Next\_Reassembly before the last byte of all received segments of this RLC SDU:

- start t-Reassembly;

- set RX\_Timer\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 5.2.2.2.4]

When *t-Reassembly* expires, the receiving UM RLC entity shall:

- update RX\_Next\_Reassembly to the SN of the first SN >= RX\_Timer\_Trigger that has not been reassembled;

- discard all segments with SN < updated RX\_Next\_Reassembly;

- if RX\_Next\_Highest > RX\_Next\_Reassembly + 1; or

- if RX\_Next\_Highest = RX\_Next\_Reassembly + 1 and there is at least one missing byte segment of the RLC SDU associated with SN = RX\_Next\_Reassembly before the last byte of all received segments of this RLC SDU:

- start t-Reassembly;

- set RX\_Timer\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 5.2.2.2.4]

This sub clause describes the state variables used in AM and UM entities in order to specify the RLC protocol. The state variables defined in this subclause are normative.

All state variables and all counters are non-negative integers.

...

All state variables related to UM data transfer can take values from 0 to 63 for 6 bit SN or from 0 to 4095 for 12 bit SN. All arithmetic operations contained in the present document on state variables related to UM data transfer are affected by the UM modulus (i.e. final value = [value from arithmetic operation] modulo 64 for 6 bit SN and 4096 for 12 bit SN).

When performing arithmetic comparisons of state variables or SN values, a modulus base shall be used.

...

RX\_Next\_Highest– UM\_Window\_Size shall be assumed as the modulus base at the receiving side of an UM RLC entity. This modulus base is subtracted from all the values involved, and then an absolute comparison is performed (e.g. (RX\_Next\_Highest– UM\_Window\_Size) <= SN < RX\_Next\_Highest is evaluated as [(RX\_Next\_Highest– UM\_Window\_Size) – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] <= [SN – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] < [RX\_Next\_Highest– (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*]), where *sn-FieldLength* is 6 or 12 for 6 bit SN and 12 bit SN, respectively.

...

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables and constant:

b) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0.

c) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

d) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0.

7.1.2.2.5.3 Test description

7.1.2.2.5.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception that the UM DRB is configured according to Table 7.1.2.2.5.3.1-1.

Table 7.1.2.2.5.3.1-1: RLC parameters

|  |  |
| --- | --- |
| t-Reassembly | ms200 |
| Uplink UM RLC sn-FieldLength | IF (pc\_um\_WithShortSN ) size6  ELSE size12 |
| Downlink UM RLC sn-FieldLength | F (pc\_um\_WithShortSN ) size6  ELSE size12 |

Table 7.1.2.2.5.3.1-2: PDCP Settings

|  |  |
| --- | --- |
| Parameter | Value |
| t-Reordering | ms30 |

7.1.2.2.5.3.2 Test procedure sequence

Table 7.1.2.2.5.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0 | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 1 | The SS transmits UMD PDU#1 containing first segment of RLC SDU#1, SN=0. | <-- | UMD PDU#1 | - | - |
| 2 | 20 ms after step 1 the SS transmits UMD PDU#3 containing first segment of RLC SDU#2, SN=1. | <-- | UMD PDU#3 | - | - |
| 3 | 40 ms after step 1 the SS transmits UMD PDU#4 containing last segment of RLC SDU#2, SN=1. | <-- | UMD PDU#4 | - | - |
| 3A | 60 ms after step 1 the SS transmits UMD PDU#9 containing first segment of RLC SDU#5, SN=w | <-- | UMD PDU#9 | - | - |
| 3B | 80 ms after step 1 the SS transmits UMD PDU#10 containing last segment of RLC SDU#5, SN=w | <-- | UMD PDU#10 | - | - |
| 3C | 100 ms after step 1 the SS assigns 2 UL grants (UL grant allocation type 2) with a time spacing of 20 ms so as to loop back RLC SDU#2. | - | - | - | - |
| 4 | Check: Does the UE transmit RLC SDU#2? (Note 3) | --> | (RLC SDU#2) | 2,3 | P |
| 4A | Check: Does the UE transmit RLC SDU#5? (Note 4) | --> | (RLC SDU#5) | 2,3 | P |
| 5 | 160 ms after step 1 the SS transmits UMD PDU#2 last segment of RLC SDU#1, SN=0. | <-- | UMD PDU#2 | - | - |
| 5A | The SS starts the UL default grant transmissions. | - | - | - | - |
| 6 | Check: For 1 sec after step 5, does the UE transmit RLC SDU#1, SN=0? (Note 6) | --> | (RLC SDU#1) | 1 | F |
| 6A |  | - | - | - | - |
| 7 | The SS transmits UMD PDU#5 containing first segment of RLC SDU#3, SN=5. | <-- | UMD PDU#5 | - | - |
| 8 | Wait for 200 ms to ensure that *t-* Reassembly for the UMD PDU#5 expires. | - | - | - | - |
| 9 | The SS transmits UMD PDU#6 containing last segment of RLC SDU#3, SN=5 (Note 7). | <-- | UMD PDU#6 | - | - |
| 10 | Check: For 1 sec after step 9, does the UE transmit RLC SDU#3? (Note 7) | --> | (RLC SDU#3) | 4 | F |
| 11 | The SS transmits UMD PDU#7 containing first segment of RLC SDU#6, SN=8. | <-- | UMD PDU#7 | - | - |
| 12 | The SS transmits UMD PDU#8 containing last segment of RLC SDU#6, SN=8. | <-- | UMD PDU#8 | - | - |
| 13 | Check: Does the UE transmit RLC SDU#6? (Note 5) | --> | (RLC SDU#6) | 2,3 | P |
| Note 1: The RLC SDU size shall be 12 octets which are segmented into 7 and 5 octets.  Note 2: UL grant of 144 bits(LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU at a time( 12 bytes RLC SDU + 1 or 2 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 or 3 bytes for short BSR and/or padding).  Note 3: The UE transmits the looped back PDCP data of RLC SDU#2 in a PDCP PDU with PDCP SN=0.  Note 4: The UE transmits the looped back PDCP data of RLC SDU#5 in a PDCP PDU with PDCP SN=1.  Note 5: The UE transmits the looped back PDCP data of RLC SDU#6 in a PDCP PDU with PDCP SN=2.  Note 6: The UE transmits the looped back PDCP data of RLC SDU#1 in a PDCP PDU with PDCP SN=2.  Note 7: The UE transmits the looped back PDCP data of RLC SDU#3 in a PDCP PDU with PDCP SN=2. | | | | | |

7.1.2.2.5.3.3 Specific message contents

None

##### 7.1.2.2.5a UM RLC / NR NTN / t-Reassembly expiry / t-ReassemblyExt-r17 configured

7.1.2.2.5a.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state on a cell which provides access by NR NTN and using UM RLC }

**ensure that** {

**when** { t-ReassemblyExt-r17 is configured }

**then** { UE ignores value signalled in t-Reassembly and updates RX\_Next\_Reassembly and discards all segments with SN < updated RX\_Next\_Reassembly after the expiry of t-ReassemblyExt-r17 }

}

7.1.2.2.5a.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.2.2.2.1, 5.2.2.2.3, 5.2.2.2.4, 7.1 and TS 38.331, clause 6.3.2. Unless otherwise stated these are Rel-17 requirements.

[TS 38.322, clause 5.2.2.2.1]

The receiving UM RLC entity shall maintain a reassembly window according to state variable RX\_Next\_Highest as follows:

- a SN falls within the reassembly window if (RX\_Next\_Highest – UM\_Window\_Size) <= SN <RX\_Next\_Highest;

- a SN falls outside of the reassembly window otherwise.

When receiving an UMD PDU from lower layer, the receiving UM RLC entity shall:

- either deliver the UMD PDU to upper layer after removing the RLC header, discard the received UMD PDU, or place it in the reception buffer (see clause 5.2.2.2.2);

- if the received UMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop *t-Reassembly* as needed (see clause 5.2.2.2.3).

When *t-Reassembly* expires, the receiving UM RLC entity shall:

- update state variables, discard RLC SDU segments and start *t-Reassembly* as needed (see clause 5.2.2.2.4).

[TS 38.322, clause 5.2.2.2.3]

When an UMD PDU with SN = x is placed in the reception buffer, the receiving UM RLC entity shall:

- if all byte segments with SN = x are received:

- reassemble the RLC SDU from all byte segments with SN = x, remove RLC headers and deliver the reassembled RLC SDU to upper layer;

- if x = RX\_Next\_Reassembly:

- update RX\_Next\_Reassembly to the SN of the first SN > current RX\_Next\_Reassembly that has not been reassembled and delivered to upper layer.

- else if x falls outside of the reassembly window:

- update RX\_Next\_Highest to x + 1;

- discard any UMD PDUs with SN that falls outside of the reassembly window;

- if RX\_Next\_Reassembly falls outside of the reassembly window:

- set RX\_Next\_Reassembly to the SN of the first SN >= (RX\_Next\_Highest – UM\_Window\_Size) that has not been reassembled and delivered to upper layer.

- if *t-Reassembly* is running:

- if RX\_Timer\_Trigger <= RX\_Next\_Reassembly; or

- if RX\_Timer\_Trigger falls outside of the reassembly window and RX\_Timer\_Trigger is not equal to RX\_Next\_Highest; or

- if RX\_Next\_Highest = RX\_Next\_Reassembly + 1 and there is no missing byte segment of the RLC SDU associated with SN = RX\_Next\_Reassembly before the last byte of all received segments of this RLC SDU:

- stop and reset *t-Reassembly*.

- if *t-Reassembly* is not running (includes the case when *t-Reassembly* is stopped due to actions above):

- if RX\_Next\_Highest > RX\_Next\_Reassembly + 1; or

- if RX\_Next\_Highest = RX\_Next\_Reassembly + 1 and there is at least one missing byte segment of the RLC SDU associated with SN = RX\_Next\_Reassembly before the last byte of all received segments of this RLC SDU:

- start *t-Reassembly*;

- set RX\_Timer\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 5.2.2.2.4]

When *t-Reassembly* expires, the receiving UM RLC entity shall:

- update RX\_Next\_Reassembly to the SN of the first SN >= RX\_Timer\_Trigger that has not been reassembled;

- discard all segments with SN < updated RX\_Next\_Reassembly;

- if RX\_Next\_Highest > RX\_Next\_Reassembly + 1; or

- if RX\_Next\_Highest = RX\_Next\_Reassembly + 1 and there is at least one missing byte segment of the RLC SDU associated with SN = RX\_Next\_Reassembly before the last byte of all received segments of this RLC SDU:

- start t-Reassembly;

- set RX\_Timer\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 7.1]

This clause describes the state variables used in AM and UM entities in order to specify the RLC protocol. The state variables defined in this clause are normative.

All state variables and all counters are non-negative integers.

…

All state variables related to UM data transfer can take values from 0 to 63 for 6 bit SN or from 0 to 4095 for 12 bit SN. All arithmetic operations contained in the present document on state variables related to UM data transfer are affected by the UM modulus (i.e. final value = [value from arithmetic operation] modulo 64 for 6 bit SN and 4096 for 12 bit SN).

When performing arithmetic comparisons of state variables or SN values, a modulus base shall be used.

…

RX\_Next\_Highest– UM\_Window\_Size shall be assumed as the modulus base at the receiving UM RLC entity. This modulus base is subtracted from all the values involved, and then an absolute comparison is performed (e.g. (RX\_Next\_Highest– UM\_Window\_Size) <= SN < RX\_Next\_Highest is evaluated as [(RX\_Next\_Highest– UM\_Window\_Size) – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] <= [SN – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] < [RX\_Next\_Highest– (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*]), where *sn-FieldLength* is 6 or 12 for 6 bit SN and 12 bit SN, respectively.

…

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next – UM send state variable

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables:

a) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0. For groupcast and broadcast of NR sidelink communication or for SL-SRB4 of NR sidelink discovery, it is initially set to the SN of the first received UMD PDU containing an SN. For the receiving UM RLC entity configured for MCCH or MTCH, it is up to UE implementation to set the initial value of RX\_Next\_Reassembly to a value before RX\_Next\_Highest.

b) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

c) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0. For groupcast and broadcast of NR sidelink communication or for SL-SRB4 of NR sidelink discovery, it is initially set to the SN of the first received UMD PDU containing an SN. For the receiving UM RLC entity configured for MCCH or MTCH, it is initially set to the SN of the first received UMD PDU containing an SN.

[TS 38.331, clause 6.3.2]

***t-Reassembly, t-ReassemblyExt***

Timer for reassembly in TS 38.322 [4], in milliseconds. Value *ms0* means 0 ms, value *ms5* means 5 ms and so on. If *t-ReassemblyExt-r17* is configured, the UE shall ignore *t-Reassembly* (without suffix).

7.1.2.2.5a.3 Test description

7.1.2.2.5a.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception that the UM DRB is configured according to Table 7.1.2.2.5a.3.1-1.

Table 7.1.2.2.5a.3.1-1: RLC parameters

|  |  |
| --- | --- |
| t-Reassembly | ms200 |
| t-ReassemblyExt-r17 | ms1100 |
| Uplink UM RLC sn-FieldLength | IF (pc\_um\_WithShortSN ) size6  ELSE size12 |
| Downlink UM RLC sn-FieldLength | F (pc\_um\_WithShortSN ) size6  ELSE size12 |

System Simulator:

- NR Cell 1 as specified in TS 38.508-1 [4] Table 4.4.2.1.

- System information combination NR-28 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used.

UE:

- The pre-configured UE location is defined in TS 38.508-1 [4] Clause 4.5C.

7.1.2.2.5a.3.2 Test procedure sequence

Table 7.1.2.2.5a.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits UMD PDU#1 containing first segment of RLC SDU#1, SN=0. | <-- | UMD PDU#1 | - | - |
| 2 | Wait for 200 ms to ensure that *t-Reassembly* for the UMD PDU#1 expires. | - | - | - | - |
| 3 | The SS transmits UMD PDU#2 containing last segment of RLC SDU#1, SN=0. | <-- | UMD PDU#2 | - | - |
| 4 | Check: For 1 sec after step 3, does the UE transmit RLC SDU#1? (Note 3) | --> | (RLC SDU#1) | 1 | P |
| 5 | The SS transmits UMD PDU#3 containing first segment of RLC SDU#2, SN=1. | <-- | UMD PDU#3 | - | - |
| 6 | Wait for 1100 ms to ensure that *t-ReassemblyExt-r17* for the UMD PDU#2 expires. | - | - | - | - |
| 7 | The SS transmits UMD PDU#4 containing last segment of RLC SDU#2, SN=1. | <-- | UMD PDU#4 | - | - |
| 8 | Check: For 1 sec after step 7, does the UE transmit RLC SDU#2? (Note 3) | --> | (RLC SDU#2) | 1 | F |
| Note 1: The RLC SDU size shall be 12 octets which are segmented into 7 and 5 octets.  Note 2: UL grant of 144 bits(LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU at a time( 12 bytes RLC SDU + 1 or 2 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 or 3 bytes for short BSR and/or padding).  Note 3: The wait time of 1 sec is chosen to be greater than the propagation delay.. | | | | | |

7.1.2.2.5a.3.3 Specific message contents

Table 7.1.2.2.5a.3.3-1: *RLC-Config* (Preamble and all steps)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-149 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-Config ::= SEQUENCE { |  |  |  |
| um-Bi-Directional SEQUENCE { |  |  |  |
| dl-UM-RLC SEQUENCE { |  |  |  |
| t-Reassembly | ms200 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.2.2.5a.3.3-2: *RLC-BearerConfig* (Preamble and all steps)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-148 | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-Config-v1700 ::= SEQUENCE { |  |  |  |
| DL-UM-RLC-v1700 SEQUENCE { |  |  |  |
| t-ReassemblyExt-r17 | ms1100 |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.2.2.6 UM RLC / RLC re-establishment procedure

7.1.2.2.6.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and using UM RLC }

**ensure that** {

**when** { RLC re-establishment is performed upon request by RRC }

**then** { The UE discards all UMD PDUs where no RLC SDUs can be reassembled }

}

(2)

**with** { UE in RRC\_CONNECTED state and using UM RLC }

**ensure that** {

**when** { RLC re-establishment is performed upon request by RRC }

**then** { The UE resets variables TX\_Next, RX\_Next\_Reassembly, and RX\_Next\_Highest to their initial value of 0 }

}

7.1.2.2.6.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.1.2 and 7.1, TS 38.331 clause 5.3.5.5.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.1.2]

When upper layers request an RLC entity re-establishment, the UE shall:

- discard all RLC SDUs, RLC SDU segments, and RLC PDUs, if any;

- stop and reset all timers;

- reset all state variables to their initial values.

[TS 38.322, clause 7.1]

d) RX\_Next\_Highest – Highest received state variable

This state variable holds the value of the SN following the SN of the RLC SDU with the highest SN among received RLC SDUs. It is initially set to 0.

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables and constant:

b) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0.

c) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

d) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0.

[TS 38.331, clause 5.3.5.5.4]

For each *RLC-Bearer-Config* received in the *rlc-BearerToAddModList* IE the UE shall:

1> if the UE’s current configuration contains a RLC bearer with the received *logicalChannelIdentity*:

2> if *reestablishRLC* is received:

3> re-establish the RLC entity as specified in TS 38.322 [4];

2> reconfigure the RLC entity or entities in accordance with the received *rlc-Config*;

2> reconfigure the logical channel in accordance with the received *mac-LogicalChannelConfig*;

NOTE: The network does not re-associate an already configured logical channel with another radio bearer. Hence *servedRadioBearer* is not present in this case.

7.1.2.2.6.3 Test description

7.1.2.2.6.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.2 with the exception that the UM DRB is configured according to Table 7.1.2.2.6.3.1-1.

Table 7.1.2.2.6.3.1-1: RLC parameters

|  |  |
| --- | --- |
| t-Reassembly | ms200 |
| Uplink UM RLC sn-FieldLength | IF (pc\_um\_WithShortSN ) size6  ELSE size12 |
| Downlink UM RLC sn-FieldLength | IF (pc\_um\_WithShortSN ) size6  ELSE size12 |

7.1.2.2.6.3.2 Test procedure sequence

Table 7.1.2.2.6.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits UMD PDU#1. Header of UMD PDU#1 does not contain an SN. This PDU carries RLC SDU#1. | <-- | UMD PDU#1 | - | - |
| 2 | The UE transmits RLC SDU#1. | --> | (RLC SDU#1) | - | - |
| 3 | The SS transmits UMD PDU#2. Header of UMD PDU#2 contains SN=0. This PDU carries the first segment of SDU#2. | <-- | UMD PDU#2 | - | - |
| 4 | The SS transmits NR *RRCR*econfiguration message to trigger RLC re-establishment on DRB using Reconfig with sync procedure.  (Note 3)(Note 5) | <-- | *RRCReconfiguration* | - | - |
| 4A | The UE transmits a NR *RRCReconfigurationcomplete* message.  (Note 4) | --> | *RRCReconfigurationComplete* | - | - |
| 5 | 100 ms after step 4A the SS transmits UMD PDU#3. Header of UMD PDU#3 contains SN=0. This PDU carries the last segment of RLC SDU#2. The UE starts t-Reassembly. | <-- | UMD PDU#3 | - | - |
| 6 | Check: For 250 ms after step 5 does the UE transmit RLC SDU#2? | --> | (RLC SDU#2) | 1 | F |
| 6A | The SS stops allocating any UL grant. |  |  |  |  |
| 7 | 300 ms (1.5 \* t- Reassembly) after step 5 the SS transmits UMD PDU#4. This PDU carries the first segment of RLC SDU#3.SN=1. | <-- | UMD PDU#4 | - | - |
| 8 | 20 ms after step 7 the SS transmits UMD PDU#5. This PDU carries the second and last segment of RLC SDU#3.SN=1. | <-- | UMD PDU#5 | - | - |
| 8A | 20 ms after step 8 the SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#3 in 2 RLC/MAC PDUs. Note 1 & 2 | - | - | - | - |
| 9 | Check: Does the UE transmit first segment of RLC SDU#3? Header of UMD PDU contains SN=0. | --> | (RLC SDU#3 first segment) | 2 | P |
| 10 | Check: Does the UE transmit second and last segment of RLC SDU#3? Header of UMD PDU contains SN=0. | --> | (RLC SDU#3 last segment) | 2 | P |
| 10A | The SS starts the UL default grant transmissions |  |  |  |  |
| 11 | The SS transmits NR *RRCR*econfiguration message to trigger RLC re-establishment on DRB using Reconfig with sync procedure.  (Note 3) | <-- | *RRCReconfiguration* | - | - |
| 11A | The UE transmits a NR *RRCReconfigurationcomplete* message.  (Note 4) | --> | *RRCReconfigurationComplete* | - | - |
| 11B | The SS stops allocating any UL grant. |  |  |  |  |
| 12 | After 100 ms the SS transmits UMD PDU#6. Header of UMD PDU#6 contains SN=0. This PDU carries the first segment of SDU#4. | <-- | UMD PDU#6 | - | - |
| 13 | 20 ms after step 12 the SS transmits UMD PDU#7. Header of UMD PDU#6 contains SN=0. This PDU carries the secondsegment of SDU#4. | <-- | UMD PDU#7 | - | - |
| 13A | 20 ms after step 13 the SS allocates 2 UL grants at an interval of 20 ms so as to loop back RLC SDU#4 in 2 RLC/MAC PDUs. Note 1 & 2 | - | - | - | - |
| 14 | Check: Does the UE transmit first segment of RLC SDU#4? Header of UMD PDU contains SN=0. | --> | (RLC SDU#4 first segment) | 2 | P |
| 15 | Check: Does the UE transmit second and last segment of RLC SDU#4? Header of UMD PDU contains SN=0. | --> | (RLC SDU#4 last segment) | 2 | P |
| Note 1: For SN size = size6 the RLC SDU size shall be 12 octets which are segmented into 6 and 6 octets. With 2 octets of MAC BSR and 2 octets of MAC header and 1 octet of RLC header (without SO) the first segment consists of 88 bits and a TBS of this size shall be allocated. With 2 octets of MAC header and 3 octets of RLC header (with SO) the second segment consists of 88 bits and a TBS of this size shall be allocated. (LRBs & IMCS as per 38.523-3[3] annex B)  Note 2: For SN size = size12 the RLC SDU size shall be 10 octets which are segmented into 5 and 5 octets. With 2 octets of MAC BSR and 2 octets of MAC header and 2 octets of RLC header (without SO) the first segment consists of 88 bits and a TBS of this size shall be allocated. With 2 octets of MAC header and 4 octets of RLC header (with SO) the second segment consists of 88 bits and a TBS of this size shall be allocated. (LRBs & IMCS as per 38.523-3[3] annex B)  Note 3: For EN-DC, the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration as defined in Table 7.1.2.2.6.3.3-2  Note 4: For EN-DC, the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete. | | | | | |

7.1.2.2.6.3.3 Specific message contents

Table 7.1.2.2.6.3.3-1: *RRCReconfiguration* for NR (steps 4, 11, Table 7.1.2.2.6.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig | According to Table 7.1.2.2.6.3.3-1A |  |
| } |  |  |  |
| nonCriticalExtension::= SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | According to Table 7.1.2.2.6.3.3-1B |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.2.2.6.3.3-1A: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | n entries | n is equal to the total number of DRBs established during preamble |  |
| DRB-ToAddMod[k=1..n] SEQUENCE { |  | entry (1..n) |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config | According to TS 38.508-1, Table 4.6.3-161 |  |
| } |  |  |  |
| drb-Identity | k | k=1..n |  |
| reestablishPDCP | Not present |  |  |
| recoverPDCP | Not present |  |  |
| pdcp-Config | PDCP-Config | According to TS 38.508-1, Table 4.6.3-99 |  |
| } |  |  |  |
| / } |  |  |  |
| } |  |  |  |

Table 7.1.2.2.6.3.3-1B: CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 with condition PCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 2+n entries | n is equal to the total number of DRBs established during preamble |  |
| RLC-BearerConfig[1] | RLC-BearerConfig with conditions SRB1 and Re-establish\_RLC | entry 1 |  |
| RLC-BearerConfig[2] | RLC-BearerConfig with conditions SRB2 and Re-establish\_RLC | entry 2 |  |
| RLC-BearerConfig[3] | RLC-BearerConfig with conditions UM, DRB1 and Re-establish\_RLC | entry 3 |  |
| RLC-BearerConfig[k+2, k=2..n] | RLC-BearerConfig with conditions AM, DRBk and Re-establish\_RLC | entry [k+2, k=2..n] | n>1 |
| } |  |  |  |

Table 7.1.2.2.6.3.3-2: *RRCConnectionReconfiguration for EN-DC* (steps 4, 11 Table 7.1.2.2.6.3.2-1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Derivation Path: 36.508 Table 4.6.1-8 | | | | | | |
| Information Element | | | Value/remark | | Comment | | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { | | |  | |  | |  |
| criticalExtensions CHOICE { | | |  | |  | |  |
| c1 CHOICE{ | | |  | |  | |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE  { | | |  | |  | |  |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nr-Config-r15 CHOICE { |  | |  | |  | |
| nr-SecondaryCellGroupConfig-r15 | OCTET STRING including the RRCReconfiguration message and the IE secondaryCellGroup according to TS 38.508-1 [67], table 4.6.1-13 with condition EN-DC\_HO | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [67], table 4.6.3-132 with conditions EN-DC\_DRB | |  | |  | |
| } |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |

#### 7.1.2.3 RLC Acknowledged Mode

##### 7.1.2.3.1 AM RLC / 12-bit SN / Segmentation and reassembly / Segmentation Info (SI) field

7.1.2.3.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 12 bit SN configured AMD PDU containing a SI field set to 00 }

**then** { UE correctly decodes the received AMD PDU }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 12 bit SN configured AMD PDU containing a SI field set to 01 }

**then** { UE correctly decodes the received AMD PDU }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 12 bit SN configured AMD PDU containing a SI field set to 11 and SO field }

**then** { UE correctly decodes the received AMD PDU }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 12 bit SN configured AMD PDU containing a SI field set to 10 and SO field }

**then** { UE correctly decodes the received AMD PDU }

}

(5)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send complete PDU }

**then** { UE transmits AMD PDU containing a complete AMD SDU and SI field set to 00 }

}

(6)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send first segment only }

**then** { UE transmits AMD PDU containing first segment of AMD SDU and SI field set to 01 }

}

(7)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send middle segment only }

**then** { UE transmits AMD PDU containing middle segment of AMD SDU and SI field set to 11, including SO field }

}

(8)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send last segment only }

**then** { UE transmits AMD PDU containing last segment of AMD SDU and SI field set to 10, including SO field }

}

7.1.2.3.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 6.2.2.4 and 6.2.3.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 6.2.2.4]

AMD PDU consists of a Data field and an AMD PDU header. The AMD PDU header is byte aligned.

An AM RLC entity is configured by RRC to use either a 12 bit SN or a 18 bit SN. The length of the AMD PDU header is two and three bytes respectively.

An AMD PDU header contains a D/C, a P, a SI, and a SN. An AMD PDU header contains the SO field only when the Data field consists of an RLC SDU segment which is not the first segment, in which case a 16 bit SO is present.



Figure 6.2.2.4-1: AMD PDU with 12 bit SN (No SO)



Figure 6.2.2.4-2: AMD PDU with 18 bit SN (No SO)



Figure 6.2.2.4-3: AMD PDU with 12 bit SN with SO



Figure 6.2.2.4-4: AMD PDU with 18 bit SN with SO

[TS 38.322, clause 6.2.3.4]

Length: 2 bits.

The SI field indicates whether an RLC PDU contains a complete RLC SDU or the first, middle, last segment of an RLC SDU.

Table 6.2.3.4-1: SI field interpretation

|  |  |
| --- | --- |
| Value | Description |
| 00 | Data field contains all bytes of an RLC SDU |
| 01 | Data field contains the first segment of an RLC SDU |
| 10 | Data field contains the last segment of an RLC SDU |
| 11 | Data field contains neither the first nor last segment of an RLC SDU |

7.1.2.3.1.3 Test description

7.1.2.3.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.1.3.1-1.

Table 7.1.2.3.1.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink SN-FieldLength-AM | size12 |
| Downlink SN-FieldLength-AM | size12 |

7.1.2.3.1.3.2 Test procedure sequence

Table 7.1.2.3.1.3.2-1: Main behaviour

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict | |
|  |  | U - S | Message |  |  | |
| 0 | The SS stops allocating any UL grant. | - | - | - | - |
| 1 | The SS transmits AMD PDU#1 containing a complete RLC SDU#1 (SI field = 00). | <-- | AMD PDU#1 | - | - | |
| 1A | 60 ms after Step1, SS allocates an UL grant sufficient to loop back RLC SDU#1 in one RLC/MAC PDU | <-- | UL Grant | - | - |
| 2 | Check: Does the UE transmit AMD PDU#1 containing a complete RLC SDU#1 (SI field = 00)? | --> | (RLC SDU#1) | 1,5 | P | |
| 3 | The SS transmits a STATUS PDU. | <-- | STATUS PDU (ACK SN=1) | - | - | |
| 4 | The SS transmits AMD PDU#2 containing the first segment of RLC SDU#2 (SI field = 01). Note 3 | <-- | AMD PDU#2 | - | - | |
| 5 | The SS transmits AMD PDU#3 containing the second segment of RLC SDU#2 (SI field = 11) and including SO field. Note 3 | <-- | AMD PDU#3 | - | - | |
| 6 | The SS transmits AMD PDU#4 containing the last segment of RLC SDU#2 (SI field = 10) and including SO field. Note 3 | <-- | AMD PDU#4 | - | - | |
| 6A | SS allocates 3 UL grants at an interval of 20 ms so as to loop back RLC SDU#2 in 3 RLC/MAC PDUs. (Note 1 and Note 2) | <-- | UL Grants | - | - | |
| 7 | Check: Does the UE transmit AMD PDU#2 containing the first segment of RLC SDU#2 (SI field = 01)? | --> | (RLC SDU#2) | 2,3,4,6 | P | |
| 8 | Check: Does the UE transmit AMD PDU#3 containing the middle segment of RLC SDU#2 (SI field = 11) and including SO field? | --> | (RLC SDU#2) | 2,3,4,7 | P | |
| 9 | Check: Does the UE transmit AMD PDU#4 containing the last segment of RLC SDU#2 (SI field = 10) and including SO field? | --> | (RLC SDU#2) | 2,3,4,8 | P | |
| 10 | The SS transmits a STATUS PDU. | <-- | STATUS PDU (ACK SN=2) | - | - | |
| Note 1: The UL grants for step 7,8,9 are sufficiently small (240 bits, LRBs & IMCS as per 38.523-3[3] annex B) that UE transmits RLC SDU#2 in 3 UL RLC PDUs by segmenting.  Note 2: The RLC PDU containing a segment shall be of size 208 bits resp. 224 bits and a MAC sub PDU header of 16 bits and a 16-bit MAC BSR CE included in step 8 resulting in a MAC PDU of size 240 bits.  Note 3: The data part in step 4 first segment not including SO is 192 bits (24 bytes). Step 5, second segment SO=24 and data is 192 bits (24 bytes). Step 6, third segment SO=24+24=48 and data is 192 bits (24 bytes). | | | | | | |

7.1.2.3.1.3.3 Specific message contents

None

##### 7.1.2.3.2 AM RLC / 18-bit SN / Segmentation and reassembly / Segmentation Info (SI) field

7.1.2.3.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 18 bit SN configured AMD PDU containing a SI field set to 00 }

**then** { UE correctly decodes the received AMD PDU or AMD PDU segment }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 18 bit SN configured AMD PDU containing a SI field set to 01 }

**then** { UE correctly decodes the received AMD PDU or AMD PDU segment }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 18 bit SN configured AMD PDU containing a SI field set to 11 and SO field }

**then** { UE correctly decodes the received AMD PDU or AMD PDU segment }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a 18 bit SN configured AMD PDU containing a SI field set to 10 and SO field }

**then** { UE correctly decodes the received AMD PDU or AMD PDU segment }

}

(5)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send complete PDU }

**then** { UE transmits AMD PDU containing a complete AMD SDU and SI field set to 00 }

}

(6)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send first segment only }

**then** { UE transmits AMD PDU containing first segment of AMD SDU and SI field set to 01 }

}

(7)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send middle segment only }

**then** { UE transmits AMD PDU containing middle segment of AMD SDU and SI field set to 11, including SO field }

}

(8)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE has UL RLC SDU to send and the UL Grant is sufficient to send last segment only }

**then** { UE transmits AMD PDU containing last segment of AMD SDU and SI field set to 10, including SO field }

}

7.1.2.3.2.2 Conformance requirements

Same conformance requirements as in clause 7.1.2.3.1.2

7.1.2.3.2.3 Test description

7.1.2.3.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.2.3.1-1.

Table 7.1.2.3.2.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink SN-FieldLength-AM | size18 |
| Downlink SN-FieldLength-AM | size18 |

7.1.2.3.2.3.2 Test procedure sequence

Same test procedure as in clause 7.1.2.3.1.3.2 except that SN is 18 bit and the data part in step 4 first segment not including SO is 184 bits (23 Bytes). Step 5, second segment SO=23 and data is 184 bits (23 bytes). Step 6, third segment SO=23+23=46 and data is 184 bits (23 bytes).

7.1.2.3.2.3.3 Specific message contents

None

##### 7.1.2.3.3 AM RLC / 12-bit SN / Correct use of sequence numbering

7.1.2.3.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN }**ensure that** {

**when** { UE transmits the PDU corresponding to first SDU } **then** { UE includes the SN field equal to 0 in PDU } }

(2)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN }**ensure that** {

**when**{ UE transmits subsequent SDUs } **then** { UE includes the SN field incremented by 1 per SDU of each PDU transmitted } }

(3)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN }**ensure that** {

**with** { UE transmits more than 4096 SDUs} **then** { UE wraps the SN after transmitting the 4096 SDUs}

}

(4)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN**ensure that** {

**with** { more than 4096 SDUs are sent to UE } t**hen** { UE accepts PDUs with SNs that wrap around every 4096 SDUs }

}

7.1.2.3.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.2.3.1.1, 5.2.3.2.1, 5.2.3.2.2, 6.2.2.4 and 7.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.2.3.2.1]

The receiving side of an AM RLC entity shall maintain a receiving window according to the state variable RX\_Next as follows:

- a SN falls within the receiving window if RX\_Next <= SN < RX\_Next + AM\_Window\_Size;

- a SN falls outside of the receiving window otherwise.

When receiving an AMD PDU from lower layer, the receiving side of an AM RLC entity shall:

- either discard the received AMD PDU or place it in the reception buffer (see sub clause 5.2.3.2.2);

- if the received AMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop *t-Reassembly* as needed (see sub clause 5.2.3.2.3).

When *t-Reassembly* expires, the receiving side of an AM RLC entity shall:

- update state variables and start *t-Reassembly* as needed (see sub clause 5.2.3.2.4).

[TS 38.322, clause 5.2.3.2.2]

When an AMD PDU is received from lower layer, where the AMD PDU contains byte segment numbers y to z of an RLC SDU with SN = x, the receiving side of an AM RLC entity shall:

- if x falls outside of the receiving window; or

- if byte segment numbers y to z of the RLC SDU with SN = x have been received before:

- discard the received AMD PDU.

- else:

- place the received AMD PDU in the reception buffer;

- if some byte segments of the RLC SDU contained in the AMD PDU have been received before:

- discard the duplicate byte segments.

[TS 38.322, clause 6.2.2.4]

AMD PDU consists of a Data field and an AMD PDU header. The AMD PDU header is byte aligned.

An AM RLC entity is configured by RRC to use either a 12 bit SN or a 18 bit SN. The length of the AMD PDU header is two and three bytes respectively.

An AMD PDU header contains a D/C, a P, a SI, and a SN. An AMD PDU header contains the SO field only when the Data field consists of an RLC SDU segment which is not the first segment, in which case a 16 bit SO is present.



Figure 6.2.2.4-1: AMD PDU with 12 bit SN (No SO)



Figure 6.2.2.4-2: AMD PDU with 18 bit SN (No SO)



Figure 6.2.2.4-3: AMD PDU with 12 bit SN with SO



Figure 6.2.2.4-4: AMD PDU with 18 bit SN with SO

[TS 38.322, clause 7.1]

c) RETX\_COUNT – Counter

This counter counts the number of retransmissions of an RLC SDU or RLC SDU segment (see subclause 5.3.2). There is one RETX\_COUNT counter maintained per RLC SDU.

The receiving side of each AM RLC entity shall maintain the following state variables:

a) RX\_Next – Receive state variable

This state variable holds the value of the SN following the last in-sequence completely received RLC SDU, and it serves as the lower edge of the receiving window. It is initially set to 0, and is updated whenever the AM RLC entity receives an RLC SDU with SN = RX\_Next.

b) RX\_Next\_Status\_Trigger – *t-Reassembly* state variable

This state variable holds the value of the SN following the SN of the RLC SDU which triggered *t-Reassembly*.

c) RX\_Highest\_Status – Maximum STATUS transmit state variable

This state variable holds the highest possible value of the SN which can be indicated by "ACK\_SN" when a STATUS PDU needs to be constructed. It is initially set to 0.

d) RX\_Next\_Highest – Highest received state variable

This state variable holds the value of the SN following the SN of the RLC SDU with the highest SN among received RLC SDUs. It is initially set to 0.

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables and constant:

b) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0.

c) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

d) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0.

7.1.2.3.3.3 Test description

7.1.2.3.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.3.3.1-1.

Table 7.1.2.3.3.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink SN-FieldLength-AM | size12 |
| Downlink SN-FieldLength-AM | size12 |
| pollPDU | p2048 |
| pollByte | kB25 |

7.1.2.3.3.3.2 Test procedure sequence

Table 7.1.2.3.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | EXCEPTION: Steps 1 – 3a1 shall be repeated from j=0 to j= FLOOR(Maximum\_RLC\_SN/iteration\_size). (Note 1, 4, 6) | - | - | - | - |
| 1 | SS transmits in one slot, several RLC PDUs in a RLC PDU List, the number of RLC PDUs sent is defined by the iteration\_size. (Note 4, 5).  Each RLC PDU contains one RLC SDU. | <-- | RLC PDUs | - | - |
| - | EXCEPTION: In Step 2, SS may receive a RLC PDU or several RLC PDUs, then step 2 may be repeated multiple times until all RLC PDUs with SN=j\*iteration\_size to SN=(((j+1)\*iteration\_size)-1) for each iteration are received. | - | - | - | - |
| 2 | Check: Does UE transmit RLC PDUs with SN=0 for the first iteration and all RLC PDUs for each iteration?  (Note 2) (Note 7) | --> | RLC PDUs | 1,2 | P |
| - | EXCEPTION: Step 3a1 describes behaviour that depends on the contents of the AMD PDU transmitted at Step 2. | - | - | - | - |
| 3a1 | IF the UE has set the poll bit in the AMD PDU transmitted at Step 2 THEN the SS transmits a Status Report. | <-- | STATUS PDU | - | - |
| 4 | SS transmits a RLC PDU containing one RLC SDU. | <-- | RLC PDU | - | - |
| 5 | Check: Does UE transmit a RLC PDU with SN=0? | --> | RLC PDU | 3,4 | P |
| 6 | The SS transmits a STATUS PDU with ACK\_SN = 1. | <-- | STATUS PDU | - | - |
| Note 1: Maximum\_RLC\_SN = 2[*RLC-SN-SizeUL*] -1.  Note 2: The verdict shall be provided each time [(SN+1) mod 256 = 0] for 12 bit SN and [(SN+1) mod 4096 = 0] for 18 bit SN respectively.  Note 3: Void  Note 4: Iteration will be incremented by iteration\_size of 1 for 12 bit SN and iteration\_size of 25 for 18 bit SN. Small RLC SDU size will be used.  Note 5: SS shall transmit a RLC PDU list with size equal to iteration\_size and incrementing SN by 1 till SN = ((j + 1) \* iteration\_size)-1.  Note 6: The RLC SDU size shall be 4 octets for pc\_supportOfRedCap\_r17=false (3 octets of PDCP header + 1 octet PDCP SDU) or 4 octets for pc\_supportOfRedCap\_r17=true (2 octets of PDCP header + 2 octets PDCP SDU).  Note 7: All RLC PDUs may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot). | | | | | |

7.1.2.3.3.3.3 Specific message contents

None.

##### 7.1.2.3.4 AM RLC / 18-bit SN / Correct use of sequence numbering

7.1.2.3.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN }**ensure that** {

**when** { UE transmits the PDU corresponding to first SDU } **then** { UE includes the SN field equal to 0 in PDU } }

(2)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN }**ensure that** {

**when**{ UE transmits subsequent SDUs } **then** { UE includes the SN field incremented by 1 per SDU of each PDU transmitted } }

(3)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN }**ensure that** {

**with** { UE transmits more than 262144 SDUs } **then** { UE wraps the SN after transmitting the 262144 SDUs }

}

(4)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN**ensure that** {

**with** { more than 262144 SDUs are sent to UE } t**hen** { UE accepts PDUs with SNs that wrap around every 262144 SDUs }

}

7.1.2.3.4.2 Conformance requirements

Same as conformance requirements in clause 7.1.2.3.3.2

7.1.2.3.4.3 Test description

7.1.2.3.4.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.4.3.1-1.

Table 7.1.2.3.4.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Uplink SN-FieldLength-AM | size18 |
| Downlink SN-FieldLength-AM | size18 |
| pollPDU | p2048 |
| pollByte | kB25 |

7.1.2.3.4.3.2 Test procedure sequence

Same as test procedure in clause 7.1.2.3.3.3.2

7.1.2.3.4.3.3 Specific message contents

None.

##### 7.1.2.3.5 AM RLC / 12-bit SN / Control of transmit window / Control of receive window

7.1.2.3.5.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN and pending uplink data for transmission }

**ensure that** {

**when** { AMD PDUs in transmission buffer fall outside TX\_Next\_Ack <= SN < TX\_Next\_Ack + AM\_Window\_Size }

**then** { UE does not transmit these AMD PDUs }

}

(2)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN and pending uplink data for transmission }

**ensure that** {

**when** { receiving a STATUS PDU where ACK\_SN acknowledges at least one AMD PDU not yet acknowledged }

**then** { UE transmits AMD PDUs within updated window range }

}

(3)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN }

**ensure that** {

**when** { the UE receives AMD PDUs with SN outside the upper boundary of the receive window }

**then** { the UE discards these AMD PDUs }

}

(4)

**with** { UE in RRC\_CONNECTED state with AM RLC 12 bit SN }

**ensure that** {

**when** { the receive window has been moved }

**then** { UE continues accepting AMD PDUs within updated window range }

}

7.1.2.3.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.2.3.2.1, 5.2.3.2.2, 5.2.3.2.3 and 7.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.2.3.2.2]

When an AMD PDU is received from lower layer, where the AMD PDU contains byte segment numbers y to z of an RLC SDU with SN = x, the receiving side of an AM RLC entity shall:

- if x falls outside of the receiving window; or

- if byte segment numbers y to z of the RLC SDU with SN = x have been received before:

- discard the received AMD PDU.

- else:

- place the received AMD PDU in the reception buffer;

- if some byte segments of the RLC SDU contained in the AMD PDU have been received before:

- discard the duplicate byte segments.

[TS 38.322, clause 5.2.3.2.3]

When an AMD PDU with SN = x is placed in the reception buffer, the receiving side of an AM RLC entity shall:

- if x >= RX\_Next\_Highest

- update RX\_Next\_Highest to x+ 1.

- if all bytes of the RLC SDU with SN = x are received:

- reassemble the RLC SDU from AMD PDU(s) with SN = x, remove RLC headers when doing so and deliver the reassembled RLC SDU to upper layer;

- if x = RX\_Highest\_Status,

- update RX\_Highest\_Status to the SN of the first RLC SDU with SN > current RX\_Highest\_Status for which not all bytes have been received.

- if x = RX\_Next:

- update RX\_Next to the SN of the first RLC SDU with SN > current RX\_Next for which not all bytes have been received.

- if *t-Reassembly* is running:

- if RX\_Next\_Status\_Trigger = RX\_Next; or

- if RX\_Next\_Status\_Trigger = RX\_Next + 1 and there is no missing byte segment of the SDU associated with SN = RX\_Next before the last byte of all received segments of this SDU; or

- if RX\_Next\_Status\_Trigger falls outside of the receiving window and RX\_Next\_Status\_Trigger is not equal to RX\_Next + AM\_Window\_Size:

- stop and reset *t-Reassembly*.

- if *t-Reassembly* is not running (includes the case *t-Reassembly* is stopped due to actions above):

- if RX\_Next\_Highest> RX\_Next +1; or

- if RX\_Next\_Highest = RX\_Next + 1 and there is at least one missing byte segment of the SDU associated with SN = RX\_Next before the last byte of all received segments of this SDU:

- start t-Reassembly;

- set RX\_Next\_Status\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 7.2]

a) AM\_Window\_Size

This constant is used by both the transmitting side and the receiving side of each AM RLC entity. AM\_Window\_Size = 2048 when a 12 bit SN is used, AM\_Window\_Size = 131072 when an 18 bit SN is used.

7.1.2.3.5.3 Test description

7.1.2.3.5.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.5.3.1-1.

Table 7.1.2.3.5.3.1-1: RLC parameters

|  |  |
| --- | --- |
| t-PollRetransmit | ms300 |
| pollPDU | infinity |
| pollByte | infinity |
| sn-FieldLength(UL-AM-RLC) | size12 |
| sn-FieldLength(DL-AM-RLC) | size12 |

7.1.2.3.5.3.2 Test procedure sequence

Table 7.1.2.3.5.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  | U - S | Message |
| 0 | The SS does not allocate any uplink grant. | - | - | - | - |
| - | EXCEPTION: The SS is configured for step 1 500 ms in advance. The transmissions are performed every second radio frame. Step 2 is started 100 ms after the first DL AMD PDU has been transmitted in step 1. | - | - | - | - |
| - | EXCEPTION: Step 1 a1 shall be repeated from j=0 to j= FLOOR((Maximum\_RLC\_SN/iteration size) -1, and the last repetition shall execute Step 1b1. (Note 1) (Note 3) (Note 4) (Note 6) | - | - | - | - |
| 1a1 | The SS transmits several RLC PDUs in a RLC PDU List, the number of RLC PDUs sent is defined by the iteration\_size.  Each RLC Data PDU contains one RLC SDU.  (Note 8) (Note 9) (Note 5) | <-- | RLC Data PDU (SN = j\*iteration\_ size, SN=(((j+1)\*iteration\_size)-1) | - | - |
| 1b1 | The SS transmits several RLC PDUs in a RLC PDU List, the number of RLC PDUs sent is defined by the iteration\_size+1.  Each RLC Data PDU contains one RLC SDU.  The SS transmits AMD PDU(SN=W+1) as last packet (Note 8) (Note 9) (Note 5) | <-- | RLC Data PDU (SN = j\*iteration\_ size, SN=(((j+1)\*iteration\_size)) | - | - |
| 1A | Void | - | - | - | - |
| 2 | In the following steps the SS transmits 1 UL grant in every second radio frame to enable the UE to return each received AMD PDU in one looped back AMD PDU. (Note 2) | <-- | (UL grants) | - | - |
| - | EXCEPTION: Step 2A shall be repeated from j=0 to j=FLOOR((Maximum\_RLC\_SN/iteration size). (Note 1) (Note 3) (Note 4) (Note 6) | - | - | - | - |
| - | EXCEPTION: In Step 2A, SS shall receive a RLC PDU and step 2A is repeated from SN=j\*iteration\_size to SN=(((j+1)\*iteration\_ size)-1). (Note 1) (Note 3) (Note 4) (Note 6) (Note 8) (Note 9) | - | - | - | - |
| 2A | Check: Does UE transmit a RLC Data PDU with the Poll bit not set and with SN=0 for the first RLC Data PDU and then incremented by 1 at each RLC Data PDU? (Note 7)(Note 10) | --> | RLC Data PDU (SN = j\*iteration\_ size, SN=(((j+1)\*iteration\_size)-1) | 1 | P |
| 3 | Check: Does the UE transmit the (W)st AMD PDU with the Poll bit set and with the contents of the SDU? | --> | AMD PDU(SN=W-1), Poll | 1 | P |
| 4 | The SS starts the UL default grant transmission. | - | - | - | - |
| 5 | Check: Does the UE transmit an AMD PDU within *t-PollRetransmit*/2? | --> | AMD PDU | 1 | F |
| 6 | The SS transmits a STATUS PDU to acknowledge the W uplink AMD PDUs with SN=0 to SN=W-1. ACK\_SN = W. | <-- | STATUS PDU | - | - |
| 7 | Check: Does the UE transmit an AMD PDU with the Poll bit set and with the contents of the SDU? | --> | AMD PDU(SN=W), Poll | 2 | P |
| 8 | The SS transmits a STATUS PDU with ACK\_SN = W+1. | <-- | STATUS PDU | - | - |
| 9 | The SS transmits the (W+2)nd AMD PDU containing a SDU to the UE with the Sequence Number field set to ((2W+1 mod AM\_Modulus) = 1) and the Polling bit set. (Note 3) (Note 5) | <-- | AMD PDU | - | - |
| 10 | Check: Does the UE transmit a STATUS PDU acknowledging W+1 SDUs? (ACK\_SN = W+1). (Note 1) | --> | STATUS PDU | 3 | P |
| 11 | The SS transmits the (W+2)nd AMD PDU to the UE with the Sequence Number field set to W+1 and the Polling bit set. (Note 5) | <-- | AMD PDU | - | - |
| - | EXCEPTION: Steps 12 and 13 can happen in any order | - | - | - | - |
| 12 | Check: Does the UE transmit a STATUS PDU acknowledging W+1 PDUs? (ACK\_SN field = W+2). (Note 11) | --> | STATUS PDU | 4 | P |
| 13 | Check: Does the UE transmit an AMD PDU with the same data as received in the corresponding DL AMD PDU in step 11? (Note 11) | --> | AMD PDU | 4 | P |
| 14 | The SS transmits a STATUS PDU with ACK\_SN = W+2. | <-- | STATUS PDU | - | - |
| Note 1: PDUs are numbered 1,2, …, W+2.  Note 2: 20 ms gap between transmissions both in DL and UL respectively allows TTCN to tolerate one HARQ retransmission (FDD/TDD) per transport block.  Note 3: AM\_Modulus is 4096 resp 262144 for SN size is size12 or size18.  Note 4: The RLC SDU size shall be 4 octets(3 octets of PDCP header + 1 octet PDCP SDU) for pc\_supportOfRedCap\_r17=false or 4 octets(2 octets of PDCP header + 2 octets PDCP SDU) for pc\_supportOfRedCap\_r17=true. If SN size is size18 is used the RLC SDU size shall be 7 octets. With 2 octets of BSR or padding, 2 octets of MAC header and 3 octets of RLC header (without SO) the RLC PDU consists of 56 bits and a TBS of 112 bits shall be allocated.  Note 5: PDCP SN=W+1.  Note 6: Maximum\_RLC\_SN = W-1.  Note 7: The verdict shall be provided each time (SN+1) mod 256 = 0 resp. (SN+1) mod 4096 = 0, if SN size is size12 or size18.  Note 8: Iteration will be 211 in case of len12bits. Small RLC SDU size will be used and no repetition will be needed.  Note 9: Iteration will be incremented by iteration\_size of 211 for SN len18bits. Small RLC SDU size will be used and it shall be repeated FLOOR(Maximum\_RLC\_SN/iteration\_size).  Note 10: -2 for the last iteration, as the last reception will be handled by step 3.  Note 11: STATUS PDU at step 12 and AMD PDU at step 13 may be received by SS in the same slot or in multiple slots. | | | | | |

7.1.2.3.5.3.3 Specific message contents

None

##### 7.1.2.3.5a AM RLC / 18-bit SN / Control of transmit window / Control of receive window

7.1.2.3.5a.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN and pending uplink data for transmission }

**ensure that** {

**when** { AMD PDUs in transmission buffer fall outside TX\_Next\_Ack <= SN < TX\_Next\_Ack + AM\_Window\_Size }

**then** { UE does not transmit these AMD PDUs }

}

(2)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN and pending uplink data for transmission }

**ensure that** {

**when** { receiving a STATUS PDU where ACK\_SN acknowledges at least one AMD PDU not yet acknowledged }

**then** { UE transmits AMD PDUs within updated window range }

}

(3)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN }

**ensure that** {

**when** { the UE receives AMD PDUs with SN outside the upper boundary of the receive window }

**then** { the UE discards these AMD PDUs }

}

(4)

**with** { UE in RRC\_CONNECTED state with AM RLC 18 bit SN }

**ensure that** {

**when** { the receive window has been moved }

**then** { UE continues accepting AMD PDUs within updated window range }

}

7.1.2.3.5a.2 Conformance requirements

Same as conformance requirements in clause 7.1.2.3.5.2.

7.1.2.3.5a.3 Test description

7.1.2.3.5a.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.5a.3.1-1.

Table 7.1.2.3.5a.3.1-1: RLC parameters

|  |  |
| --- | --- |
| t-PollRetransmit | ms300 |
| pollPDU | infinity |
| pollByte | infinity |
| sn-FieldLength(UL-AM-RLC) | size18 |
| sn-FieldLength(DL-AM-RLC) | size18 |

7.1.2.3.5a.3.2 Test procedure sequence

Same as test procedure in clause 7.1.2.3.5.3.2

7.1.2.3.5a.3.3 Specific message contents

None.

##### 7.1.2.3.6 AM RLC / Polling for status

7.1.2.3.6.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { last data in the UL buffer is being transmitted }

**then** { UE transmits a Poll }

}

(2)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { the t-PollRetransmit timer expires }

**then** { UE transmits a Poll }

}

(3)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { PDU\_WITHOUT\_POLL >= pollPDU }

**then** { UE transmits a Poll }

}

(4)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { BYTE\_WITHOUT\_POLL >= pollByte }

**then** { UE transmits a Poll }

}

7.1.2.3.6.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.3.3.2, 7.3 and 7.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.3.3.2]

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall:

- increment PDU\_WITHOUT\_POLL by one;

- increment BYTE\_WITHOUT\_POLL by every new byte of Data field element that it maps to the Data field of the AMD PDU;

- if PDU\_WITHOUT\_POLL >= pollPDU; or

- if BYTE\_WITHOUT\_POLL >= pollByte:

- include a poll in the AMD PDU as described below.

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission, the transmitting side of an AM RLC entity shall:

- if both the transmission buffer and the retransmission buffer becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU; or

- if no new RLC SDU can be transmitted after the transmission of the AMD PDU (e.g. due to window stalling);

- include a poll in the AMD PDU as described below.

NOTE: Empty RLC buffer (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) should not lead to unnecessary polling when data awaits in the upper layer. Details are left up to UE implementation.

To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall:

- set the P field of the AMD PDU to "1";

- set PDU\_WITHOUT\_POLL to 0;

- set BYTE\_WITHOUT\_POLL to 0.

After submitting an AMD PDU including a poll to lower layer and after incrementing of TX\_Next if necessary, the transmitting side of an AM RLC entity shall:

- set POLL\_SN to TX\_Next – 1;

- if *t-PollRetransmit* is not running:

- start t-PollRetransmit.

- else:

- restart t-PollRetransmit.

[TS 38.322, clause 5.3.3.4]

Upon expiry of *t-PollRetransmit*, the transmitting side of an AM RLC entity shall:

- if both the transmission buffer and the retransmission buffer are empty (excluding transmitted RLC SDU or RLC SDU segment awaiting acknowledgements); or

- if no new RLC SDU or RLC SDU segment can be transmitted (e.g. due to window stalling):

- consider the RLC SDU with SN = TX\_Next – 1 for retransmission; or

- consider any RLC SDU which has not been positively acknowledged for retransmission.

- include a poll in an AMD PDU as described in section 5.3.3.2.

[TS 38.322, clause 7.3]

a) t-PollRetransmit

This timer is used by the transmitting side of an AM RLC entity in order to retransmit a poll (see sub clause 5.3.3).

[TS 38.322, clause 7.4]

b) pollPDU

This parameter is used by the transmitting side of each AM RLC entity to trigger a poll for every pollPDU PDUs (see subclause 5.3.3).

c) pollByte

This parameter is used by the transmitting side of each AM RLC entity to trigger a poll for every pollByte bytes (see subclause 5.3.3).

7.1.2.3.6.3 Test description

7.1.2.3.6.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.6.3.1-1.

Table 7.1.2.3.6.3.1-1: RLC parameters

|  |  |
| --- | --- |
| t-PollRetransmit | ms400 |
| pollPDU | p256 |
| pollByte | kB25 |

7.1.2.3.6.3.2 Test procedure sequence

Table 7.1.2.3.6.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | During the whole test sequence, the SS should not allocate UL grants unless when explicitly stated so in the procedure. | - | - | - | - |
| 2 | The SS transmits 4 AMD PDUs such that 1 AMD PDU is sent every two radio frame, each containing an RLC SDU. (Note 2) | <-- | AMD PDU (SN=0)  AMD PDU (SN=1)  AMD PDU (SN=2)  AMD PDU (SN=3) | - | - |
| - | EXCEPTION: In parallel to the events described in step 3, the step specified in Table 7.1.2.3.6.3.2-2 should take place. | - | - | - | - |
| 3 | The SS waits for 100 ms after the first DL AMD PDU has been transmitted in step 2, then starts assigning UL grants in every second radio frame of size 1032 bits. (Note 1) (Note 2) | - | - | - | - |
| 4 | Check 1: Does the UE transmit an AMD PDU with a SN in range 0 to 3 and P=1?  Record time TB.  Check 2: Is (TB – TA) = *t-PollRetransmit*? | --> | AMD PDU | 2 | P |
| 5 | The SS starts the UL default grant transmission on reception of SR. | - | - | - | - |
| 6 | The SS transmits an RLC Status Report ACKing reception of PDU’s 0-3. | <-- | STATUS PDU | - | - |
| 7 | Check: Does the UE retransmit an AMD PDU within 1 sec? | --> | AMD PDU | 2 | F |
| 8 | The SS transmits NR RRCReconfiguration message changing *pollPDU* to p4.  (Note 3) | <-- | RRCReconfiguration | - | - |
| 8A | The UE transmits a NR *RRCReconfigurationcomplete* message.  (Note 4) | --> | RRCReconfigurationComplete | - | - |
| 9 | The SS stops allocating any UL grant. | - | - | - | - |
| 10 | The SS transmits 8 AMD PDUs such that 1 AMD PDU is sent every second radio frame, each containing an RLC SDU. (Note 2) | <-- | AMD PDU (SN=4)  AMD PDU (SN=5)  ...  AMD PDU (SN=11) | - | - |
| - | EXCEPTION: In parallel to the events described in step 11, the step specified in Table 7.1.2.3.6.3.2-3 should take place. | - | - | - | - |
| 11 | The SS waits for 100 ms after the first DL AMD PDU has been transmitted in step 10, then starts assigning UL grants (UL grant allocation type 2) in every second radio frame of size 1032 bits. (Note 1) (Note 2) | - | - | - | - |
| 12 | The SS transmits a Status Report with ACK\_SN=12, NACK\_SN=4, NACK\_SN=5, NACK\_SN=6 (constructed by NACK\_SN Range), NACK\_SN=8 and NACK\_SN=9 (constructed by NACK\_SN Range). | <-- | STATUS PDU | - | - |
| 12A | Void. | - | - | - | - |
| 13 | Check: Does the UE transmit AMD PDUs with the following SN and P values?  AMD PDU, SN=4, P=0  AMD PDU, SN=5, P=0  AMD PDU, SN=6, P=0  AMD PDU, SN=8, P=0  AMD PDU, SN=9, P=1 | --> | AMD PDU (SN=4, P=0)  AMD PDU (SN=5, P=0)  AMD PDU (SN=6, P=0)  AMD PDU (SN=8, P=0)  AMD PDU (SN=9, P=1) | 2 | P |
| 14 | The SS starts the UL default grant transmission on reception of SR. | - | - | - | - |
| 15 | The SS transmits a Status Report with ACK\_SN=12 and no NACK\_SN. | <-- | STATUS PDU | - | - |
| 16 | The SS transmits NR RRCReconfiguration message changing *pollPDU* to p256.  (Note 3) | <-- | RRCReconfiguration | - | - |
| 16A | The UE transmits a NR *RRCReconfigurationcomplete* message.  (Note 4) | --> | RRCReconfigurationComplete | - | - |
| 17 | The SS does not allocate any UL grant. | - | - | - | - |
| 18 | After 500 ms the SS transmits 412 AMD PDUs such that 1 AMD PDU is sent every second radio frame, each containing an RLC SDU. (Note 2) | <-- | AMD PDU (SN=12)  AMD PDU (SN=13)  ...  AMD PDU (SN=423) | - | - |
| - | EXCEPTION: In parallel to the events described in step 19, the steps specified in Table 7.1.2.3.6.3.2-4 should take place. | - | - | - | - |
| 19 | The SS waits for 100 ms after the first DL AMD PDU has been transmitted in step 10, then starts assigning UL grants (UL grant allocation type 2) in every second radio frame of size 1032 bits. (Note 1) (Note 2) | - | - | - | - |
| 20 | The SS starts the UL default grant transmission | - | - | - | - |
| Note 1: UL grant of 1032 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to loop back one SDU of size 976 bits and one short BSR (16 bits) into each MAC PDU sent in the uplink (1032 bits - 24 bit AMD PDU header - 16 bit MAC BSR CE- 16 bit MAC PDU subheader) for pc\_supportOfRedCap\_r17=false, or one SDU of size 976 bits and one short BSR (16 bits) and/or padding into each MAC PDU sent in the uplink (1032 bits - 16 bit AMD PDU header - 16 bit MAC PDU subheader - 24 bit (MAC BSR CE and/or Padding)) for pc\_supportOfRedCap\_r17=true. The UE will include an SDU and one short BSR in the looped back MAC PDU.  Note 2: 20ms gap between transmissions both in DL and UL respectively allows TTCN to tolerate one HARQ retransmission (FDD/TDD) per transport block, if such happen (TS 38.523-3 [3]).  Note 3: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7] Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 4: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete. | | | | | |

Table 7.1.2.3.6.3.2-2: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE transmit 4 AMD PDUs, with only the last one having the poll bit set? Record time TA when the PDU with the poll bit set is received at the SS. | --> | AMD PDUs | 1 | P |

Table 7.1.2.3.6.3.2-3: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE transmit 8 AMD PDUs, with the poll bit set only in the 4th and the 8th PDUs? | --> | AMD PDUs | 3 | P |

Table 7.1.2.3.6.3.2-4: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE transmit 205 AMD PDUs, with the poll bit set only in the last (205th) one? (Note 1) | --> | AMD PDUs | 4 | P |
| 2 | The SS transmits an RLC Status Report. | <-- | STATUS PDU | - | - |
| 3 | Check: Does the UE transmit 205 AMD PDUs, with the poll bit set only in the last (410th) one? (Note 1) | --> | AMD PDUs | 4 | P |
| 4 | The SS transmits an RLC Status Report. | <-- | STATUS PDU | - | - |
| 5 | Check: Does the UE transmit 2 AMD PDUs, with the poll bit set only in the last (412th ) one? | --> | AMD PDUs | 1 | P |
| 6 | The SS transmits an RLC Status Report. | <-- | STATUS PDU | - | - |
| Note 1: (976 bits x 205PDUs) / 8 = 25010 > 25 KB, with 1 kB = 1000 bytes (TS 38.331 [12], clause 3.2) | | | | | |

7.1.2.3.6.3.3 Specific message contents

Table 7.1.2.3.6.3.3-1: *RRCReconfiguration* (steps 8 and 16, Table 7.1.2.3.6.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.2.3.6.3.3-2: *CellGroupConfig* (Table 7.1.2.3.6.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 1 entry |  |  |
| RLC-BearerConfig[1] | RLC-BearerConfig | entry 1 |  |
| } |  |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig | Not present |  |  |
| spCellConfig | Not present |  |  |
| } |  |  |  |

Table 7.1.2.3.6.3.3-3: *RLC-BearerConfig* (Table 7.1.2.3.6.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-148 with condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-BearerConfig ::= SEQUENCE { |  |  |  |
| logicalChannelIdentity | Set to LCID of the DRB under test |  |  |
| rlc-Config | RLC-Config |  |  |
| } |  |  |  |

Table 7.1.2.3.6.3.3-4: *RLC-Config* (Table 7.1.2.3.6.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-149 with condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-Config ::= CHOICE { |  |  |  |
| am SEQUENCE { |  |  |  |
| ul-AM-RLC SEQUENCE { |  |  |  |
| sn-FieldLength | Not present |  |  |
| t-PollRetransmit | ms400 |  |  |
| pollPDU | p4 |  | step 8 |
|  | p256 |  | step 16 |
| pollByte | kB25 |  |  |
| } |  |  |  |
| dl-AM-RLC SEQUENCE { |  |  |  |
| sn-FieldLength | Not present |  |  |
| } |  |  |  |

##### 7.1.2.3.7 AM RLC / Receiver status triggers

7.1.2.3.7.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { Reception failure of an RLC data PDU is detected and t-Reassembly expires }

**then** { UE initiates Status Reporting }

}

(2)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { Status Reporting is triggered and t-StatusProhibit is running }

**then** { UE wait until t-StatusProhibit has expired to send Status Report}

}

(3)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { Polling from peer AM RLC entity is detected and the sequence number ‘x’ of the PDU that carries the Poll satisfies x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size }

**then** { UE initiates Status Reporting }

}

(4)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { Polling from peer AM RLC entity is detected and the sequence number ‘x’ of the PDU that carries the Poll does not satisfies x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size }

**then** { UE waits until ‘x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size’ before initiating Status Reporting}

}

(5)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { the UE needs to send a Status Report and the UL grant is not large enough to accommodate the whole report }

**then** { UE includes as many NACK\_SNs in the Status Report as allowed by the UL grant }

}

(6)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { the UE needs to send a Status Report and continuous sequence of RLC SDUs that have not been received yet }

**then** { UE includes NACK\_SN with NACK range }

}

7.1.2.3.7.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clause 5.3.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.3.4]

An AM RLC entity sends STATUS PDUs to its peer AM RLC entity in order to provide positive and/or negative acknowledgements of RLC SDUs (or portions of them).

Triggers to initiate STATUS reporting include:

- Polling from its peer AM RLC entity:

- When an AMD PDU with SN = x and the P field set to "1" is received from lower layer, the receiving side of an AM RLC entity shall:

- if the AMD PDU is to be discarded as specified in subclause 5.2.3.2.2; or

- if x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size:

- trigger a STATUS report.

- else:

- delay triggering the STATUS report until x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size.

NOTE 1: This ensures that the RLC Status report is transmitted after HARQ reordering.

- Detection of reception failure of an AMD PDU

- The receiving side of an AM RLC entity shall trigger a STATUS report when *t-Reassembly* expires.

NOTE 2: The expiry of *t-Reassembly* triggers both RX\_Highest\_Status to be updated and a STATUS report to be triggered, but the STATUS report shall be triggered after RX\_Highest\_Status is updated.

When STATUS reporting has been triggered, the receiving side of an AM RLC entity shall:

- if *t-StatusProhibit* is not running:

- at the first transmission opportunity indicated by lower layer, construct a STATUS PDU and submit it to lower layer.

- else:

- at the first transmission opportunity indicated by lower layer after *t-StatusProhibit* expires, construct a single STATUS PDU even if status reporting was triggered several times while *t-StatusProhibit* was running and submit it to lower layer.

When a STATUS PDU has been submitted to lower layer, the receiving side of an AM RLC entity shall:

- start t-StatusProhibit.

When constructing a STATUS PDU, the AM RLC entity shall:

- for the RLC SDUs with SN such that RX\_Next <= SN < RX\_Highest\_Status that has not been completely received yet, in increasing SN order of RLC SDUs and increasing byte segment order within RLC SDUs, starting with SN = RX\_Next up to the point where the resulting STATUS PDU still fits to the total size of RLC PDU(s) indicated by lower layer:

- for an RLC SDU for which no byte segments have been received yet:

- include in the STATUS PDU a NACK\_SN which is set to the SN of the RLC SDU.

- for a continuous sequence of byte segments of a partly received RLC SDU that have not been received yet:

- include in the STATUS PDU a set of NACK\_SN, SOstart and SOend.

- for a continuous sequence of RLC SDUs that have not been received yet:

- include in the STATUS PDU a set of NACK\_SN and NACK range;

- include in the STATUS PDU, if required, a pair of SOstart and SOend.

- set the ACK\_SN to the SN of the next not received RLC SDU which is not indicated as missing in the resulting STATUS PDU.

7.1.2.3.7.3 Test description

7.1.2.3.7.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.7.3.1-1.

Table 7.1.2.3.7.3.1-1: RLC parameters

|  |  |
| --- | --- |
| *t-Reassembly* | ms150 |
| *t-StatusProhibit* | ms300 |
| *t-PollRetransmit* | ms500 |

7.1.2.3.7.3.2 Test procedure sequence

Table 7.1.2.3.7.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 1 | The SS transmits 4 AMD PDUs with SN=0, 1, 2, and 4. The SS sets the P field of all the AMD PDUs to 0. A time spacing of 20 ms is applied.  Record time TA when the AMD PDU with SN=4 is sent. (Note 6) | <-- | AMD PDU (SN=0, P=0)  AMD PDU (SN=1, P=0)  AMD PDU (SN=2, P=0)  AMD PDU (SN=4, P=0) | - | - |
| 2 | The SS waits for 70 ms after the transmission of the first AMD PDU to ensure UE RLC has all the required SDUs available and then assigns 3 UL grants (UL grant allocation type 2) with a time spacing of 20 ms of size 848 bits (UL Grant Allocation type 2). (Note 1) | <-- | (UL grants, 848 bits) | - | - |
| 3 | The UE transmits RLC SDU#1. | --> | (RLC SDU#1) | - | - |
| 4 | The UE transmits RLC SDU#2. | --> | (RLC SDU#2) | - | - |
| 5 | The UE transmits RLC SDU#3. | --> | (RLC SDU#3) | - | - |
| 6 | 60 ms after step 5, the SS transmits a STATUS PDU | <-- | STATUS PDU | - | - |
| 7 | 80 ms after step 5, the SS starts the UL default grant transmission. | - | - | - | - |
| 8 | Check 1: Does the UE transmit a Status Report with NACK\_SN=3 and ACK\_SN=5?  Record time TB (Note 5)  Check 2: (TB – TA) = *t-Reassembly*? | --> | STATUS PDU | 1 | P |
| 9 | 100 ms after the Status Report is received at Step 8, the SS transmits 4 AMD PDUs with SN=5, 6, 8 and 9. The SS sets the P field of all the AMD PDUs to 0. A time spacing of 20 ms is applied. (Note 6) | <-- | AMD PDU (SN=5, P=0)  AMD PDU (SN=6, P=0)  AMD PDU (SN=8, P=0)  AMD PDU (SN=9, P=0) | - | - |
| 10 | Check 1: Does the UE transmit a Status Report with NACK\_SN=3 and ACK\_SN=7?  Record time TC  Check 2: (TC – TB) = *t-StatusProhibit*? | --> | STATUS PDU | 2 | P |
| 11 | The SS ignores scheduling requests unless otherwise specified and does not allocate any uplink grant. | - | - | - | - |
| 12 | 200 ms after step 10, the SS transmits 2 AMD PDUs with SN=3, SN=7. The SS sets the P field of all the AMD PDUs to 0 except for that of the AMD PDU with SN=7. A time spacing of 20 ms is applied. | <-- | AMD PDU (SN=3, P=0)  AMD PDU (SN=7, P=1) | - | - |
| 13 | The SS waits for 100 ms after the transmission of the last AMD PDU to ensure UE RLC has all the required SDUs available and then assigns 1 UL grant (UL grant allocation type 3) of size 88 bits. (Note 2) | <-- | (UL grant, 88 bits) | - | - |
| 14 | Check: Does the UE transmit a Status Report with no NACK\_SN and ACK\_SN = 10? | --> | STATUS PDU | 3 | P |
| 15 | In the second frame following the one scheduled in step 13 the SS assigns 7 UL grants (UL grant allocation type 2) with a time spacing of 20 ms of size 848 bits. (Note 1) | <-- | (UL grant, 848 bits) | - | - |
| 16 | The UE transmits RLC SDU#4. | --> | (RLC SDU#4) | - | - |
| 17 | The UE transmits RLC SDU#5. | --> | (RLC SDU#5) | - | - |
| 18 | The UE transmits RLC SDU#6. | --> | (RLC SDU#6) | - | - |
| 19 | The UE transmits RLC SDU#7. | --> | (RLC SDU#7) | - | - |
| 20 | The UE transmits RLC SDU#8. | --> | (RLC SDU#8) | - | - |
| 21 | The UE transmits RLC SDU#9. | --> | (RLC SDU#9) | - | - |
| 22 | The UE transmits RLC SDU#10. | --> | (RLC SDU#10) | - | - |
| 23 | The SS transmits a STATUS PDU | <-- | STATUS PDU | - | - |
| 24 | After 300 ms the SS transmits an AMD PDU with SN=11 and P=0, and an AMD PDU with SN=12 and P=1.A time spacing of 20 ms is applied. (Note 6) | <-- | AMD PDU (SN=11, P=0)  AMD PDU (SN=12, P=1) | - | - |
| 25 | Check: Does the UE transmit a scheduling request within *t-Reassembly*/ 2 ms after the transmission of the first AMD PDU of Step 24? | --> | (SR) | 4 | F |
| 26 | At *t-Reassembly*/ 2 ms after the transmission of the second AMD PDU of Step 24, the SS transmits an AMD PDU with SN=10 and P=0. (Note 6) | <-- | AMD PDU (SN=10, P=0) | - | - |
| 27 | The SS waits for 60 ms to ensure UE RLC has all the required SDUs available and then assigns 1 UL grant (UL grant allocation type 3) of size 88 bits. (Note 2) | <-- | (UL grant, 88 bits) | - | - |
| 28 | Check: Does the UE transmit a Status Report with no NACK\_SN and ACK\_SN=13? | --> | STATUS PDU | 4 | P |
| 29 | The SS assigns 3 UL grants (UL grant allocation type 2) with a time spacing of 20 ms of size 848 bits. (Note 1) | <-- | (UL grant, 848 bits) | - | - |
| 30 | The UE transmits RLC SDU#11. | --> | (RLC SDU#11) | - | - |
| 31 | The UE transmits RLC SDU#12. | --> | (RLC SDU#12) | - | - |
| 32 | The UE transmits RLC SDU#13. | --> | (RLC SDU#13) | - | - |
| 33 | The SS transmits a STATUS PDU. | <-- | STATUS PDU | - | - |
| 34 | After 300 ms the SS transmits an AMD PDU with SN=17 and P=0, and an AMD PDU with SN=19 and P=1. A time spacing of 20 ms is applied. (Note 6) | <-- | AMD PDU (SN=17, P=0)  AMD PDU (SN=19, P=1) | - | - |
| 35 | The SS waits for *t-Reassembly* ms to ensure expiry. | - | - | - | - |
| 36 | 60 ms after step 35 the SS assigns an UL grant (UL grant allocation type 3) of size 88 bits. (Note 3) | <-- | (UL Grant, 88 bits) | - | - |
| 37 | Check: Does the UE transmit a Status Report with ACK\_SN=18 and NACK\_SN: 13 including NACK Range 4 (SN 13, 14, 15, 16)? | --> | STATUS PDU | 5,6 | P |
| 38 | After 300 ms the SS transmits an AMD PDU with SN=16 and P=1. (Note 6) | <-- | AMD PDU (SN=16, P=1) | - | - |
| 39 | 30 ms after step 38 the SS assigns an UL grant (UL grant allocation type 3) of size 112 bits. (Note 4) | <-- | (UL Grant, size 112) | - | - |
| 40 | Check: Does the UE transmit a Status Report with ACK\_SN=20 and NACK\_SN: 13 including NACK Range 3 (SN 13, 14, 15) and NACK\_SN=18 without NACK Range? | --> | STATUS PDU | 5,6 | P |
| 41 | 60 ms after step 38 the SS transmits 4 AMD PDUs with SN=13, 14, 15 and 18. A time spacing of 20 ms is applied. (Note 6) | <-- | AMD PDU (SN=13, P=0)  AMD PDU (SN=14, P=0)  AMD PDU (SN=15, P=0)  AMD PDU (SN=18, P=0) | - | - |
| 42 | 130 ms after the transmission of the first AMD PDU the SS assigns 7 UL grant (UL grant allocation type 3 with a time spacing of 20 ms of size 848 bits. (Note 1) | <-- | (UL grant, 848 bits) | - | - |
| 43 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#14) | - | - |
| 44 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#15) | - | - |
| 45 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#16) | - | - |
| 46 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#17) | - | - |
| 47 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#18) | - | - |
| 48 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#19) | - | - |
| 49 | The UE loopbacks the complete RLC SDU. | --> | (RLC SDU#20) | - | - |
| 50 | The SS transmits a STATUS PDU. | <-- | STATUS PDU | - | - |
| Note 1: UL grant of 848 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU at a time ( 99 bytes RLC SDU + 3 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding) for pc\_supportOfRedCap\_r17=false, or ( 100 bytes RLC SDU + 2 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding) for pc\_supportOfRedCap\_r17=true.  Note 2: UL grant of 88 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit a Status Report with ACK\_SN(3 byte) + 2 byte MAC PDU subheader and (2 byte short BSR). 4 Bytes additional space provided to confirm UE does not include NACK\_SN and conformant UE instead will include MAC Padding.  Note 3: UL grant of 88 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit (a Status Report with ACK\_SN (3 Bytes)and 1 NACK\_SNs with NACK Range(4 Bytes) + MAC PDU subheader (2 Bytes) + Short BSR (2 Byte)) for pc\_supportOfRedCap\_r17=false, or (a Status Report with ACK\_SN (3 Bytes) and 1 NACK\_SNs with NACK Range (3 Bytes) + MAC PDU subheader (2 Bytes) + Short BSR (2 Bytes) + Padding (1 Bytes)) for pc\_supportOfRedCap\_r17=true.  Note 4: UL grant of 112 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit (a Status Report with ACK\_SN (3 Bytes)and 1 NACK\_SNs with NACK Range(4 Bytes) +NACK SN (3 Bytes) + MAC PDU subheader (2 Bytes) + Short BSR (2 Byte)) for pc\_supportOfRedCap\_r17=false,or (a Status Report with ACK\_SN (3 Bytes) and 1 NACK\_SNs with NACK Range (3 Bytes) +NACK SN (2 Bytes) + MAC PDU subheader (2 Bytes) + Short BSR (2 Bytes) + Padding (2 Bytes)) for pc\_supportOfRedCap\_r17=true.  Note 5: Time TB should be recorded by factoring in the SR-Periodicity as configured in the *SchedulingRequestResourceConfig*->*periodicityAndOffset*.  Note 6: Every DL AMD PDU contains 1 RLC SDU size of 99 bytes for pc\_supportOfRedCap\_r17=false, or 100 bytes for pc\_supportOfRedCap\_r17=true. | | | | | |

7.1.2.3.7.3.3 Specific message contents

None

##### 7.1.2.3.8 AM RLC / Reconfiguration of RLC parameters by upper layers

7.1.2.3.8.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { t-PollRetransmit value is changed during reconfiguration of RLC parameters by upper layers}

**then** { UE starts using new t-PollRetransmit value }

}

(2)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { t-Reassembly value is changed during reconfiguration of RLC parameters by upper layers }

**then** { UE starts using new t-Reassembly value }

}

(3)

**with** { UE in RRC\_CONNECTED state and using AM RLC }

**ensure that** {

**when** { t-StatusProhibit value is changed during reconfiguration of RLC parameters by upper layers }

**then** { UE starts using new t-StatusProhibit value }

}

7.1.2.3.8.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.322, clauses 5.3.3.1, 5.3.3.2, 5.3.3.3, 5.3.4 and 7.3. TS 38.331 clause 5.3.5.5.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.3.3.1]

An AM RLC entity can poll its peer AM RLC entity in order to trigger STATUS reporting at the peer AM RLC entity.

[TS 38.322, clause 5.3.3.2]

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission such that the AMD PDU contains either a not previously transmitted RLC SDU or an RLC SDU segment containing not previously transmitted byte segment, the transmitting side of an AM RLC entity shall:

- increment PDU\_WITHOUT\_POLL by one;

- increment BYTE\_WITHOUT\_POLL by every new byte of Data field element that it maps to the Data field of the AMD PDU;

- if PDU\_WITHOUT\_POLL >= pollPDU; or

- if BYTE\_WITHOUT\_POLL >= pollByte:

- include a poll in the AMD PDU as described below.

Upon notification of a transmission opportunity by lower layer, for each AMD PDU submitted for transmission, the transmitting side of an AM RLC entity shall:

- if both the transmission buffer and the retransmission buffer becomes empty (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) after the transmission of the AMD PDU; or

- if no new RLC SDU can be transmitted after the transmission of the AMD PDU (e.g. due to window stalling);

- include a poll in the AMD PDU as described below.

NOTE: Empty RLC buffer (excluding transmitted RLC SDUs or RLC SDU segments awaiting acknowledgements) should not lead to unnecessary polling when data awaits in the upper layer. Details are left up to UE implementation.

To include a poll in an AMD PDU, the transmitting side of an AM RLC entity shall:

- set the P field of the AMD PDU to "1";

- set PDU\_WITHOUT\_POLL to 0;

- set BYTE\_WITHOUT\_POLL to 0.

After submitting an AMD PDU including a poll to lower layer and after incrementing of TX\_Next if necessary, the transmitting side of an AM RLC entity shall:

- set POLL\_SN to TX\_Next – 1;

- if *t-PollRetransmit* is not running:

- start t-PollRetransmit.

- else:

- restart t-PollRetransmit.

[TS 38.322, clause 5.3.3.3]

Upon reception of a STATUS report from the receiving RLC AM entity the transmitting side of an AM RLC entity shall:

- if the STATUS report comprises a positive or negative acknowledgement for the RLC SDU with sequence number equal to POLL\_SN:

- if *t-PollRetransmit* is running:

- stop and reset *t-PollRetransmit*.

[TS 38.322, clause 5.3.4]

Upon expiry of *t-PollRetransmit*, the transmitting side of an AM RLC entity shall:

- if both the transmission buffer and the retransmission buffer are empty (excluding transmitted RLC SDU or RLC SDU segment awaiting acknowledgements); or

- if no new RLC SDU or RLC SDU segment can be transmitted (e.g. due to window stalling):

- consider the RLC SDU with SN = TX\_Next – 1 for retransmission; or

- consider any RLC SDU which has not been positively acknowledged for retransmission.

- include a poll in an AMD PDU as described in section 5.3.3.2.

[TS 38.322, clause 7.3]

The following timers are configured by 3GPP TS 38.331 [5]:

a) t-PollRetransmit

This timer is used by the transmitting side of an AM RLC entity in order to retransmit a poll (see sub clause 5.3.3).

b) t-Reassembly

This timer is used by the receiving side of an AM RLC entity and receiving UM RLC entity in order to detect loss of RLC PDUs at lower layer (see sub clauses 5.2.2.2 and 5.2.3.2). If t-Reassembly is running, t-Reassembly shall not be started additionally, i.e. only one t-Reassembly per RLC entity is running at a given time.

c) t-StatusProhibit

This timer is used by the receiving side of an AM RLC entity in order to prohibit transmission of a STATUS PDU (see sub clause 5.3.4).

[TS 38.331, clause 5.3.5.5.4]

For each RLC-Bearer-Config received in the rlc-BearerToAddModList IE the UE shall:

1> if the UE’s current configuration contains a RLC bearer with the received *logicalChannelIdentity*:

2> if *reestablishRLC* is received:

3> re-establish the RLC entity as specified in TS 38.322 [4];

2> reconfigure the RLC entity or entities in accordance with the received *rlc-Config*;

2> reconfigure the logical channel in accordance with the received *mac-LogicalChannelConfig*;

NOTE: The network does not re-associate an already configured logical channel with another radio bearer. Hence *servedRadioBearer* is not present in this case.

7.1.2.3.8.3 Test description

7.1.2.3.8.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.8.3.1-1.

Table 7.1.2.3.8.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Parameter | Value |
| *t-Reassembly* | ms150 |
| *t-StatusProhibit* | ms300 |
| *t-PollRetransmit* | ms400 |
| *pollPDU* | infinity |
| *pollByte* | infinity |

7.1.2.3.8.3.2 Test procedure sequence

Table 7.1.2.3.8.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message/PDU/SDU |  |  |
| 1-29 | Same expected sequence as in Table 7.1.2.3.8.3.2-2 with (X=0, t-Reassembly = ms150, *t-StatusProhibit = ms300, t-PollRetransmit=ms400*) Note 1. | - | - | 1,2,3 | - |
| 30 | The SS transmits NR RRCReconfiguratioin message to reconfigure RLC in the UE and set:  - *t-Reassembly* to ms200,  - *t-StatusProhibit* to ms400,  - *t-PollRetransmit* to ms500.  (Note 1) | <-- | RRCReconfiguration | - | - |
| 30A | The UE transmits a NR *RRCReconfigurationcomplete* message.  (Note 2) | --> | RRCReconfigurationComplete | - | - |
| 31-59 | Same expected sequence as in Table 7.1.2.3.8.3.2-2 with (X=11, t-Reassembly = ms200, *t-StatusProhibit = ms400, t-PollRetransmit=ms500)*. | - | - | 1,2,3 | - |
| Note 1: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon.  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete. | | | | | |

Table 7.1.2.3.8.3.2-2: Behaviour Sequence (X, t-Reassembly, *t-StatusProhibit,t-PollRetransmit*)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message/PDU/SDU |  |  |
| 1 | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 2 | The SS transmits 4 AMD PDUs with P=0 and SN=X, X+1, X+2 and X+4.  The SS record time TA when AMD PDU#5 (with SN=X+4) is sent. A time spacing of 20 ms is applied. | <-- | AMD PDU#1 (SN=X, P=0)  AMD PDU#2 (SN=X+1, P=0)  AMD PDU#3 (SN=X+2, P=0)  AMD PDU#5 (SN=X+4, P=0) | - | - |
| 3 | The SS waits for 70 ms after the transmission of the first AMD PDU to ensure UE RLC has all the required SDUs available and then assigns 3 UL grants of size 848 bits with a time spacing of 20 ms. (Note 1) | <-- | (UL grants, 848 bits) | - | - |
| 4 | The UE transmits RLC SDU#1+X. | --> | (RLC SDU#1+X) | - | - |
| 5 | The UE transmits RLC SDU#2+X. | --> | (RLC SDU#2+X) | - | - |
| 6 | The UE transmits RLC SDU#3+X. | --> | (RLC SDU#3+X) | - | - |
| 7 | 60 ms after step 3 the SS transmits a STATUS PDU. | <-- | STATUS PDU | - | - |
| 8 | The SS starts the UL default grant transmission. | - | - | - | - |
| 9 | Check 1: Does the UE transmit a STATUS PDU with NACK\_SN=X+3 and ACK\_SN=X+5? Record time TB (Note 5).  Check 2: Is (TB – TA ) = *t-Reassembly*? | --> | STATUS PDU | 2 | P |
| 10 | 100 ms after the Status Report received at Step 9, the SS sends 4 AMD PDUs with P=0 and SN=X+5, X+6, X+8 and X+9. A time spacing of 20 ms is applied. | <-- | AMD PDU#6 (SN=X+5, P=0)  AMD PDU#7 (SN=X+6, P=0)  AMD PDU#9 (SN=X+8, P=0)  AMD PDU#10 (SN=X+9, P=0) | - | - |
| 11 | Check 1: Does the UE transmit a Status Report with NACK\_SN=X+3 and ACK\_SN=X+7?  Record time TC  Check 2: (TC – TB) = *t-StatusProhibit?* | --> | STATUS PDU | 3 | P |
| 12 | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 13 | After 250 ms the SS transmits 3 AMD PDUs with SN=X+3, X+7 and X+9. The SS sets the P field of all the AMD PDUs to 0 except for that of the AMD PDU with SN=X+9. A time spacing of 20 ms is applied. | <-- | AMD PDU#4 (SN=X+3, P=0)  AMD PDU#8 (SN=X+7, P=0)  AMD PDU#10 (SN=X+9, P=1) | - | - |
| 14 | The SS waits for 150 ms after AMD PDU#4 transmission to ensure UE RLC has all the required SDUs available and then assigns 1 UL grant of size 88 bits (UL Grant Allocation type 3). (Note 2)(Note 4) | <-- | (UL grant, 88 bits) | - | - |
| 15 | The UE transmits a Status Report with no NACK\_SN and ACK\_SN=X+10. | --> | STATUS PDU | - | - |
| 16 | In the subframe following the one scheduled in step 14 the SS assigns 7 UL grants of size 848 bits (UL Grant Allocation type 2) with a time spacing of 20 ms. (Note 1) | <-- | (UL grants, 848 bits) | - | - |
| 17 | The UE transmits RLC SDU#4+X. | --> | (RLC SDU#4+X) | - | - |
| 18 | The UE transmits RLC SDU#5+X. | --> | (RLC SDU#5+X) | - | - |
| 19 | The UE transmits RLC SDU#6+X. | --> | (RLC SDU#6+X) | - | - |
| 20 | The UE transmits RLC SDU#7+X. | --> | (RLC SDU#7+X) | - | - |
| 21 | The UE transmits RLC SDU#8+X. | --> | (RLC SDU#8+X) | - | - |
| 22 | The UE transmits RLC SDU#9+X. | --> | (RLC SDU#9+X) | - | - |
| 23 | The UE transmits RLC SDU#10+X. | --> | (RLC SDU#10+X) | - | - |
| 24 | The SS transmits a STATUS PDU. | <-- | STATUS PDU | - | - |
| 25 | The SS transmits an AMD PDU to the UE. | <-- | AMD PDU#11 (SN=X+10, P=0) | - | - |
| 26 | The SS starts the UL default grant transmission. | - | - | - | - |
| 27 | The UE transmits an AMD PDU with the same data as received in the corresponding DL AMD PDU. Record time TD. | --> | AMD PDU#11 (SN=X+10, P=1) | - | - |
| 28 | Check 1: Does the UE set the poll bit as both the transmission and retransmission buffers become empty? Record time TE. Check 2: Is (TE – TD ) = *t-PollRetransmit*? | --> | AMD PDU#11 (SN=X+10, P=1) | 1 | P |
| 29 | The SS transmits a STATUS PDU | <-- | STATUS PDU | - | - |
| Note 1: UL grant of 848 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU ((99 bytes RLC SDU + 3 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding) for pc\_supportOfRedCap\_r17 or (100 bytes RLC SDU + 2 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding) for pc\_supportOfRedCap\_r17=true) at a time.  Note 2: UL grant of 88 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit a Status Report with ACK\_SN(3 byte) + 2 byte MAC PDU subheader and (2 byte short BSR). 4 Bytes additional space provided to confirm UE does not include NACK\_SN and conformant UE instead will include MAC Padding.  Note 3: Every DL AMD PDU contains 1 RLC SDU size of 99 bytes for pc\_supportOfRedCap\_r17=false or 100 bytes for pc\_supportOfRedCap\_r17=true.  Note 4: Timing difference between step 11 to step 15 is equal to t-statusProhibit timer. UE starts SR from step 13 with AMD-PDU#4. 150 ms is chosen so that UE does not reach sr-transMax(n16) otherwise UE RACHes.  Note 5: Time TB should be recorded by factoring in the SR-Periodicity as configured in the *SchedulingRequestResourceConfig*->*periodicityAndOffset.* | | | | | |

7.1.2.3.8.3.3 Specific message contents

Table 7.1.2.3.8.3.3-1: *RRCReconfiguration* (step 30, Table 7.1.2.3.8.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.2.3.8.3.3-2: *CellGroupConfig* (Table 7.1.2.3.8.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 1 entry |  |  |
| RLC-BearerConfig[1] | RLC-BearerConfig | entry 1 |  |
| } |  |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig | Not present |  |  |
| spCellConfig | Not present |  |  |
| } |  |  |  |

Table 7.1.2.2.8.3.3-3: RLC-BearerConfig (Table 7.1.2.3.8.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-148 with condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-BearerConfig ::= SEQUENCE { |  |  |  |
| logicalChannelIdentity | Set to LCID of the DRB under test |  |  |
| rlc-Config | RLC-Config |  |  |
| } |  |  |  |

Table 7.1.2.2.8.3.3-4: *RLC-Config* (Table 7.1.2.3.8.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-149 with condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-Config ::= CHOICE { |  |  |  |
| am SEQUENCE { |  |  |  |
| ul-AM-RLC SEQUENCE { |  |  |  |
| sn-FieldLength | Not present |  |  |
| t-PollRetransmit | ms500 |  |  |
| } |  |  |  |
| dl-AM-RLC SEQUENCE { |  |  |  |
| sn-FieldLength | Not present |  |  |
| t-Reassembly | ms200 |  |  |
| t-StatusProhibit | ms400 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.2.3.9 AM RLC / Reassembling of AMD PDUs

7.1.2.3.9.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives AMD PDUs，and all bytes of the RLC SDU(s) with SN = x are received }

**then** { UE reassembles the RLC SDU(s) from AMD PDU(s) with SN = x }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { t-Reassembly expires }

**then** { update RX\_Highest\_Status to the SN of the first RLC SDU with SN >= RX\_Next\_Status\_Trigger for which not all bytes have been received }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {  
 **when** { UE receives AM PDU segments }

**then** { UE delivers reassembled RLC SDU to upper layer }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives duplicate RLC AM PDU segments }

**then** { UE discards duplicate RLC AMD PDU segments }

}

(5)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives RLC AMD PDU segments with segments lost }

**then** { UE transmits STATUS PDU to request retransmission of missing segments }

}

(6)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives overlapping RLC AMD PDU segments }

**then** { UE discards duplicate RLC AMD PDU byte segments }

}

(7)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives an AMD PDU with a SN gap }

**then** { UE sends STATUS PDU to request retransmissions of PDUs in the SN gap}

}

7.1.2.3.9.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: 3GPP TS 38.322 clauses 4.2.1.3.3, 5.2.3.2.1, 5.2.3.2.2, 5.2.3.2.3, 5.2.3.2.4 and 5.3.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 4.2.1.3.3]

When the receiving side of an AM RLC entity receives AMD PDUs, it shall:

- detect whether or not the AMD PDUs have been received in duplication, and discard duplicated AMD PDUs;

- detect the loss of AMD PDUs at lower layers and request retransmissions to its peer AM RLC entity;

- reassemble RLC SDUs from the received AMD PDUs and deliver the RLC SDUs to upper layer as soon as they are available.

[TS 38.322, clause 5.2.3.2.1]

The receiving side of an AM RLC entity shall maintain a receiving window according to the state variable RX\_Next as follows:

- a SN falls within the receiving window if RX\_Next <= SN < RX\_Next + AM\_Window\_Size;

- a SN falls outside of the receiving window otherwise.

When receiving an AMD PDU from lower layer, the receiving side of an AM RLC entity shall:

- either discard the received AMD PDU or place it in the reception buffer (see sub clause 5.2.3.2.2);

- if the received AMD PDU was placed in the reception buffer:

- update state variables, reassemble and deliver RLC SDUs to upper layer and start/stop t-Reassembly as needed (see sub clause 5.2.3.2.3).

When t-Reassembly expires, the receiving side of an AM RLC entity shall:

- update state variables and start t-Reassembly as needed (see sub clause 5.2.3.2.4).

[TS 38.322, clause 5.2.3.2.2]

When an AMD PDU is received from lower layer, where the AMD PDU contains byte segment numbers y to z of an RLC SDU with SN = x, the receiving side of an AM RLC entity shall:

- if x falls outside of the receiving window; or

- if byte segment numbers y to z of the RLC SDU with SN = x have been received before:

- discard the received AMD PDU.

- else:

- place the received AMD PDU in the reception buffer;

- if some byte segments of the RLC SDU contained in the AMD PDU have been received before:

- discard the duplicate byte segments.

[TS 38.322, clause 5.2.3.2.3]

When an AMD PDU with SN = x is placed in the reception buffer, the receiving side of an AM RLC entity shall:

- if x >= RX\_Next\_Highest

- update RX\_Next\_Highest to x+ 1.

- if all bytes of the RLC SDU with SN = x are received:

- reassemble the RLC SDU from AMD PDU(s) with SN = x, remove RLC headers when doing so and deliver the reassembled RLC SDU to upper layer;

- if x = RX\_Highest\_Status,

- update RX\_Highest\_Status to the SN of the first RLC SDU with SN > current RX\_Highest\_Status for which not all bytes have been received.

- if x = RX\_Next:

- update RX\_Next to the SN of the first RLC SDU with SN > current RX\_Next for which not all bytes have been received.

- if t-Reassembly is running:

- if RX\_Next\_Status\_Trigger = RX\_Next; or

- if RX\_Next\_Status\_Trigger = RX\_Next + 1 and there is no missing byte segment of the SDU associated with SN = RX\_Next before the last byte of all received segments of this SDU; or

- if RX\_Next\_Status\_Trigger falls outside of the receiving window and RX\_Next\_Status\_Trigger is not equal to RX\_Next + AM\_Window\_Size:

- stop and reset t-Reassembly.

- if t-Reassembly is not running (includes the case t-Reassembly is stopped due to actions above):

- if RX\_Next\_Highest> RX\_Next +1; or

- if RX\_Next\_Highest = RX\_Next + 1 and there is at least one missing byte segment of the SDU associated with SN = RX\_Next before the last byte of all received segments of this SDU:

- start t-Reassembly;

- set RX\_Next\_Status\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 5.2.3.2.4]

When t-Reassembly expires, the receiving side of an AM RLC entity shall:

- update RX\_Highest\_Status to the SN of the first RLC SDU with SN >= RX\_Next\_Status\_Trigger for which not all bytes have been received;

- if RX\_Next\_Highest> RX\_Highest\_Status +1: or

- if RX\_Next\_Highest = RX\_Highest\_Status + 1 and there is at least one missing byte segment of the SDU associated with SN = RX\_Highest\_Status before the last byte of all received segments of this SDU:

- start t-Reassembly;

- set RX\_Next\_Status\_Trigger to RX\_Next\_Highest.

[TS 38.322, clause 5.3.4]

An AM RLC entity sends STATUS PDUs to its peer AM RLC entity in order to provide positive and/or negative acknowledgements of RLC SDUs (or portions of them).

Triggers to initiate STATUS reporting include:

- Polling from its peer AM RLC entity:

- When an AMD PDU with SN = x and the P field set to "1" is received from lower layer, the receiving side of an AM RLC entity shall:

- if the AMD PDU is to be discarded as specified in subclause 5.2.3.2.2; or

- if x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size:

- trigger a STATUS report.

- else:

- delay triggering the STATUS report until x < RX\_Highest\_Status or x >= RX\_Next + AM\_Window\_Size.

NOTE 1: This ensures that the RLC Status report is transmitted after HARQ reordering.

- Detection of reception failure of an AMD PDU

- The receiving side of an AM RLC entity shall trigger a STATUS report when t-Reassembly expires.

NOTE 2: The expiry of t-Reassembly triggers both RX\_Highest\_Status to be updated and a STATUS report to be triggered, but the STATUS report shall be triggered after RX\_Highest\_Status is updated.

When STATUS reporting has been triggered, the receiving side of an AM RLC entity shall:

- if *t-StatusProhibit* is not running:

- at the first transmission opportunity indicated by lower layer, construct a STATUS PDU and submit it to lower layer.

- else:

- at the first transmission opportunity indicated by lower layer after *t-StatusProhibit* expires, construct a single STATUS PDU even if status reporting was triggered several times while *t-StatusProhibit* was running and submit it to lower layer.

When a STATUS PDU has been submitted to lower layer, the receiving side of an AM RLC entity shall:

- start *t-StatusProhibit*.

When constructing a STATUS PDU, the AM RLC entity shall:

- for the RLC SDUs with SN such that RX\_Next <= SN < RX\_Highest\_Status that has not been completely received yet, in increasing SN order of RLC SDUs and increasing byte segment order within RLC SDUs, starting with SN = RX\_Next up to the point where the resulting STATUS PDU still fits to the total size of RLC PDU(s) indicated by lower layer:

- for an RLC SDU for which no byte segments have been received yet:

- include in the STATUS PDU a NACK\_SN which is set to the SN of the RLC SDU.

- for a continuous sequence of byte segments of a partly received RLC SDU that have not been received yet:

- include in the STATUS PDU a set of NACK\_SN, SOstart and SOend.

- for a continuous sequence of RLC SDUs that have not been received yet:

- include in the STATUS PDU a set of NACK\_SN and NACK range;

- include in the STATUS PDU, if required, a pair of SOstart and SOend.

- set the ACK\_SN to the SN of the next not received RLC SDU which is not indicated as missing in the resulting STATUS PDU.

When STATUS reporting has been triggered, the receiving side of an AM RLC entity shall:

- if *t-StatusProhibit* is not running:

- at the first transmission opportunity indicated by lower layer, construct a STATUS PDU and submit it to lower layer.

- else:

- at the first transmission opportunity indicated by lower layer after *t-StatusProhibit* expires, construct a single STATUS PDU even if status reporting was triggered several times while *t-StatusProhibit* was running and submit it to lower layer.

When a STATUS PDU has been submitted to lower layer, the receiving side of an AM RLC entity shall:

- start *t-StatusProhibit*.

When constructing a STATUS PDU, the AM RLC entity shall:

- for the RLC SDUs with SN such that RX\_Next <= SN < RX\_Highest\_Status that has not been completely received yet, in increasing SN order of RLC SDUs and increasing byte segment order within RLC SDUs, starting with SN = RX\_Next up to the point where the resulting STATUS PDU still fits to the total size of RLC PDU(s) indicated by lower layer:

- for an RLC SDU for which no byte segments have been received yet:

- include in the STATUS PDU a NACK\_SN which is set to the SN of the RLC SDU.

- for a continuous sequence of byte segments of a partly received RLC SDU that have not been received yet:

- include in the STATUS PDU a set of NACK\_SN, SOstart and SOend.

- for a continuous sequence of RLC SDUs that have not been received yet:

- include in the STATUS PDU a set of NACK\_SN and NACK range;

- include in the STATUS PDU, if required, a pair of SOstart and SOend.

- set the ACK\_SN to the SN of the next not received RLC SDU which is not indicated as missing in the resulting STATUS PDU.

7.1.2.3.9.3 Test description

7.1.2.3.9.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception that the AM DRB is configured according to Table 7.1.2.3.9.3.1-1.

Table 7.1.2.3.9.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Parameter | Value |
| *t-Reassembly* | ms150 |
| *t-StatusProhibit* | ms300 |
| *t-PollRetransmit* | ms500 |

7.1.2.3.9.3.2 Test procedure sequence

Table 7.1.2.3.9.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure |  | Message Sequence | TP | Verdict |
|  |  | U - S | Message/PDU/SDU |  |  |
| 0 | The SS stops the UL grant transmission. | - | - | - | - |
| 1 | The SS transmits AMD PDU#1 containing a complete RLC SDU#4 (89 bytes and SI field=00). (Note 4) | <-- | AMD PDU#1 (SN=3) | - | - |
|
| 2 | The SS transmits AMD PDU#2 containing the last segment (44 bytes) of RLC SDU#1 (SI field=10, SO=45). | <-- | AMD PDU#2 (SN=0) segment 2 | - | - |
|
| 3 | The SS transmits AMD PDU#3 containing the last segment (44 bytes) of RLC SDU#2 (SI field=10, SO=45). | <-- | AMD PDU#3 (SN=1) segment 2 | - | - |
|
| 4 | The SS transmits AMD PDU#4 containing the first segment (45 bytes) of RLC SDU#2 (SI field=01). | <-- | AMD PDU#4 (SN=1) segment 1 | - | - |
|
| 5 | The SS transmits AMD PDU#5 containing the first segment (45 bytes) of RLC SDU#1 (SI field =01). | <-- | AMD PDU#5 (SN=0) segment 1 | - | - |
|
| 6 | The SS waits for 20 ms then SS transmits 2 uplink grants with a time spacing of 20 ms. (Note 1) | <-- | UL Grants | - | - |
| 7 | Check: Does the UE transmit an AMD PDU containing RLC SDU#1 in its data field? | --> | AMD PDU (RLC SDU#1) | 1,3 | P |
| 8 | Check: Does the UE transmit an AMD PDU containing RLC SDU#2 in its data field? | --> | AMD PDU (RLC SDU#2) | 1,3 | P |
| 9 | Void |  |  |  |  |
| 9A | 110 ms after step 5 the SS starts the UL default grant transmission. | <-- | UL Grant | - | - |
| 10 | Wait for t-reassembly of UE side to expire.  Check: Does the UE transmit an RLC STATUS PDU with NACK\_SN=2 and ACK\_SN=4 to correctly to inform SS of missing RLC SDU#3? | --> | STATUS PDU (ACK\_SN=4, NACK\_SN=2) | 2,7 | P |
| 10A | The SS stops the UL grant transmission. | - | - | - | - |
| 11 | 120 ms after step 10 the SS transmits AMD PDU#6 containing the first 45 bytes of SDU#3 in its data field. SO=0 and LSF=0. No header extension part is provided.(Note 5) | <-- | AMD PDU#6 (SN=2)  segment 1 | - | - |
| 11A | 20 ms after step 11 the SS transmits AMD PDU#6 containing the first 45 bytes of SDU#3 in its data field. SO=0 and LSF=0. No header extension part is provided. | <-- | AMD PDU#6 (SN=2)  segment 1 | - | - |
| 12 | 40 ms after step 11 the SS transmits AMD PDU#12 containing the last 44 bytes of SDU#3 in its data field, with the P-bit set. SO=45 and LSF=1. No header extension part is provided. | <-- | AMD PDU#12 (SN=2, P=1)  segment 2 | - | - |
| 13 | After the expiry of t-StatusProhibit timer started at step 10, the SS assigns 1 UL grant (UL grant allocation type 3) of size 88 bits. (Note 2) | <-- | UL Grant | - | - |
| 14 | Check: Does the UE transmit a STATUS PDU with ACK\_SN=4, thus acknowledging the reception of PDUs with SN=0 to SN=3, and no NACK\_SN provided? | --> | STATUS PDU | 1,3,4 | P |
| 14A | The SS waits for 40 ms to ensure UE has all the required SDUs available and then assigns 2 UL grants of 768 bits (Note 1). | <-- | UL Grant | - | - |
| 15 | Check: Does the UE transmit RLC SDU#3? | --> | (RLC SDU#3) | 1,3,4 | P |
| 15A | Check: Does the UE transmit RLC SDU#4 with the P-bit set? | --> | (RLC SDU#4) | 1,3,4 | P |
| 16 | The SS transmits a STATUS PDU. | <-- | STATUS PDU (ACK SN=4) | - | - |
| 17 | The SS transmits AMD PDU#7 containing the last segment (44 bytes) of RLC SDU#5 (SI field=10, SO=45). | <-- | AMD PDU#7 (SN=4) segment 2 | - | - |
| 17A | The SS starts the UL default grant transmission. | <-- | UL Grant | - | - |
| 18 | Wait for t-reassembly of UE side to expire.  Check: Does the UE transmit an RLC STATUS PDU with ACK\_SN=5, NACK\_SN=4 with SOStart=0 and SOEnd=44? | --> | STATUS PDU (ACK\_SN=5, NACK\_SN=4 with SOStart=0 /SOEnd=44) | 2,5 | P |
| 18A | The SS stops the UL grant transmission. | - | - | - | - |
| 19 | 160 ms after step 18 The SS transmits AMD PDU#8 containing the first segment (45 bytes) of RLC SDU#5 (SI field=01). (Note 6) | <-- | AMD PDU#8 (SN=4, P=1) segment 1 | - | - |
| 20 | Void |  |  |  |  |
| 21 | Void |  |  |  |  |
| 21A | After the expiry of t-StatusProhibit timer started at step 18, the SS assigns 1 UL grant (UL grant allocation type 3) of size 88 bits. (Note 2) | <-- | UL Grant | - | - |
| 22 | Check: Does the UE transmit an RLC STATUS PDU with ACK\_SN=5? | --> | STATUS PDU (ACK\_SN=5) | 1,3,5 | P |
| 22A | The SS waits for 100 ms then SS transmits one uplink grant. (Note 1) | <-- | UL Grant | - | - |
| 22B | Check: Does the UE transmit an AMD PDU containing RLC SDU#5 in its data field with the P-bit set? | --> | AMD PDU (RLC SDU#5) | 1,3,5 | P |
| 22C | The SS transmits a STATUS PDU | <-- | STATUS PDU (ACK SN=5) |  |  |
| 23 | The SS transmits AMD PDU#9 containing the last 29 bytes of RLC SDU#6 (SI field=10, SO=60). | <-- | AMD PDU#9 (SN=5) segment 3 | - | - |
| 23A | The SS starts the UL default grant transmission. | <-- | UL Grant | - | - |
| 24 | Wait for t-reassembly of UE side to expire.  Check: Does the UE transmit an RLC STATUS PDU with ACK\_SN=6, NACK\_SN=5 with SOStart=0 and SOEnd=59? | --> | STATUS PDU  (ACK\_SN=6, NACK\_SN=5 with SOStart=0 / SOEnd=59) | 2,5 | P |
| 25 | The SS transmits AMD PDU#10 containing the last 49 byte of RLC SDU#6 (SI field=10, SO=40). | <-- | AMD PDU#10 (SN=5)  segment 2 | - | - |
| 25A | Void. |  |  |  |  |
| 26 | Wait for t-reassembly of UE side to expire.  Check: Does the UE transmit an RLC STATUS PDU with ACK\_SN=6, NACK\_SN=5 with SOStart=0 and SOEnd=39? | --> | STATUS PDU (ACK\_SN=6, NACK\_SN=5 with SOStart=0 / SOEnd=39) | 2,6 | P |
| 26A | The SS stops the UL grant transmission. | - | - | - | - |
| 27 | 160 ms after step 26 The SS transmits AMD PDU#11 containing the first 40 bytes of RLC SDU#6 (SI field =01). | <-- | AMD PDU#11 (SN=5, P=1)  segment 1 | - | - |
| 28 | Void |  |  |  |  |
| 29 | Void |  |  |  |  |
| 29A | After the expiry of t-StatusProhibit timer started at step 26, the SS assigns 1 UL grant (UL grant allocation type 3) of size 88 bits. (Note 2, Note 7) | <-- | UL Grant | - | - |
| 30 | Check: Does the UE transmit an RLC STATUS PDU with ACK\_SN=6, thus acknowledging the reception of RLC SDUs with SN=0 to SN=5, and no NACK\_SN provided? | --> | STATUS PDU (ACK\_SN=6) | 1,3,6 | P |
| 30A | The SS transmits one uplink grant. (Note 1) | <-- | UL Grant | - | - |
| 30B | Check: Does the UE transmit an AMD PDU containing RLC SDU#6 in its data field with the P-bit set? | --> | AMD PDU (RLC SDU#6) | 1,3,6 | P |
| 31 | The SS transmits a STATUS PDU. | <-- | STATUS PDU (ACK SN=6) | - | - |
| Note 1: UL grant of 768 bits(LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU at a time( 89 bytes RLC SDU + 3 bytes RLC Header + 2 bytes MAC Sub PDU header + 2 bytes for short BSR or padding) for pc\_supportOfRedCap\_r17=false, or one PDU (89 bytes RLC SDU + 2 bytes RLC Header + 2 bytes MAC Sub PDU header + 3 bytes for short BSR and padding or only padding) for pc\_supportOfRedCap\_r17=true.  Note 2: UL grant of 88 bits (LRBs & IMCS as per 38.523-3 [3] annex B) is chosen to allow the UE to transmit a Status Report with ACK\_SN(3 byte) + 2 Bytes MAC PDU subheader and (2 Bytes short BSR). 4 Bytes additional space provided to confirm UE does include resp. does not include NACK\_SN and conformant UE instead will include MAC Padding.  Note 3: Void  Note 4: The PDUs in steps 1-5 are scheduled with a 20 ms time spacing. The UL grant provision in step 6 is scheduled 20 ms later That way this step sequence takes less than t-Reassembly.  Note 5: Timing difference between step 10 to step 14 is equal to t-statusProhibit timer. UE starts SR from step 12. 120 ms is chosen so that UE does not reach sr-transMax(n16) otherwise UE RACHes.  Note 6: Timing difference between step 18 to step 22 is equal to t-statusProhibit timer. UE starts SR from step 19. 160 ms is chosen so that UE does not reach sr-transMax(n16) otherwise UE RACHes.  Note 7: Timing difference between step 26 to step 30 is equal to t-statusProhibit timer. UE starts SR from step 27. 160 ms is chosen so that UE does not reach sr-transMax(n16) otherwise UE RACHes. | | | | | |

7.1.2.3.9.3.3 Specific message contents

None.

##### 7.1.2.3.10 AM RLC / Re-transmission of RLC PDU with and without re-segmentation

7.1.2.3.10.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives a STATUS PDU including a NACK\_SN for missing AMD PDUs and missing AMD PDUs can be transmitted as indicated by lower layer at the particular transmission opportunity }

**then** { UE successfully retransmits missing AMD PDUs without re-segmentation }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { NACK received for missing AMD PDUs and RETX\_COUNT < maxRetxThreshold }

**then** { UE retransmits AMD PDUs }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { AMD PDU to be retransmitted does not fit in new allocated TBS }

**then** { UE segments AMD PDU }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { AMD PDU segment to be retransmitted does not fit in new allocated TBS }

**then** { UE re-segments AMD PDU segment to fit TBS }

}

7.1.2.3.10.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.322, clauses 5.3.2, 6.2.2.5, 6.2.3.3, 6.2.3.4, 6.2.3.5, 6.2.3.7, 6.2.3.10, 6.2.3.12, 6.2.3.14 and 6.2.3.15. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.3.2]

The transmitting side of an AM RLC entity can receive a negative acknowledgement (notification of reception failure by its peer AM RLC entity) for an RLC SDU or an RLC SDU segment by the following:

- STATUS PDU from its peer AM RLC entity.

When receiving a negative acknowledgement for an RLC SDU or an RLC SDU segment by a STATUS PDU from its peer AM RLC entity, the transmitting side of the AM RLC entity shall:

- if the SN of the corresponding RLC SDU falls within the range TX\_Next\_Ack <= SN < = the highest SN of the AMD PDU among the AMD PDUs submitted to lower layer:

- consider the RLC SDU or the RLC SDU segment for which a negative acknowledgement was received for retransmission.

When an RLC SDU or an RLC SDU segment is considered for retransmission, the transmitting side of the AM RLC entity shall:

- if the RLC SDU or RLC SDU segment is considered for retransmission for the first time:

- set the RETX\_COUNT associated with the RLC SDU to zero.

- else, if it (the RLC SDU or the RLC SDU segment that is considered for retransmission) is not pending for retransmission already and the RETX\_COUNT associated with the RLC SDU has not been incremented due to another negative acknowledgment in the same STATUS PDU:

- increment the RETX\_COUNT.

- if RETX\_COUNT = *maxRetxThreshold*:

- indicate to upper layers that max retransmission has been reached.

When retransmitting an RLC SDU or an RLC SDU segment, the transmitting side of an AM RLC entity shall:

- if needed, segment the RLC SDU or the RLC SDU segment;

- form a new AMD PDU which will fit within the total size of AMD PDU(s) indicated by lower layer at the particular transmission opportunity;

- submit the new AMD PDU to lower layer.

When forming a new AMD PDU, the transmitting side of an AM RLC entity shall:

- only map the original RLC SDU or RLC SDU segment to the Data field of the new AMD PDU;

- modify the header of the new AMD PDU in accordance with the description in sub clause 6.2.2.4;

- set the P field according to sub clause 5.3.3.

[TS 38.322, clause 6.2.2.4]

AMD PDU consists of a Data field and an AMD PDU header. The AMD PDU header is byte aligned.

An AM RLC entity is configured by RRC to use either a 12 bit SN or a 18 bit SN. The length of the AMD PDU header is two and three bytes respectively.

An AMD PDU header contains a D/C, a P, a SI, and a SN. An AMD PDU header contains the SO field only when the Data field consists of an RLC SDU segment which is not the first segment, in which case a 16 bit SO is present.



Figure 6.2.2.4-1: AMD PDU with 12 bit SN (No SO)



Figure 6.2.2.4-2: AMD PDU with 18 bit SN (No SO)



Figure 6.2.2.4-3: AMD PDU with 12 bit SN with SO



Figure 6.2.2.4-4: AMD PDU with 18 bit SN with SO

[TS 38.322, clause 6.2.2.5]

STATUS PDU consists of a STATUS PDU payload and an RLC control PDU header.

RLC control PDU header consists of a D/C and a CPT field.

The STATUS PDU payload starts from the first bit following the RLC control PDU header, and it consists of one ACK\_SN and one E1, zero or more sets of a NACK\_SN, an E1, an E2 and an E3, and possibly a pair of a SOstart and a SOend or a NACK range field for each NACK\_SN.



Figure 6.2.2.5-1: STATUS PDU with 12 bit SN



Figure 6.2.2.5-2: STATUS PDU with 18 bit SN

[TS 38.322, clause 6.2.3.3]

Length: 12 bits or 18 bits (configurable) for AMD PDU. 6 bits or 12 bits (configurable) for UMD PDU.

The SN field indicates the sequence number of the corresponding RLC SDU. For RLC AM, the sequence number is incremented by one for every RLC SDU. For RLC UM, the sequence number is incremented by one for every segmented RLC SDU.

[TS 38.322, clause 6.2.3.4]

Length: 2 bits.

The SI field indicates whether an RLC PDU contains a complete RLC SDU or the first, middle, last segment of an RLC SDU.

Table 6.2.3.4-1: SI field interpretation

|  |  |
| --- | --- |
| Value | Description |
| 00 | Data field contains all bytes of an RLC SDU |
| 01 | Data field contains the first segment of an RLC SDU |
| 10 | Data field contains the last segment of an RLC SDU |
| 11 | Data field contains neither the first nor last segment of an RLC SDU |

[TS 38.322, clause 6.2.3.5]

Length: 16 bits

The SO field indicates the position of the RLC SDU segment in bytes within the original RLC SDU. Specifically, the SO field indicates the position within the original RLC SDU to which the first byte of the RLC SDU segment in the Data field corresponds. The first byte of the original RLC SDU is referred by the SO field value "0000000000000000", i.e., numbering starts at zero.

[TS 38.322, clause 6.2.3.7]

Length: 1 bit.

The P field indicates whether or not the transmitting side of an AM RLC entity requests a STATUS report from its peer AM RLC entity. The interpretation of the P field is provided in Table 6.2.3.7-1.

Table 6.2.3.7-1: P field interpretation

|  |  |
| --- | --- |
| Value | Description |
| 0 | Status report not requested |
| 1 | Status report is requested |

[TS 38.322, clause 6.2.3.10]

Length: 12 bits or 18 bits (configurable).

The ACK\_SN field indicates the SN of the next not received RLC SDU which is not reported as missing in the STATUS PDU. When the transmitting side of an AM RLC entity receives a STATUS PDU, it interprets that all RLC SDUs up to but not including the RLC SDU with SN = ACK\_SN have been received by its peer AM RLC entity, excluding those RLC SDUs indicated in the STATUS PDU with NACK\_SN, portions of RLC SDUs indicated in the STATUS PDU with NACK\_SN, SOstart and SOend, RLC SDUs indicated in the STATUS PDU with NACK\_SN and NACK\_range, and portions of RLC SDUs indicated in the STATUS PDU with NACK\_SN, NACK range, SOstart and SOend.

[TS 38.322, clause 6.2.3.12]

Length: 12 bits or 18 bits (configurable).

The NACK\_SN field indicates the SN of the RLC SDU (or RLC SDU segment) that has been detected as lost at the receiving side of the AM RLC entity.

[TS 38.322, clause 6.2.3.14]

Length: 16 bits.

The SOstart field (together with the SOend field) indicates the portion of the RLC SDU with SN = NACK\_SN (the NACK\_SN for which the SOstart is related to) that has been detected as lost at the receiving side of the AM RLC entity. Specifically, the SOstart field indicates the position of the first byte of the portion of the RLC SDU in bytes within the original RLC SDU. The first byte of the original RLC SDU is referred by the SOstart field value "0000000000000000", i.e., numbering starts at zero.

[TS 38.322, clause 6.2.3.15]

Length: 16 bits.

When E3 is 0, the SOend field (together with the SOstart field) indicates the portion of the RLC SDU with SN = NACK\_SN (the NACK\_SN for which the SOend is related to) that has been detected as lost at the receiving side of the AM RLC entity. Specifically, the SOend field indicates the position of the last byte of the portion of the RLC SDU in bytes within the original RLC SDU. The first byte of the original RLC SDU is referred by the SOend field value "0000000000000000", i.e., numbering starts at zero. The special SOend value "1111111111111111" is used to indicate that the missing portion of the RLC SDU includes all bytes to the last byte of the RLC SDU.

When E3 is 1, the SOend field indicates the portion of the RLC SDU with SN = NACK\_SN + NACK range - 1 that has been detected as lost at the receiving side of the AM RLC entity. Specifically, the SOend field indicates the position of the last byte of the portion of the RLC SDU in bytes within the original RLC SDU. The first byte of the original RLC SDU is referred by the SOend field value "0000000000000000", i.e., numbering starts at zero. The special SOend value "1111111111111111" is used to indicate that the missing portion of the RLC SDU includes all bytes to the last byte of the RLC SDU.

7.1.2.3.10.3 Test description

7.1.2.3.10.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception for the AM DRB is configured according to Tables 7.1.2.3.10.3.1-1.

Table 7.1.2.3.10.3.1-1: RLC settings

|  |  |
| --- | --- |
| Parameter | Value |
| *t-PollRetransmit* | ms150 |

7.1.2.3.10.3.2 Test procedure sequence

Table 7.1.2.3.10.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits one AMD PDU containing SDU#1 (91 bytes) in its data field. | <-- | AMD PDU#1 | - | - |
| 2 | The UE transmits one AMD PDU containing SDU#1 in its data field. | --> | AMD PDU#1 (SN=0) | - | - |
| 3 | The SS transmits one AMD PDU containing SDU#2 (91 bytes) in its data field. | <-- | AMD PDU#2 | - | - |
| 4 | The UE transmits one AMD PDU containing SDU#2 in its data field. | --> | AMD PDU#2 (SN=1) | - | - |
| 5 | The SS transmits a RLC STATUS PDU. ACK\_SN=2, NACK\_SN=0. | <-- | STATUS PDU | - | - |
| 6 | Check: Does the UE transmit the AMD PDU not yet acknowledged? | --> | AMD PDU#1 (SN=0) | 1 | P |
| 7 | The SS transmits a RLC STATUS PDU. ACK\_SN=2. | <-- | STATUS PDU | - | - |
| 8 | The SS transmits one AMD PDU containing SDU#3 (91 bytes) in its data field. | <-- | AMD PDU#3 | - | - |
| 9 | The UE transmits an AMD PDU containing SDU#3 in its data field. | --> | AMD PDU#3 (SN=2) | - | - |
| - | EXCEPTION: Steps 10 to 11 shall be repeated until RETX\_COUNT= maxRetxThreshold-1. | - | - | - | - |
| 10 | The SS transmits a RLC STATUS PDU. ACK\_SN=3 and NACK\_SN=2. | <-- | STATUS PDU | - | - |
| 11 | Check: Does the UE retransmit the AMD PDU not yet acknowledged? | --> | AMD PDU#3 (SN=2) | 2 | P |
| 12 | The SS transmits a RLC STATUS PDU. ACK\_SN=3. | <-- | STATUS PDU | - | - |
| 13 | The SS stops the UL grant transmission. | - | - | - | - |
| 14 | The SS transmits one AMD PDU containing SDU#4 (91 bytes) in its data field. | <-- | AMD PDU#4 (SN=3) | - | - |
| 15 | The SS waits for 60 ms and allocates one UL grant of size 808 bits.  (Note 1) | <-- | (UL grant, 808 bits) | - | - |
| 16 | The UE transmits an AMD PDU with the same data contents as received in the corresponding part of SDU#4? | --> | AMD PDU#4 (SN=3) | - | - |
| 17 | The SS transmits a STATUS PDU. This PDU nacks the AMD PDU with SN=3. ACK\_SN=4 and NACK\_SN=3. | <-- | STATUS PDU | - | - |
| 18 | The SS waits for 100 ms and then allocates 1 UL grant of size 408 bits (Note 2) | <-- | (UL grant, 408 bits) | - | - |
| 18A | The SS waits for 20 ms and then allocates 1 UL grant of size 456 bits (Note 5) | <-- | (UL grant, 456 bits) | - | - |
| 19 | Check: Does the UE transmit an SDU segment with SI=01 and SOEnd=43+X (Note 7) and the same data contents at the received positions as in the original SDU#4? | --> | SDU#4 segment 1 (SN=3) | 3 | P |
| 20 | Check: Does the UE transmit an SDU segment with SI=10 and SOStart=44+X (Note 7) and the same data contents at the received positions as in the original SDU#4? | --> | SDU#4 segment 2 (SN=3) | 3 | P |
| 21 | After 100 ms SS transmits a STATUS PDU. This PDU nacks the SDU with SN=3. NACK\_SN=3, SOStart=0, SOEnd=43+X (Note 7) and ACK\_SN=4. | <-- | STATUS PDU | - | - |
| 22 | The SS waits for 100 ms and then allocates 2 UL grants (UL grant allocation type 2) at an interval of 20 ms of size 240 bits (Note 3, Note 6) | <-- | (UL grant, 240 bits) | - | - |
| 22A | Void |  |  | - | - |
| 23 | Check: Does the UE transmit an AMD PDU segment with SI=01 and SOEnd=22+X (Note 7) and the same data contents at the received positions as in the original SDU#4? | --> | SDU#4 segment 1, first part (SN=3) | 4 | P |
| 24 | Check: Does the UE transmit an AMD PDU segment with SI=11, SOStart=23+X (Note 7) and the same data contents at the received positions as in the original SDU#4? | --> | SDU#4 segment 1, second part (SN=3) | 4 | P |
| 25 | The SS transmits a STATUS PDU. This PDU acks the AMD PDUs with SN=3. ACK\_SN=4. | <-- | STATUS PDU | - | - |
| Note 1: UL grant of 808 bits=101 bytes (LRBs & IMCS as per 38.523-3[3] annex B) is chosen to allow the UE to transmit one PDU (91 bytes RLC SDU and 3 bytes RLC Header and 2 bytes MAC Sub PDU header and 2 bytes short BSR + 3 bytes padding or 5 bytes padding) for pc\_supportOfRedCap\_r17=false, or one PDU (91 bytes RLC SDU and 2 bytes RLC Header and 2 bytes MAC Sub PDU header and 2 bytes short BSR + 4 bytes padding or 6 bytes padding) for pc\_supportOfRedCap\_r17=true at a time.  Note 2: UL grant of 408 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen such that UE will segment into 2 AMD PDUs. MAC PDU of 408 bits=51 bytes fit an AMD PDU payload of 44 bytes + 3 bytes for the segment 1 of the AMD PDU header + 2 bytes for MAC header + 2 bytes of MAC BSR CE for pc\_supportOfRedCap\_r17 =false, or an AMD PDU payload of 45 bytes + 2 bytes for the segment 1 of the AMD PDU header + 2 bytes for MAC header + 2 bytes of MAC BSR CE for pc\_supportOfRedCap\_r17=true.  Note 3: UL grant of 240 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen such that UE will segment into 2 AMD PDUs. MAC PDU of 240 bits=30 bytes fit an AMD PDU payload of = 23 bytes + 3 bytes for the segment 1 first part of the AMD PDU header + 2 bytes for MAC header + 2 bytes for MAC BSR CE for pc\_supportOfRedCap\_r17=false, or an AMD PDU payload of = 24 bytes + 2 bytes for the segment 1 first part of the AMD PDU header + 2 bytes for MAC header + 2 bytes for MAC BSR CE for pc\_supportOfRedCap\_r17=true.  Note 4: Void.  Note 5: UL grant of 456 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen such that UE will segment into 2 AMD PDUs. MAC PDU of 456 bits=57 bytes fit an AMD PDU payload of 47 bytes + 5 bytes for the segment 2 of the AMD PDU header + 2 bytes for MAC header +2 bytes for possible short BSR and 1 byte padding or only 3 bytes padding for pc\_supportOfRedCap\_r17=false, or an AMD PDU payload of 46 bytes + 4 bytes for the segment 2 of the AMD PDU header + 2 bytes for MAC header +2 bytes for possible short BSR and 3 byte padding or only 5 bytes padding for pc\_supportOfRedCap\_r17=true.  Note 6: UL grant of 240 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen such that UE will segment into 2 AMD PDUs. MAC PDU of 240 bits=30 bytes fit an AMD PDU payload of 21 bytes + 5 bytes for the segment 1 second part of the AMD PDU header + 2 bytes for MAC header +2 bytes for possible short BSR or padding for pc\_supportOfRedCap\_r17=false, or an AMD PDU payload of 21 bytes + 4 bytes for the segment 1 second part of the AMD PDU header + 2 bytes for MAC header +2 bytes for possible short BSR and 1 bytes padding or only 3 bytes padding for pc\_supportOfRedCap\_r17=true.  Note 7: X=0 for pc\_supportOfRedCap\_r17=false and X=1 for pc\_supportOfRedCap\_r17=true. | | | | | |

7.1.2.3.10.3.3 Specific message contents

None.

##### 7.1.2.3.11 AM RLC / RLC re-establishment procedure

7.1.2.3.11.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { RLC re-establishment is performed upon request by RRC }

**then** { The UE discards all RLC SDUs, RLC SDU segments, and RLC PDUs, if any }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { RLC re-establishment is performed upon request by RRC }

**then** { The UE resets all state variables to their initial values }

}

7.1.2.3.11.2 Conformance requirements

References:

The conformance requirements covered in the present test case are specified in: TS 38.322, clauses 5.1.2, 7.1 and TS 38.331 clause 5.3.11. Unless otherwise stated these are Rel-15 requirements.

[TS 38.322, clause 5.1.2]

When upper layers request an RLC entity re-establishment, the UE shall:

- discard all RLC SDUs, RLC SDU segments, and RLC PDUs, if any;

- stop and reset all timers;

- reset all state variables to their initial values.

[TS 38.322, clause 7.1]

This sub clause describes the state variables used in AM and UM entities in order to specify the RLC protocol. The state variables defined in this subclause are normative.

All state variables and all counters are non-negative integers.

All state variables related to AM data transfer can take values from 0 to 4095 for 12 bit SN or from 0 to 262143 for 18 bit SN. All arithmetic operations contained in the present document on state variables related to AM data transfer are affected by the AM modulus (i.e. final value = [value from arithmetic operation] modulo 4096 for 12 bit SN and 262144 for 18 bit SN).

All state variables related to UM data transfer can take values from 0 to 63 for 6 bit SN or from 0 to 4095 for 12 bit SN. All arithmetic operations contained in the present document on state variables related to UM data transfer are affected by the UM modulus (i.e. final value = [value from arithmetic operation] modulo 64 for 6 bit SN and 4096 for 12 bit SN).

When performing arithmetic comparisons of state variables or SN values, a modulus base shall be used.

TX\_Next\_Ack and RX\_Next shall be assumed as the modulus base at the transmitting side and receiving side of an AM RLC entity, respectively. This modulus base is subtracted from all the values involved, and then an absolute comparison is performed (e.g. RX\_Next <= SN < RX\_Next + AM\_Window\_Size is evaluated as [RX\_Next – RX\_Next] modulo 2[*sn-FieldLength*] <= [SN – RX\_Next] modulo 2[*sn-FieldLength*] < [RX\_Next + AM\_Window\_Size – RX\_Next] modulo 2[*sn-FieldLength*]), where *sn-FieldLength* is 12 or 18 for 12 bit SN and 18 bit SN, respectively.

RX\_Next\_Highest– UM\_Window\_Size shall be assumed as the modulus base at the receiving side of an UM RLC entity. This modulus base is subtracted from all the values involved, and then an absolute comparison is performed (e.g. (RX\_Next\_Highest– UM\_Window\_Size) <= SN < RX\_Next\_Highest is evaluated as [(RX\_Next\_Highest– UM\_Window\_Size) – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] <= [SN – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] < [RX\_Next\_Highest– (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*]), where *sn-FieldLength* is 6 or 12 for 6 bit SN and 12 bit SN, respectively.

The transmitting side of each AM RLC entity shall maintain the following state variables:

a) TX\_Next\_Ack – Acknowledgement state variable

This state variable holds the value of the SN of the next RLC SDU for which a positive acknowledgment is to be received in-sequence, and it serves as the lower edge of the transmitting window. It is initially set to 0, and is updated whenever the AM RLC entity receives a positive acknowledgment for an RLC SDU with SN = TX\_Next\_Ack.

b) TX\_Next – Send state variable

This state variable holds the value of the SN to be assigned for the next newly generated AMD PDU. It is initially set to 0, and is updated whenever the AM RLC entity constructs an AMD PDU with SN = TX\_Next and contains an RLC SDU or the last segment of a RLC SDU.

c) POLL\_SN – Poll send state variable

This state variable holds the value of the highest SN of the AMD PDU among the AMD PDUs submitted to lower layer when POLL\_SN is set according to sub clause 5.3.3.2. It is initially set to 0.

The transmitting side of each AM RLC entity shall maintain the following counters:

a) PDU\_WITHOUT\_POLL – Counter

This counter is initially set to 0. It counts the number of AMD PDUs sent since the most recent poll bit was transmitted.

b) BYTE\_WITHOUT\_POLL – Counter

This counter is initially set to 0. It counts the number of data bytes sent since the most recent poll bit was transmitted.

c) RETX\_COUNT – Counter

This counter counts the number of retransmissions of an RLC SDU or RLC SDU segment (see subclause 5.3.2). There is one RETX\_COUNT counter maintained per RLC SDU.

The receiving side of each AM RLC entity shall maintain the following state variables:

a) RX\_Next – Receive state variable

This state variable holds the value of the SN following the last in-sequence completely received RLC SDU, and it serves as the lower edge of the receiving window. It is initially set to 0, and is updated whenever the AM RLC entity receives an RLC SDU with SN = RX\_Next.

b) RX\_Next\_Status\_Trigger – *t-Reassembly* state variable

This state variable holds the value of the SN following the SN of the RLC SDU which triggered *t-Reassembly*.

c) RX\_Highest\_Status – Maximum STATUS transmit state variable

This state variable holds the highest possible value of the SN which can be indicated by "ACK\_SN" when a STATUS PDU needs to be constructed. It is initially set to 0.

d) RX\_Next\_Highest – Highest received state variable

This state variable holds the value of the SN following the SN of the RLC SDU with the highest SN among received RLC SDUs. It is initially set to 0.

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables and constant:

b) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0.

c) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

d) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0.

[TS 38.331, clause 5.3.11]

UE shall:

1> reset MAC;

1> if T302 is running:

2> stop timer T302;

2> perform the actions as specified in 5.3.14.4;

1> stop all timers that are running except T320 and T325;

1> discard the UE Inactive AS context;

1> set the variable *pendingRnaUpdate* to *false*, if that is set to *true*;

1> discard the KgNB, the KRRCenc key, the KRRCint, the KUPint key and the KUPenc key, if any;

1> release all radio resources, including release of the RLC entity, the MAC configuration and the associated PDCP entity and SDAP for all established RBs;

1> indicate the release of the RRC connection to upper layers together with the release cause;

1> enter RRC\_IDLE and perform cell selection as specified in TS 38.304 [20], except if going to RRC\_IDLE was triggered by selecting an inter-RAT cell while T311 was running;

1> if going to RRC\_IDLE was triggered by reception of the *RRCRelease* message including a *waitTime*:

2> start timer T302 with the value set to the *waitTime*;

2> inform the upper layer that access barring is applicable for all access categories except categories '0' and '2'.

7.1.2.3.11.3 Test description

7.1.2.3.11.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.2.1.1 with the exception for the AM DRB is configured according to Table 7.1.2.3.11.3.1-1.

Table 7.1.2.3.11.3.1-1: RLC parameters

|  |  |
| --- | --- |
| Parameter | Value |
| *t-Reassembly* | ms200 |
| *t-PollRetransmit* | ms4000 |

Table 7.1.2.3.11.3.1-2: PDCP parameters

|  |  |
| --- | --- |
| Parameter | Value |
| *t-Reordering* | ms160 |
| *statusReportRequired* | Not present |

7.1.2.3.11.3.2 Test procedure sequence

Table 7.1.2.3.11.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | The SS ignores scheduling requests and does not allocate any uplink grant. | - | - | - | - |
| 1 | The SS creates 2 RLC SDUs of size 40 bytes segmented into two AMD PDUs each. AMD PDU#1 and AMD PDU#2 belong to RLC SDU#1, AMD PDU#3 and #4 belong to RLC SDU#2. SS transmits AMD PDU#1 (SN=0), AMD PDU#2 (SN=0) and AMD PDU#4 (SN=1). | <-- | AMD PDU#1  AMD PDU#2  AMD PDU#4 | - | - |
| 2 | 60 ms after sending PDU#1 in step 1 the SS allocates 1 UL grant of default size. | <-- | (UL grant) | - | - |
| 3 | The UE returns RLC SDU#1. | --> | (RLC SDU#1) | - | - |
| 4 | The SS does not acknowledge the reception of RLC SDU#1. | - | - | - | - |
| 5 | The SS transmits NR RRC*R*econfiguration message to trigger RLC re-establishment on DRB using Reconfig with sync procedure.  (Note 1) (Note 4) (Note 6) (Note 7) | <-- | *RRCReconfiguration* | - | - |
| 6 | The SS starts the UL default grant transmissions and for NR sets UL grant in Random Access Msg4 to allow the UE to send step7 and step 8 together. (Note 10) | *-* | - | - | - |
| - | EXCEPTION: Steps 7 and 8 can occur in any order. (Note 8) | - | *-* | - | - |
| 7 | The UE transmits a NR RRCReconfigurationComplete message. (Note 5) | --> | *RRCReconfigurationComplete* | - | - |
| 8 | The UE retransmits RLC SDU #1 (SN=0).  (Note 2) | --> | (RLC SDU#1) | - | - |
| 9 | SS transmits a STATUS PDU (ACK\_SN = 1). | <-- | STATUS PDU | - | - |
| 10 | SS transmits AMD PDU#3 with SN=0 and the P field set to "1" | <-- | AMD PDU#3 | - | - |
| 11 | Void |  |  |  |  |
| 12 | Check: For 1 second, does the UE return RLC SDU#2  (Note 3) | --> | (RLC SDU#2) | 1 | F |
| 13 | SS transmits AMD PDU#4 with SN=0 | <-- | AMD PDU#4 | - | - |
| 13A | UE transmits a STATUS PDU (ACK\_SN=1)  (Note 9) | --> | STATUS PDU | - | - |
| 14 | Check: Does the UE return RLC SDU#2 with SN=1?  (Note 9) | --> | (RLC SDU#2) | 2 | P |
| 15 | SS transmits a STATUS PDU (ACK\_SN = 2) | <-- | STATUS PDU | - | - |
| Note 1: Upon a RLC re-establishment a conformant UE discards any remaining AMD PDUs in the receiver and transmitter side, stops and resets all timers and resets all state variables to their initial values.  Note 2: The UE will retransmit the PDCP SDU associated with RLC SDU#1 in accordance to TS 38.323 clause 5.5  Note 3: AMD PDU#4 is discarded by a conformant UE in step 5.  Note 4: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_EmbedNR\_RRCRecon, EN-DC\_PSCell\_HO and RBConfig\_NoKeyChange.  Note 5: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 6: For NR, the RRCReconfiguration message is as per RRCReconfiguration-HO with condition RBConfig\_NoKeyChange according to 38.508-1 [4], Table 4.8.1-1A.  Note 7: The expiry of t-Reassembly timer started in step 1 will trigger STATUS PDU from the UE. This starts SR. The RRC reconfiguration is scheduled 300 ms in advance. sr-transMax is therefore set to n32 so that the UE does not reach sr-transMax and then RACHes before reconfiguring.  Note 8: Per 38.508-1 Table 4.6.3-66: *LogicalChannelConfig*, both SRB1 and DRB have the same logical channel priority with prioritisedBitRate as infinity.  Note 9 RLC PDUs at steps 13A and 14 may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot).  Note 10: For NR, UL grant in Random Access Msg4 of 480 bits (LRBs & IMCS as per 38.523-3[3] annex B) is chosen such that UE is allowed to send 12 bytes for RRCReconfigurationComplete + 44 or 45 bytes for RLC SDU #1 + 3 or 4 bytes for MAC BSR or padding. The MAC subPDU size for RRCReconfigurationComplete is 12 bytes with 2 bytes MAC Header+ 2 bytes RLC Header+6 bytes PDCP Header with MAC-I+2bytes RRC message. The MAC subPDU size for RLC SDU #1 is 44 bytes with 2 bytes MAC Header + 2 bytes RLC Header+40 bytesRLC SDU for pc\_supportOfRedCap\_r17=true, or 45 bytes with 2 bytes MAC Header + 3 bytes RLC Header+40 bytesRLC SDU. | | | | | |

7.1.2.3.11.3.3 Specific message contents

Table 7.1.2.3.11.3.3-0: SchedulingRequest-Config (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-155 | | | |
| Information Element | Value/remark | Comment | Condition |
| sr-TransMax | n32 | 7.1.2.3.11.3.2-1 Note 7 |  |

Table 7.1.2.3.11.3.3-1: *RRCReconfiguration-HO* (step 5, Table 7.1.2.3.11.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.8.1-1A with condition RBConfig\_NoKeyChange | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig | According to Table 7.1.2.3.11.3.3-1A |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | According to Table 7.1.2.3.11.3.3-1B |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.2.3.11.3.3-2: Void

Table 7.1.2.3.11.3.3-1A: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | n entries | n is equal to the total number of DRBs established during preamble |  |
| DRB-ToAddMod[k=1..n] SEQUENCE { |  | entry (1..n) |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config | According to TS 38.508-1, Table 4.6.3-161 |  |
| } |  |  |  |
| drb-Identity | k | k=1..n |  |
| reestablishPDCP | Not present |  |  |
| recoverPDCP | true |  |  |
| pdcp-Config | PDCP-Config | According to TS 38.508-1, Table 4.6.3-99 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.2.3.11.3.3-1B: CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 with condition PCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 2+n entries | n is equal to the total number of DRBs established during preamble |  |
| RLC-BearerConfig[1] | RLC-BearerConfig with conditions SRB1 and Re-establish\_RLC | entry 1 |  |
| RLC-BearerConfig[2] | RLC-BearerConfig with conditions SRB2 and Re-establish\_RLC | entry 2 |  |
| RLC-BearerConfig[k+2, k=1..n] | RLC-BearerConfig with conditions AM, DRBk and Re-establish\_RLC | entry [k+2, k=1..n] |  |
| } |  |  |  |

### 7.1.3 PDCP

#### 7.1.3.0 Default Pre-Test Conditions for all PDCP test cases

The following pre-test conditions shall be applied in all PDCP test cases until the test case explicitly over writes these conditions

System Simulator:

- The SS configures the test environment in accordance to the execution conditions in Table 7.1.3.0-1.

UE:

- None

Preamble:

- The SS performs the generic procedure in [4] to get UE in state RRC\_CONNECTED in accordance to the execution conditions in Table 7.1.3.0-2 and using the message condition UE TEST LOOP MODE A to return one UL PDCP SDU per DL PDCP SDU.

Table 7.1.3.0-1: Test environment

|  |  |  |
| --- | --- | --- |
| Execution Condition | Cell configuration | System Information Combination |
| IF pc\_NG\_RAN\_NR and Connectivity(*NR-DC*) | NR Cell 1 is PCell  NR Cell 10 is PSCell | NR System information Combination NR-1 |
| IF pc\_NG\_RAN\_NR | NR Cell 1 | NR System information Combination NR-1 |
| ELSE IF pc\_EN\_DC | E-UTRA Cell 1 is PCell,  NR Cell 1 is PSCell | EUTRA: System information Combination 1  NR: N/A |
| ELSE IF pc\_NGEN\_DC | NG-RAN E-UTRA Cell 1 is PCell,  NR Cell 1 is PSCell | EUTRA: System information Combination 1  NR: N/A |
| ELSE IF pc\_NE\_DC | NR Cell 1 is PCell,  E-UTRA Cell 1 is PSCell | NR: System information Combination NR-1  EUTRA: N/A |

Table 7.1.3.0-2: Preamble parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Execution Condition | Multi-PDN / Multi-PDU Sessions Condition | Generic Procedure Parameters | Primary DRB used for Data testing |
| IF pc\_NG\_RAN\_NR | FALSE | Connectivity(*NR*),  Test loop function(*On*)  One DRB | Default DRB of the first PDU session on NR Cell |
| Connectivity(*NR-DC*),  DC bearer(One MN Terminated MCG bearer and OneSN Terminated SCG bearer),  Test loop function(*On*) | SN terminated SCG DRB |
| TRUE | Connectivity(*NR*),  Test loop function(*On*)  *N* DRBs (*N* ≥ 2) | Default DRB of the first PDU session on NR Cell |
| Connectivity(*NR-DC*),  DC bearer(N MN Terminated MCG bearers and One SN Terminated SCG bearer),  N DRBs (*N* ≥ 2)  Test loop function(*On*) | SN terminated SCG DRB |
| ELSE IF pc\_EN\_DC | FALSE | Connectivity(*EN-DC*),  DC bearer(One MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) | SN Terminated SCG bearer unless explicitly specified in test case |
| TRUE | Connectivity(*EN-DC*),  DC bearer(Two MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) |
| ELSE IF pc\_NGEN\_DC | FALSE | Connectivity(*NGEN-DC*),  DC bearer(One MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) | SN Terminated SCG bearer unless explicitly specified in test case |
| TRUE | Connectivity(NG*EN-DC*),  DC bearer(Two MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) |
| ELSE IF pc\_NE\_DC | FALSE | Connectivity(*NE-DC*),  DC bearer(One MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) | SN Terminated SCG bearer unless explicitly specified in test case |
|  | TRUE | Connectivity(N*E-DC*),  DC bearer(*N* ≥ 2 MN Terminated MCG bearer and One *SN terminated SCG bearer*),  Test loop function(*On*) |  |

Table 7.1.3.0-3: Message conditions

|  |  |
| --- | --- |
| **Execution Condition** | **Message condition exceptions** |
| IF pc\_NG\_RAN\_NR | Message with condition AM is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_EN\_DC | Message condition MCG\_and\_SCG with condition AM is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_NGEN\_DC | Message condition MCG\_and\_SCG with condition AM is used for step 7 in 4.5.4.2 according to [4] |
| ELSE IF pc\_NE\_DC | Message condition MCG\_and\_SCG with condition AM is used for step 7 in 4.5.4.6 according to [4] |

#### 7.1.3.1 Maintenance of PDCP sequence numbers for radio bearers

##### 7.1.3.1.1 Maintenance of PDCP sequence numbers / User plane / 12 bit SN

7.1.3.1.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP configured for 12 bit SN}

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB }

**then** { UE increments SN with 1 for each transmitted PDU for SN=0 to Maximum\_PDCP\_SN (2[*pdcp-SN-SizeUL*] -1) }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP configured for 12 bit SN }

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB and, after incrementation, TX\_NEXT is larger than the Maximum\_PDCP\_SN(2[*pdcp-SN-SizeUL*] -1) }

**then** { UE sets SN to 0 in the next transmitted PDCP SDU}

}

7.1.3.1.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.2.1, 5.2.2.1 and 6.2.2.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.2.1]

At reception of a PDCP SDU from upper layers, the transmitting PDCP entity shall:

- start the *discardTimer* associated with this PDCP SDU (if configured).

For a PDCP SDU received from upper layers, the transmitting PDCP entity shall:

- associate the COUNT value corresponding to TX\_NEXT to this PDCP SDU;

NOTE 1: Associating more than half of the PDCP SN space of contiguous PDCP SDUs with PDCP SNs, when e.g., the PDCP SDUs are discarded or transmitted without acknowledgement, may cause HFN desynchronization problem. How to prevent HFN desynchronization problem is left up to UE implementation.

- perform header compression of the PDCP SDU as specified in the subclause 5.7.4;

- perform integrity protection, and ciphering using the TX\_NEXT as specified in the subclause 5.9 and 5.8, respectively;

- set the PDCP SN of the PDCP Data PDU to TX\_NEXT modulo 2[*pdcp-SN-Size*];

- increment TX\_NEXT by one;

- submit the resulting PDCP Data PDU to lower layer as specified below.

When submitting a PDCP Data PDU to lower layer, the transmitting PDCP entity shall:

- if the transmitting PDCP entity is associated with one RLC entity:

- submit the PDCP Data PDU to the associated RLC entity.

- else, if the transmitting PDCP entity is associated with two RLC entities:

- if *pdcpDuplication* is configured and activated:

- duplicate the PDCP Data PDU and submit the PDCP Data PDU to both associated RLC entities.

- else, if *pdcpDuplication* is configured but not activated:

- submit the PDCP Data PDU to the primary RLC entity.

- else:

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 36.322 [5]) in the two associated RLC entities is less than *ul-DataSplitThreshold*:

- submit the PDCP Data PDU to the primary RLC entity.

- else:

- submit the PDCP Data PDU to either the primary RLC entity or the secondary RLC entity.

NOTE 2: If the transmitting PDCP entity is associated with two RLC entities, the UE should minimize the amount of PDCP PDUs submitted to lower layers before receiving request from lower layers and minimize the PDCP SN gap between PDCP PDUs submitted to two associated RLC entities to minimize PDCP reordering delay in the receiving PDCP entity.

[TS 38.323, clause 5.2.2.1]

In this section, following definitions are used:

- HFN(State Variable): the HFN part (i.e. the number of most significant bits equal to HFN length) of the State Variable;

- SN(State Variable): the SN part (i.e. the number of least significant bits equal to PDCP SN length) of the State Variable;

- RCVD\_SN: the PDCP SN of the received PDCP Data PDU, included in the PDU header;

- RCVD\_HFN: the HFN of the received PDCP Data PDU, calculated by the receiving PDCP entity;

- RCVD\_COUNT: the COUNT of the received PDCP Data PDU = [RCVD\_HFN, RCVD\_SN]

At reception of a PDCP Data PDU from lower layers, the receiving PDCP entity shall determine the COUNT value of the received PDCP Data PDU, i.e. RCVD\_COUNT, as follows:

- if RCVD\_SN < SN(RX\_DELIV) – Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) + 1.

- else if RCVD\_SN >= SN(RX\_DELIV) + Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) – 1.

- else:

- RCVD\_HFN = HFN(RX\_DELIV);

- RCVD\_COUNT = [RCVD\_HFN, RCVD\_SN].

After determining the COUNT value of the received PDCP Data PDU = RCVD\_COUNT, the receiving PDCP entity shall:

- if RCVD\_COUNT < RX\_DELIV; or

- if the PDCP Data PDU with COUNT = RCVD\_COUNT has been received before:

- perform deciphering and integrity verification of the PDCP Data PDU using COUNT = RCVD\_COUNT;

- if integrity verification fails:

- indicate the integrity verification failure to upper layer;

- discard the PDCP Data PDU.

- else:

- perform deciphering and integrity verification of the PDCP Data PDU using COUNT = RCVD\_COUNT;

- if integrity verification fails:

- indicate the integrity verification failure to upper layer;

- discard the PDCP Data PDU.

If the received PDCP Data PDU with COUNT value = RCVD\_COUNT is not discarded above, the receiving PDCP entity shall:

- store the resulting PDCP SDU in the reception buffer;

- if RCVD\_COUNT >= RX\_NEXT:

- update RX\_NEXT to RCVD\_COUNT + 1.

- if *outOfOrderDelivery* is configured:

- deliver the resulting PDCP SDU to upper layers.

- if RCVD\_COUNT = RX\_DELIV:

- deliver to upper layers in ascending order of the associated COUNT value after performing header decompression, if not decompressed before;

- all stored PDCP SDU(s) with consecutively associated COUNT value(s) starting from COUNT = RX\_DELIV;

- update RX\_DELIV to the COUNT value of the first PDCP SDU which has not been delivered to upper layers, with COUNT value > RX\_DELIV;

- if *t-Reordering* is running, and if RX\_DELIV >= RX\_REORD:

- stop and reset *t-Reordering*.

- if *t-Reordering* is not running (includes the case when *t-Reordering* is stopped due to actions above), and RX\_DELIV < RX\_NEXT:

- update RX\_REORD to RX\_NEXT;

- start t-Reordering.

[TS 38.322, clause 6.2.2.2]

Figure 6.2.2.2-1 shows the format of the PDCP Data PDU with 12 bits PDCP SN. This format is applicable for UM DRBs and AM DRBs.



Figure 6.2.2.2-1: PDCP Data PDU format with 12 bits PDCP SN

7.1.3.1.1.3 Test description

7.1.3.1.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 exception of PDCP parameters according to Table 7.1.3.1.1.3.1-1.

Table 7.1.3.1.1.3.1-1: PDCP parameters

|  |  |
| --- | --- |
| PDCP-Config pdcp-SN-SizeUL | len12bits |
| PDCP-Config pdcp-SN-SizeDL | len12bits |

7.1.3.1.1.3.2 Test procedure sequence

Table 7.1.3.1.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | EXCEPTION: Steps 1 – 2 shall be repeated from j = 0 to j = FLOOR(Maximum\_PDCP\_SN/iteration\_size). (Note 1, 4) | - | - | - | - |
| 1 | SS transmits in one slot, several PDCP PDUs in a PDCP PDU list without header compression, the number of PDCP PDUs sent in each PDCP PDU list is defined by the iteration\_size. (Note 4, 5). | <-- | PDCP PDUs | - | - |
| - | EXCEPTION: In Step 2, SS may receive a PDCP PDU or several PDCP PDUs, then step 2 may be repeated multiple times until all PDCP PDUs with SN=j\*iteration\_size to SN=(((j+1)\* iteration\_size)-1) for each iteration are received. | - | - | - | - |
| 2 | Check: Does UE transmit PDCP PDUs with SN=0 for the first iteration and all PDCP PDUs for each iteration?  (Note 2) (Note 6) | --> | PDCP PDUs | 1 | P |
| 3 | SS transmits a PDCP PDU containing one PDCP SDU without header compression. | <-- | PDCP PDU | - | - |
| 4 | Check: Does UE transmit a PDCP PDU with SN=0? | --> | PDCP PDU | 2 | P |
| 5 | SS transmits a PDCP PDU containing one PDCP SDU without header compression. | <-- | PDCP PDU | - | - |
| 6 | Check: Does UE transmit a PDCP PDU with SN=1? | --> | PDCP PDU | 1 | P |
| Note 1: Maximum\_PDCP\_SN = 2[*pdcp-SN-SizeUL*] -1.  Note 2: The verdict shall be provided each time [(SN+1) mod 256 = 0] for 12 bit SN and [(SN+1) mod 4096 = 0] for 18 bit SN respectively.  Note 3: Void  Note 4: Iteration will be incremented by iteration\_size of 1 for 12 bit SN and iteration\_size of 25.for 18 bits SN. Small PDCP SDU size will be used.  Note 5: SS shall transmit a PDCP PDU list with size equal to iteration\_size and incrementing SN by 1 till SN = ((j+1)\*iteration\_size)-1.  Note 6 All PDCP PDUs may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot) | | | | | |

7.1.3.1.1.3.3 Specific message contents

None.

##### 7.1.3.1.2 Maintenance of PDCP sequence numbers / User plane / 18 bit SN

7.1.3.1.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP configured for 18 bit SN}

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB }

**then** { UE increments SN with 1 for each transmitted PDU for SN=0 to Maximum\_PDCP\_SN (2[*pdcp-SN-SizeUL*] -1) }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP configured for 18 bit SN }

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB and, after incrementation, TX\_Next is larger than the Maximum\_PDCP\_SN (2[*pdcp-SN-SizeUL*] -1) }

**then** { UE sets SN to 0 in the next transmitted PDCP SDU}

}

7.1.3.1.2.2 Conformance requirements

Same as conformance requirements in clause 7.1.3.1.1.2

7.1.3.1.2.3 Test description

7.1.3.1.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 exception of PDCP parameters according to Table 7.1.3.1.2.3.1-1.

Table 7.1.3.1.2.3.1-1: PDCP parameters

|  |  |
| --- | --- |
| PDCP-Config pdcp-SN-SizeUL | len18bits |
| PDCP-Config pdcp-SN-SizeDL | len18bits |

7.1.3.1.2.3.2 Test procedure sequence

Same as test procedure in clause 7.1.3.1.1.3.2

7.1.3.1.2.3.3 Specific message contents

None.

#### 7.1.3.2 PDCP integrity protection

##### 7.1.3.2.1 Integrity protection / Correct functionality of integrity algorithm SNOW3G / SRB / DRB

(1)

**with** { UE in RRC\_CONNECTED state and SRB is configured with NR-PDCP}

**ensure that** {

**when** { Functionality of integrity algorithms with SNOW3G is taken into use on SRB }

**then** { UE performs correct integrity protection function in NR-PDCP entities associated with SRB }

}

(2)

**with** { UE in RRC\_CONNECTED state and NOT EN-DC }

**ensure that** {

**when** { Functionality of integrity algorithms with SNOW3G is taken into use on DRB }

**then** { UE performs correct integrity protection function in PDCP entities associated with DRB }

}

(3)

**with** { UE in RRC\_CONNECTED state and SRB3 is configured }

**ensure that** {

**when** { message on SRB 3 is received and fails the integrity protection check }

**then** { UE transmits *SCGFailureInformationNR* message with failure type 'srb3-IntegrityFailure' }

}

NOTE: TP2 (integrity on DRB) is not applicable to EN-DC as per 38.331 clause 6.3.2, the IE *PDCP-Config.drb.*integrityProtection is‘ Cond ConnectedTo5GC‘.

7.1.3.2.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.9, 5.2.2.1, TS 33.501 clauses 5.6.2, D.3.1 and TS 38.331 clauses5.7.3.1, 5.7.3.2, 5.7.3.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.9]

The integrity protection function includes both integrity protection and integrity verification and is performed in PDCP, if configured. The data unit that is integrity protected is the PDU header and the data part of the PDU before ciphering. The integrity protection is always applied to PDCP Data PDUs of SRBs. The integrity protection is applied to PDCP Data PDUs of DRBs for which integrity protection is configured. The integrity protection is not applicable to PDCP Control PDUs.

The integrity protection algorithm and key to be used by the PDCP entity are configured by upper layers TS 38.331 [3] and the integrity protection method shall be applied as specified in TS 33.501 [6].

The integrity protection function is activated by upper layers TS 38.331 [3]. When security is activated, the integrity protection function shall be applied to all PDUs including and subsequent to the PDU indicated by upper layers TS 38.331 [3] for the downlink and the uplink, respectively.

NOTE: As the RRC message which activates the integrity protection function is itself integrity protected with the configuration included in this RRC message, this message needs first be decoded by RRC before the integrity protection verification could be performed for the PDU in which the message was received.

For downlink and uplink integrity protection and verification, the parameters that are required by PDCP for integrity protection are defined in TS 33.501 [6] and are input to the integrity protection algorithm. The required inputs to the integrity protection function include the COUNT value, and DIRECTION (direction of the transmission: set as specified in TS 33.501 [6]). The parameters required by PDCP which are provided by upper layers TS 38.331 [3] are listed below:

- BEARER (defined as the radio bearer identifier in TS 33.501 [6]. It will use the value RB identity –1 as in TS 38.331 [3]);

- KEY (the integrity protection keys for the control plane and for the user plane are KRRCint and KUPint, respectively).

At transmission, the UE computes the value of the MAC-I field and at reception it verifies the integrity of the PDCP Data PDU by calculating the X-MAC based on the input parameters as specified above. If the calculated X-MAC corresponds to the received MAC-I, integrity protection is verified successfully.

[TS 38.323, clause 5.2.2.1]

At reception of a PDCP Data PDU from lower layers, the receiving PDCP entity shall determine the COUNT value of the received PDCP Data PDU, i.e. RCVD\_COUNT, as follows:

- if RCVD\_SN < SN(RX\_DELIV) – Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) + 1.

- else if RCVD\_SN >= SN(RX\_DELIV) + Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) – 1.

- else:

- RCVD\_HFN = HFN(RX\_DELIV);

- RCVD\_COUNT = [RCVD\_HFN, RCVD\_SN].

After determining the COUNT value of the received PDCP Data PDU = RCVD\_COUNT, the receiving PDCP entity shall:

- perform deciphering and integrity verification of the PDCP Data PDU using COUNT = RCVD\_COUNT;

- if integrity verification fails:

- indicate the integrity verification failure to upper layer;

- discard the PDCP Data PDU;

- if RCVD\_COUNT < RX\_DELIV; or

- if the PDCP Data PDU with COUNT = RCVD\_COUNT has been received before:

- discard the PDCP Data PDU;

[TS 33.501, clause 5.6.2]

All Identifiers and names specified in the present subclause are for 5G.

Each Integrity Algorithm used for 5G will be assigned a 4-bit identifier. The following values for integrity algorithms are defined:

"00002" NIA0 Null Integrity Protection algorithm;

"00012" 128-NIA1 128-bit SNOW 3G based algorithm;

"00102" 128-NIA2 128-bit AES based algorithm; and

"00112" 128-NIA3 128-bit ZUC based algorithm.

128-NIA1 is based on SNOW 3G (see TS35.215 [14]).

128-NIA2 is based on 128-bit AES [15] in CMAC mode [17].

128-NIA3 is based on 128-bit ZUC (see TS35.221 [18]).

Full details of the algorithms are specified in Annex D.

[TS 33.501, clause D.3.1.1]

The input parameters to the integrity algorithm are a 128-bit integrity key named KEY, a 32-bit COUNT, a 5-bit bearer identity called BEARER, the 1-bit direction of the transmission i.e. DIRECTION, and the message itself i.e. MESSAGE. The DIRECTION bit shall be 0 for uplink and 1 for downlink. The bit length of the MESSAGE is LENGTH.

Figure D.3.1.1-1 illustrates the use of the integrity algorithm NIA to authenticate the integrity of messages.



Figure D.3.1.1-1: Derivation of MAC-I/NAS-MAC (or XMAC-I/XNAS-MAC)

Based on these input parameters the sender computes a 32-bit message authentication code (MAC-I/NAS-MAC) using the integrity algorithm NIA. The message authentication code is then appended to the message when sent. For integrity protection algorithms, the receiver computes the expected message authentication code (XMAC-I/XNAS-MAC) on the message received in the same way as the sender computed its message authentication code on the message sent and verifies the data integrity of the message by comparing it to the received message authentication code, i.e. MAC-I/NAS-MAC.

[TS 38.331, clause 5.7.3.1]



Figure 5.7.3.1-1: SCG failure information

The purpose of this procedure is to inform EUTRAN or NR MN about an SCG failure the UE has experienced i.e. SCG radio link failure, e failure of SCG reconfiguration with sync, SCG configuration failure for RRC message on SRB3, SCG integrity check failure and exceeding the maximum uplink transmission timing difference.

[TS 38.331, clause 5.7.3.2]

A UE initiates the procedure to report SCG failures when SCG transmission is not suspended and when one of the following conditions is met:

1> upon detecting radio link failure for the SCG, in accordance with subclause 5.3.10.3;

1> upon reconfiguration with sync failure of the SCG, in accordance with subclause 5.3.5.9.3;

1> upon SCG configuration failure, in accordance with subclause 5.3.5.9.2;

1> upon integrity check failure indication from SCG lower layers, in accordance with subclause 5.3.5.9.1.

Upon initiating the procedure, the UE shall:

1> suspend SCG transmission for all SRBs and DRBs;

1> reset SCG-MAC;

1> stop T304, if running;

1> if the UE is operating in EN-DC:

2> initiate transmission of the *SCGFailureInformationNR* message as specified in TS 36.331 [10, 5.6.13a].

[TS 38.331, clause 5.7.3.3]

The UE shall set the SCG failure type as follows:

...

1> else, if the UE initiates transmission of the *SCGFailureInformationNR* message due to SRB3 IP check failure:

2> set the failureType as srb3-IntegrityFailure;

7.1.3.2.1.3 Test description

7.1.3.2.1.3.1 Pre-test conditions

- Same Pre-test conditions as in clause 7.1.3.0 with the exception that integrity protection algorithm ‘nia1 (SNOW3G)’ is configured.

- For EN\_DC, same Pre-test conditions as in clause 7.1.3.0 with the exception that integrity protection algorithms ‘nia1 (SNOW3G)’ and ‘eia1 (SNOW3G)’ are configured and without message condition UE TEST LOOP MODE A.

- For EN\_DC or NGEN\_DC, RRCConnectionReconfiguration message including MobilityControlInfo IE is transmitted on E-UTRA Cell 1 to reconfigure SRB1 and SRB2 from E-UTRA PDCP to NR PDCP.

7.1.3.2.1.3.2 Test procedure sequence

Table 7.1.3.2.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | EXCEPTION: Steps 1a1 to 1b2 describe behaviour that depends on UE configuration; the "lower case letter" identifies a step sequence that takes place depending on a particular configuration. | - | - | - | - |
| 1a1 | IF *Connectivity* is *EN-DC* or *NGEN-DC*, the SS sends EUTRA RRC *UECapabilityEnquiry* message including *RAT-Type* *eutra-nr* to the UE integrity protected. | <-- | RRC: *UECapabilityEnquiry* | - | - |
| 1a2 | Check: Does the UE send a EUTRA RRC *UECapabilityInformation* message integrity protected? | --> | RRC: *UECapabilityInformation* | 1 | P |
| 1b1 | ELSE the SS sends NR RRC *UECapabilityEnquiry* message to the UE. | <-- | NR RRC: *UECapabilityEnquiry* | - | - |
| 1b2 | Check: Does the UE send a NR RRC *UECapabilityInformation* message? | --> | NR RRC: *UECapabilityInformation* | 1 | P |
| - | EXCEPTION: Steps 2a1-2a4 describe behaviour that depends on UE configuration; the "lower case letter" identifies a step sequence that takes place if SRB3 is configured | - | - | - | - |
| 2a1 | IF *Connectivity* is *EN-DC* or *NGEN-DC*, IF pc\_srb3 then the SS transmits an *RRCReconfiguration* message to reconfigure NR MAC, sent on SRB3 integrity protected.  Note 1 | <-- | *RRCReconfiguration* | - | - |
| 2a2 | Check: Does the UE transmit an *RRCReconfigurationComplete* message on SRB3 integrity protected? | --> | *RRCReconfigurationComplete* | 1 | P |
| 2a3 | The SS sends *RRCReconfiguration* message to the UE integrity protected on SRB3. The MAC-I is corrupted so as to result in integrity failure at UE. | <-- | *RRCReconfiguration* | - | - |
| 2a4 | Check: Does the UE send *SCGFailureInformationNR* with failureType ‘srb3-IntegrityFailure’ on SRB1? | --> | *SCGFailureInformationNR* | 3 | P |
| - | EXCEPTION: Steps 3a1-3a2 describe behaviour that depends on whether 5GC is being emulated; the "lower case letter" identifies a step sequence that takes place if 5GC is being emulated. | - | - | - | - |
| 3a1 | SS transmits PDCP PDU on DRB integrity protected. | <-- | PDCP PDU | ***-*** | ***-*** |
| 3a2 | Check: Does the UE transmit looped back PDCP PDU integrity protected on DRB? | --> | PDCP PDU | 2 | P |
| Note 1: For EN-DC the NR RRCReconfiguration is contained in *RRCConnectionReconfiguration* Table 7.1.3.2.1.3.3-1 | | | | | |

7.1.3.2.1.3.3 Specific message contents

Table 7.1.3.2.1.3.3-1: *RRCConnectionReconfiguration (Preamble for EN-DC or NGEN-DC)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Derivation Path: 36.508 [7] Table 4.6.1-8 | | | | | | |
| Information Element | | | Value/remark | | Comment | | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { | | |  | |  | |  |
| criticalExtensions CHOICE { | | |  | |  | |  |
| c1 CHOICE{ | | |  | |  | |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE { | | |  | |  | |  |
| mobilityControlInfo | | | MobilityControlInfo-HO-SameCell | | As per Table 7.1.3.2.1.3.3-1A | |  |
| nonCriticalExtension ::= SEQUENCE { | | |  | |  | |  |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nonCriticalExtension ::= SEQUENCE { |  | |  | |  | |
| nr-Config-r15 CHOICE { |  | |  | |  | |
| setup SEQUENCE { |  | |  | |  | |
| nr-SecondaryCellGroupConfig-r15 | OCTET STRING including the RRCReconfiguration message according to TS 38.508-1 [4], table 4.6.1-13 with condition EN-DC\_HO | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| sk-Counter-r15 | Increment the value by 1 from the previous value | |  | |  | |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [4], Table 4.6.3-132 with conditions EN-DC\_DRB and Re-establish\_PDCP | |  | |  | |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [4], Table 4.6.3-132 with conditions EN-DC\_DRB and Re-establish\_PDCP and SRB3 | |  | | SRB3 | |
| nr-RadioBearerConfig2-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [4], table 4.6.3-132 with condition SRB\_NR\_PDCP | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |

|  |  |
| --- | --- |
| Condition | Explanation |
| SRB3 | Establishment of SRB3 |

Table 7.1.3.2.1.3.3-1A: *MobilityControlInfo-HO-SameCell* (Table 7.1.3.2.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.5-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| MobilityControlInfo-HO ::= SEQUENCE { |  |  |  |
| targetPhysCellId | PhysicalCellIdentity of E-UTRA Cell 1 |  |  |
| carrierFreq | Not present |  |  |
| } |  |  |  |

Table 7.1.3.2.1.3.3-2: MAC-CellGroupConfig (step 2a1, Table 7.1.3.2.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| bsr-Config SEQUENCE { |  |  |  |
| periodicBSR-Timer | sf10 | Different from default |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.2.1.3.3-3: *SCGFailureInformationNR* message (step 2a4, Table 7.1.3.2.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.1-18AA | | | |
| Information Element | Value/remark | Comment | Condition |
| SCGFailureInformationNR-r15::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE { |  |  |  |
| scgFailureInformationNR-r15 SEQUENCE { |  |  |  |
| failureReportSCG-NR-r15 SEQUENCE { |  |  |  |
| failureType-r15 | srb3-IntegrityFailure |  |  |
| measResultFreqListNR-r15 | Not checked |  |  |
| measResultSCG-r15 | Not checked |  |  |
| } |  |  |  |
| nonCriticalExtension SEQUENCE {} |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.2.1.3.3-4: *RRCReconfiguration (Preamble for NR/5GC)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 with condition NR | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration ::= SEQUENCE { | |  |  |  |
| radioBearerConfig | | RadioBearerConfig-IntegrityOnDRB |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.2.1.3.3-5: *RadioBearerConfig-IntegrityOnDRB (Preamble for NR/5GC)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-132 with conditions SRB2 and DRB1 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry | Primary DRB as per Table 7.1.3.0-2 | DRB1 |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB1 |  |  |
| reestablishPDCP | Not present |  |  |
| recoverPDCP | Not present |  |  |
| pdcp-Config | PDCP-Config-IntegrityOnDRB |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.2.1.3.3-6: *PDCP-Config-IntegrityOnDRB (Preamble for NR/5GC)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | NULL |  |  |
| } |  |  |  |
| integrityProtection | enabled |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| moreThanOneRLC | Not present |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

##### 7.1.3.2.2 Integrity protection / Correct functionality of integrity algorithm AES / SRB / DRB

7.1.3.2.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and SRB is configured with NR-PDCP }

**ensure that** {

**when** { Functionality of integrity algorithms with AES is taken into use on SRB }

**then** { UE performs correct integrity protection function in NR-PDCP entity associated with SRB }

}

(2)

**with** { UE in RRC\_CONNECTED state and NOT EN-DC }

**ensure that** {

**when** { Functionality of integrity algorithms with AES is taken into use on DRB }

**then** { UE performs correct integrity protection function in PDCP entities associated with DRB }

}

(3)

**with** { UE in RRC\_CONNECTED state and SRB3 is configured }

**ensure that** {

**when** { message on SRB 3 is received and fails the integrity protection check }

**then** { UE transmits *SCGFailureInformationNR* message with failure type as srb3-IntegrityFailure }

}

NOTE: TP2 (integrity on DRB) is not applicable to EN-DC as per TS 38.331 [12] clause 6.3.2, the IE *PDCP-Config.drb.*integrityProtection is 'Cond ConnectedTo5GC'.

7.1.3.2.2.2 Conformance requirements

Same conformance requirements as in clause 7.1.3.2.1.2

7.1.3.2.2.3 Test description

7.1.3.2.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.2.1.3.1 except that integrity protection algorithm ‘nia2 (AES)’ and ‘eia2 (AES)’ is configured.

7.1.3.2.2.3.2 Test procedure sequence

Same test procedure sequence as in clause 7.1.3.2.1.3.2.

7.1.3.2.2.3.3 Specific message contents

Same specific message contents as in clause 7.1.3.2.1.3.3 except for integrity protection algorithm ‘nia2 (AES)’ and ‘eia2 (AES)’.

##### 7.1.3.2.3 Integrity protection / Correct functionality of integrity algorithm ZUC / SRB / DRB

(1)

**with** { UE in RRC\_CONNECTED state and SRB is configured with NR-PDCP }

**ensure that** {

**when** { Functionality of integrity algorithms with ZUC is taken into use on SRB }

**then** { UE performs correct integrity protection function in NR-PDCP entities associated with SRB }

}

(2)

**with** { UE in RRC\_CONNECTED state and NOT EN-DC }

**ensure that** {

**when** { Functionality of integrity algorithms with ZUC is taken into use on DRB }

**then** { UE performs correct integrity protection function in PDCP entities associated with DRB }

}

(3)

**with** { UE in RRC\_CONNECTED state and SRB3 is configured }

**ensure that** {

**when** { message on SRB 3 is received and fails the integrity protection check }

**then** { UE transmits *SCGFailureInformationNR* message with failure type as srb3-IntegrityFailure }

}

NOTE: TP2 (integrity on DRB) is not applicable to EN-DC as per TS 38.331 [12] clause 6.3.2, the IE *PDCP-Config.drb.*integrityProtection is 'Cond ConnectedTo5GC.

7.1.3.2.3.2 Conformance requirements

Same conformance requirements as in clause 7.1.3.2.1.2.

7.1.3.2.3.3 Test description

7.1.3.2.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.2.1.3.1 except that integrity protection algorithm ‘nia3 (ZUC)’ and ‘eia3 (ZUC)’ is configured.

7.1.3.2.3.3.2 Test procedure sequence

Same test procedure sequence as in clause 7.1.3.2.1.3.2.

7.1.3.2.3.3.3 Specific message contents

Same specific message contents as in clause 7.1.3.2.1.3.3 except integrity protection algorithm ‘nia3 (ZUC)’ and ‘eia3 (ZUC)’.

##### 7.1.3.2.4

##### 7.1.3.2.5

##### 7.1.3.2.6 Integrity protection / Correct functionality of UP integrity protection / multiple DRBs

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Functionality of integrity algorithms is taken into use on the MCG DRB }

**then** { UE performs correct integrity protection function in PDCP entities associated with MCG DRB }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Functionality of integrity algorithms is taken into use on the SCG DRB }

**then** { UE performs correct integrity protection function in PDCP entities associated with SCG DRB }

}

7.1.3.2.6.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 33.401, clauses 7.3.3 and 7.3.4, TS 36.300, clause 14.1 and TS 36.331, clause.5.3.1.2.

[TS 33.401, clause 7.3.3]

NOTE a: Only EN-DC capable UEs and EN-DC capable eNBs support UP integrity protection. Therefore, the eNB can only activate UP integrity protection with a UE that is EN-DC capable and supports user plane integrity protection with EPS.

If the UE indicates that it supports user plane integrity protection with EPS in EIA7 in the EPS security capability, the MME shall provide UP integrity protection policy for each E-RAB to the eNB during the Attach/Dedicated bearer activation/Dedicated bearer modification procedure as specified in TS 23.401 [2]. The MME receives UP integrity protection policy from SMF+PGW-C via SGW.

NOTE 1: The SMF+PGW-C can be locally configured with UP integrity protection and confidentiality policy. However, the SMF+PGW-C only sends UP integrity protection policy to the upgraded SGW. The SMF+PGW-C, SGW and MME can use GTP-C signalling compatibility concepts to jugde whether to send UP integrity protection policy to the peer.

The UP integrity protection policy shall indicate whether UP integrity protection shall be activated or not for all DRBs belonging to that E-RAB.

The eNB shall be locally configured with UP integrity protection policy. If the eNB receives UP integrity protection policy from the MME, the eNB shall use the received UP integrity protection policy, otherwise, the eNB shall use the locally configured UP integrity protection policy if EIA7 in the EPS security capability indicates that the UE supports user plane integrity protection with EPC.

The locally configured UP integrity protection policy on eNB should be set as "preferred".

The eNB shall activate UP integrity protection per each DRB, according to the UP integrity protection policy, using RRC signalling as defined in clause 7.3.4. If the UP integrity protection policy indicates "Required", the eNB shall activate UP integrity protection. If the eNB cannot activate UP integrity protection, and when the UP integrity protection policy is "Required", the eNB shall reject establishment of UP resources for the E-RAB and indicate reject-cause to the MME. If the UP integrity protection policy is " Not needed ", the eNB shall not activate UP integrity protection.

…

[TS 33.401, clause 7.3.4]

AS UP integrity protection activation shall be done as part of the DRB addition procedure using RRC Connection Reconfiguration procedure as described in this clause, see Figure 7.3.4 -1.

As defined in Clause 7.3.3, the MME may send the UP integrity protection policy to the eNB. If the MME does not send the UP integrity protection policy, the eNB may use locally configured UP integrity protection policy.

Figure 7.3.4-1: User plane (UP) integrity protection activation mechanism

1a. This RRC Connection Reconfiguration procedure which is used to add DRBs shall be performed only after RRC security and UP ciphering have been activated as part of the AS security mode command procedure defined in Clause 7.2.4.5 and the UE indicates that it supports use of user plane integrity protection with EPC.

1b. The eNB shall send the RRC Connection Reconfiguration message to the UE for UP security activation containing indication for the activation of UP integrity protection for each DRB according to the security policy.

The eNB shall select the NR integrity algorithm and indicate it in the RRC Connection Reconfiguration procedure to the UE. The selected NR integrity algorithm corresponds to the EPS integrity algorithm which the eNB selected and indicated to the UE in the AS Security Mode Command procedure.

1c. If UP integrity protection is activated for DRBs as indicated in the RRC Connection Reconfiguration message, and if the eNB does not have KUPint, the eNB shall generate KUPint and UP integrity protection for such DRBs shall start at the eNB.

2a. UE shall verify the RRC Connection Reconfiguration message. If successful, if UP integrity protection is activated for DRBs as indicated in the RRC Connection Reconfiguration message, and if the UE does not have KUPint, the UE shall generate KUPint and UP integrity protection for such DRBs shall start at the UE.

2b. If the UE successfully verifies integrity of the RRC Connection Reconfiguration message, the UE shall send the RRC Connection Reconfiguration Complete message to the eNB.

When the UE receives the RRC Connection Reconfiguration message then the UE shall use the EPS algorithm which corresponds to the NR algorithm indicated in the RRC Connection Reconfiguration message for UP integrity protection.

If UP integrity protection is not activated for DRBs, the eNB and the UE shall not integrity protect the traffic of such DRB and shall not put MAC-I into PDCP packet.

[TS 36.300, clause 14.1]

The following principles apply to E-UTRAN security:

…

- Separate AS and NAS level security mode command procedures are used. AS level security mode command procedure configures AS security (RRC and user plane) and NAS level security mode command procedure configures NAS security. Both integrity protection and ciphering for RRC are activated within the same AS SMC procedure. User plane ciphering is activated at the same time as RRC ciphering. An EN-DC capable UE supporting user plane integrity protection (see TS 24.301 [20]) when connected to E-UTRA/EPC (as specified in TS 33.401 [22]) shall support integrity protection for all DRBs (MN and SN terminated) at any data rate, up to and including the highest data rate supported by the UE for both UL and DL. When supported, user plane integrity protection with NR PDCP can be activated (on a per radio bearer basis) upon DRB addition.

…

[TS 36.331, clause.5.3.1.2]

…

The AS applies different security keys: one for the integrity protection of RRC signalling (KRRCint), one for the ciphering of RRC signalling (KRRCenc) and one for the ciphering of user data (KUPenc). For the UE capable of user plane integrity protection when it is connected to E-UTRA/EPC (TS 33.401 [32]), the AS applies a security key for integrity protection of user data (KUPint) for the DRBs that are configured to apply integrity protection of user data. All AS keys are derived from the KeNB key. The KeNB is based on the KASME key for E-UTRA/EPC, or KAMF for E-UTRA/5GC, which is handled by upper layers.

…

7.1.3.2.6.3 Test description

7.1.3.2.6.3.1 Pre-test conditions

- Same Pre-test conditions as in clause 7.1.3.0 with *Connectivity* set to *EN-DC* without message condition UE TEST LOOP MODE A, then RRCConnectionReconfiguration message including MobilityControlInfo IE is transmitted on E-UTRA Cell 1 to reconfigure SRB1, SRB2 and MCG DRB from E-UTRA PDCP to NR PDCP and Test Loop Function (On) with UE test loop mode A (message condition UE TEST LOOP MODE A to return one UL PDCP SDU per DL PDCP SDU) according to TS 38.508-1 [4]

7.1.3.2.6.3.2 Test procedure sequence

Table 7.1.3.2.6.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits PDCP PDU on MCG DRB integrity protected. | <-- | PDCP PDU | - | - |
| 2 | Check: Does the UE transmit looped back PDCP PDU integrity protected on MCG DRB? | --> | PDCP PDU | 1 | P |
| 3 | SS transmits PDCP PDU on SCG DRB integrity protected. | <-- | PDCP PDU | - | - |
| 4 | Check: Does the UE transmit looped back PDCP PDU integrity protected on SCG DRB? | --> | PDCP PDU | 2 | P |

7.1.3.2.6.3.3 Specific message contents

Table 7.1.3.2.6.3.3-1: ATTACH REQUEST *(Preamble)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7] Table 4.7.2-4 | | | |
| Information Element | | Value/remark | Comment | Condition |
| UE network capability | |  |  |  |
| All octets with the exception of octet 4, bit 1 | | Any allowed value |  |  |
| EPS-UPIP supported (octet 4, bit 1) | | 1 | EPS-UPIP supported |  |

Table 7.1.3.2.6.3.3-2: *SecurityModeCommand* message (*Preamble*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7] Table 4.6.1-19 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SecurityModeCommand ::= SEQUENCE { | |  |  |  |
| rrc-TransactionIdentifier | | RRC-TransactionIdentifier-DL |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| c1 CHOICE{ | |  |  |  |
| securityModeCommand-r8 SEQUENCE { | |  |  |  |
| securityConfigSMC SEQUENCE { | |  |  |  |
| securityAlgorithmConfig SEQUENCE { | |  |  |  |
| cipheringAlgorithm | | Set according to PIXIT parameter for default ciphering algorithm |  |  |
| integrityProtAlgorithm | | Set according to PIXIT parameter for default integrity protection algorithm | null algorithm is not allowed |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.2.6.3.3-3: *RRCConnectionReconfiguration (Preamble)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508[47] Table 4.6.1-8 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| c1 CHOICE{ | |  |  |  |
| rrcConnectionReconfiguration-r8 SEQUENCE { | |  |  |  |
| mobilityControlInfo | | MobilityControlInfo-HO-SameCell | As per Table 7.1.3.2.6.3.3-4 |  |
| radioResourceConfigDedicated | | RadioResourceConfigDedicated-DRB-Rel-Add | As per Table 7.1.3.2.6.3.3-5 |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nr-Config-r15 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| nr-SecondaryCellGroupConfig-r15 | OCTET STRING including the RRCReconfiguration message according to TS 38.508-1 [4], table 4.6.1-13 with condition EN-DC\_HO. |  |  |
| } |  |  |  |
| } |  |  |  |
| sk-Counter-r15 | Increment the value by 1 from the previous value |  |  |
| nr-RadioBearerConfig1-r15 | RadioBearerConfig-MCG-SCG-DRB-NR-PDCP | Table 7.1.3.2.6.3.3-6 |  |
| nr-RadioBearerConfig2-r15 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.2.6.3.3-4: *MobilityControlInfo-HO-SameCell* (Table7.1.3.2.6.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.5-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| MobilityControlInfo-HO ::= SEQUENCE { |  |  |  |
| targetPhysCellId | PhysicalCellIdentity of E-UTRA Cell 1 |  |  |
| carrierFreq | Not present |  |  |
| } |  |  |  |

Table 7.1.3.2.6.3.3-5: *RadioResourceConfigDedicated-DRB-Rel-Add* (Table 7.1.3.2.6.3.3-3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.3-19AAAAAD | | | | | |
| Information Element | | Value/remark | Comment | | Condition |
| RadioResourceConfigDedicated-SRB2-DRB ::= SEQUENCE { |  | |  |  | | |
| srb-ToAddModList | Not present | |  |  | | |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry | |  |  | | |
| drb-ToAddMod[1] | DRB-ToAddMod-DEFAULT (8) using condition AM except pdcp-Config not included | | entry 1  See TS 36.508 subclause 4.8.2 |  | | |
| } |  | |  |  | | |
| drb-ToReleaseList SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity { | 1 entry | |  |  | | |
| DRB-Identity[1] | 8 | | entry 1  Same as the DRB Identity associated with the default EPS bearer |  | | |
| } |  | |  |  | | |
| } |  | |  |  | | |

Table 7.1.3.2.6.3.3-6: *RadioBearerConfig*-*MCG-SCG-DRB-NR-PDCP* (Table 7.1.3.2.6.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-132, condition MCG\_NR\_PDCP | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 2 entries |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | Same as the default EPS bearer Identity | MCG DRB |  |
| } |  |  |  |
| drb-Identity | Same as the DRB identity associated with the default EPS bearer |  |  |
| reestablishPDCP | Not present |  |  |
| recoverPDCP | Not present |  |  |
| pdcp-Config | PDCP-Config | Table 7.1.3.2.6.3.3-7 |  |
| } |  |  |  |
| DRB-ToAddMod[2] SEQUENCE { |  | entry 2 |  |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | 6 |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB2 |  |  |
| reestablishPDCP | true |  |  |
| recoverPDCP | Not present |  |  |
| pdcp-Config | PDCP-Config | Table 7.1.3.2.6.3.3-7 |  |
| } |  |  |  |
| } |  |  |  |
| securityConfig SEQUENCE { |  |  |  |
| securityAlgorithmConfig SEQUENCE { |  |  |  |
| cipheringAlgorithm | Same as the ciphering algorithm configured Table 7.1.3.2.6.3.3-2 |  |  |
| integrityProtAlgorithm | Same as the integrity algorithm configured Table 7.1.3.2.6.3.3-2 |  |  |
| } |  |  |  |
| keyToUse | secondary |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.2.6.3.3-7: *PDCP-Config* (Table 7.1.3.2.6.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| integrityProtection | enable |  |  |
| } |  |  |  |
| } |  |  |  |

#### 7.1.3.3 PDCP Ciphering and deciphering

##### 7.1.3.3.1 Ciphering and deciphering / Correct functionality of encryption algorithm SNOW3G / SRB / DRB

7.1.3.3.1.1 Test Purpose (TP)

(1)

(1)

**with** { UE in RRC\_CONNECTED state and SRB is configured with NR-PDCP }

**ensure that** {

**when** { Functionality of encryption algorithms with SNOW3G is taken into use on SRB }

**then** { UE performs correct ciphering/deciphering function in NR-PDCP entity associated with SRB }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Functionality of encryption algorithms with SNOW3G is taken into use on DRB }

**then** {UE performs correct ciphering/deciphering function in NR-PDCP entity associated with DRB }

}

7.1.3.3.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323 clause 5.8, TS 33.501 clauses 5.6.1, D.2.1.1 and TS 36.331 clause 6.3.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.8]

The ciphering function includes both ciphering and deciphering and is performed in PDCP, if configured. The data unit that is ciphered is the data part of the PDCP Data PDU (see subclause 6.3.3) except the SDAP header if included in the PDCP SDU, and the MAC-I (see subclause 6.3.4). The ciphering is not applicable to PDCP Control PDUs.

The ciphering algorithm and key to be used by the PDCP entity are configured by upper layers TS 38.331 [3] and the ciphering method shall be applied as specified in TS 33.501 [6].

The ciphering function is activated by upper layers TS 38.331 [3]. When security is activated, the ciphering function shall be applied to all PDCP Data PDUs indicated by upper layers TS 38.331 [3] for the downlink and the uplink, respectively.

For downlink and uplink ciphering and deciphering, the parameters that are required by PDCP for ciphering are defined in TS 33.501 [6] and are input to the ciphering algorithm. The required inputs to the ciphering function include the COUNT value, and DIRECTION (direction of the transmission: set as specified in TS 33.501 [6]).The parameters required by PDCP which are provided by upper layers TS 38.331 [3] are listed below:

- BEARER (defined as the radio bearer identifier in TS 33.501 [6]. It will use the value RB identity –1 as in TS 38.331 [3]);

- KEY (the ciphering keys for the control plane and for the user plane are KRRCenc and KUPenc, respectively).

[TS 33.501, clause 5.6.1]

All Identifiers and names specified in this subclause are for5G.

Each Encryption Algorithm used for 5G will be assigned a 4-bit identifier. The following values for ciphering algorithms are defined:

"00002" NEA0 Null ciphering algorithm;

"00012" 128-NEA1 128-bit SNOW 3G based algorithm;

"00102" 128-NEA2 128-bit AES based algorithm; and

"00112" 128-NEA3 128-bit ZUC based algorithm.

128-NEA1 is based on SNOW 3G (see TS35.215 [14]).

128-NEA2 is based on 128-bit AES [15] in CTR mode [16].

128-NEA3 is based on 128-bit ZUC (sseTS35.221 [18]).

Full details of the algorithms are specified in Annex D.

[TS 33.501, clause D.2.1.1]

The input parameters to the ciphering algorithm are a 128-bit cipher key named KEY, a 32-bit COUNT, a 5-bit bearer identity BEARER, the 1-bit direction of the transmission i.e. DIRECTION, and the length of the keystream required i.e. LENGTH. The DIRECTION bit shall be 0 for uplink and 1 for downlink.

Figure D.2.1.1-1 illustrates the use of the ciphering algorithm NEA to encrypt plaintext by applying a keystream using a bit per bit binary addition of the plaintext and the keystream. The plaintext may be recovered by generating the same keystream using the same input parameters and applying a bit per bit binary addition with the ciphertext.



Figure D.2.1.1-1: Ciphering of data

Based on the input parameters the algorithm generates the output keystream block KEYSTREAM which is used to encrypt the input plaintext block PLAINTEXT to produce the output ciphertext block CIPHERTEXT.

The input parameter LENGTH shall affect only the length of the KEYSTREAM BLOCK, not the actual bits in it.

[TS 36.331, clause 6.3.3]

The IE *SecurityAlgorithmConfig* is used to configure AS integrity protection algorithm (SRBs) and AS ciphering algorithm (SRBs and DRBs).

…

| SecurityAlgorithmConfig field descriptions |
| --- |
| **cipheringAlgorithm**  Indicates the ciphering algorithm to be used for SRBs and DRBs, as specified in TS 33.501 [11]. The algorithms nea0-nea3 are identical to the LTE algorithms eea0-3. For EN-DC, the algorithms configured for bearers using KeNB shall be the same as for all bearers using KeNB. |
| **integrityProtAlgorithm**  For EN-DC, this IE indicates the integrity protection algorithm to be used for SRBs, as specified in TS 33.501 [11]. The algorithms nia0-nia3 is identical to the LTE algorithms eia0-3. For EN-DC, the algorithms configured for SRBs using KeNB shall be the same as for all SRBs using KeNB. |

7.1.3.3.1.3 Test description

7.1.3.3.1.3.1 Pre-test conditions

- Same Pre-test conditions as in clause 7.1.3.0 with the exception that ciphering algorithm ‘nea1 (SNOW3G)’ is configured.

- For EN\_DC or NGEN\_DC, same Pre-test conditions as in clause 7.1.3.0 with the exception that ciphering algorithms ‘eea1 (SNOW3G)’ and ‘nea1 (SNOW3G)’ are configured and without message condition UE TEST LOOP MODE A, then RRCConnectionReconfiguration message including MobilityControlInfo IE is transmitted on E-UTRA Cell 1 to reconfigure SRB1, SRB2 and MCG DRB from E-UTRA PDCP to NR PDCP and Test Loop Function (On) with UE test loop mode A (message condition UE TEST LOOP MODE A to return one UL PDCP SDU per DL PDCP SDU) according to TS 38.508-1 [4].

7.1.3.3.1.3.2 Test procedure sequence

Table 7.1.3.3.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U – S | Message |  |  |
| - | Exception steps 1a1 to 1b2 depends on UE configuration. | - | - | - | - |
| 1a1 | IF *Connectivity* is *EN-DC* or *NGEN-DC*,  the SS sends EUTRA RRC *UECapabilityEnquiry* including *RAT-Type* *eutra* message to the UE. | <-- | RRC*: UECapabilityEnquiry* | - | - |
| 1a2 | Check: Does the UE send a EUTRA RRC *UECapabilityInformation* message? | --> | RRC: *UECapabilityInformation* | 1 | P |
| 1b1 | ELSE the SS sends NR RRC *UECapabilityEnquiry* message to the UE. | <-- | NR RRC: *UECapabilityEnquiry* | - | - |
| 1b2 | Check: Does the UE send a NR RRC *UECapabilityInformation* message? | --> | NR RRC: *UECapabilityInformation* | 1 | P |
| - | EXCEPTION: steps 2a1-2a2 depends on UE configuration, executed if SCG DRB is configured | - | *-* | - | - |
| 2a1 | IF *Connectivity* is *EN-DC* or *NGEN-DC*, SS transmits PDCP PDU on SCG DRB ciphered. | <-- | PDCP PDU | - | - |
| 2a2 | Check: Does the UE transmit looped back PDCP PDU ciphered on SCG DRB? | --> | PDCP PDU | 2 | P |
| 3 | SS transmits PDCP PDU on MCG DRB ciphered. | <-- | PDCP PDU | - | - |
| 4 | Check: Does the UE transmit looped back PDCP PDU ciphered on MCG DRB? | --> | PDCP PDU | 2 | P |

7.1.3.3.1.3.3 Specific message contents

Table 7.1.3.3.1.3.3-1: *RRCConnectionReconfiguration (Preamble for EN-DC or NGEN-DC)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Derivation Path: 36.508[47] Table 4.6.1-8 | | | | | | |
| Information Element | | | Value/remark | | Comment | | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { | | |  | |  | |  |
| criticalExtensions CHOICE { | | |  | |  | |  |
| c1 CHOICE{ | | |  | |  | |  |
| rrcConnectionReconfiguration-r8 SEQUENCE { | | |  | |  | |  |
| mobilityControlInfo | | | MobilityControlInfo-HO-SameCell | | As per Table 7.1.3.3.1.3.3-2 | |  |
| radioResourceConfigDedicated | | | RadioResourceConfigDedicated-DRB-Rel-Add | | As per Table 7.1.3.3.1.3.3-3 | |  |
| nonCriticalExtension SEQUENCE { | | |  | |  | |  |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nonCriticalExtension SEQUENCE { |  | |  | |  | |
| nr-Config-r15 CHOICE { |  | |  | |  | |
| setup SEQUENCE { |  | |  | |  | |
| nr-SecondaryCellGroupConfig-r15 | OCTET STRING including the RRCReconfiguration message according to TS 38.508-1 [4], table 4.6.1-13 with condition EN-DC\_HO. | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| sk-Counter-r15 | Increment the value by 1 from the previous value | |  | |  | |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [4], table 4.6.3-132 with condition EN-DC\_DRB and Re-establish\_PDCP | |  | |  | |
| nr-RadioBearerConfig2-r15 | OCTET STRING including RadioBearerConfig according to TS 38.508-1 [4], table 4.6.3-132 with conditions SRB\_NR\_PDCP and MCG\_NR\_PDCP | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |
| } | |  | |  | |  | |

Table 7.1.3.3.1.3.3-2: *MobilityControlInfo-HO-SameCell* (Table 7.1.3.3.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.5-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| MobilityControlInfo-HO ::= SEQUENCE { |  |  |  |
| targetPhysCellId | PhysicalCellIdentity of E-UTRA Cell 1 |  |  |
| carrierFreq | Not present |  |  |
| } |  |  |  |

Table 7.1.3.3.1.3.3-3: *RadioResourceConfigDedicated-DRB-Rel-Add* (Table 7.1.3.3.1.3.3-1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.3-19AAAAAD | | | | | |
| Information Element | | Value/remark | Comment | | Condition |
| RadioResourceConfigDedicated-SRB2-DRB ::= SEQUENCE { |  | |  |  | | |
| srb-ToAddModList | Not present | |  |  | | |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry | |  |  | | |
| drb-ToAddMod[1] | DRB-ToAddMod-DEFAULT (8) using condition AM except pdcp-Config not included | | entry 1  See TS 36.508 subclause 4.8.2 |  | | |
| } |  | |  |  | | |
| drb-ToReleaseList SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity { | 1 entry | |  |  | | |
| DRB-Identity[1] | 8 | | entry 1  Same as the DRB Identity associated with the default EPS bearer |  | | |
| } |  | |  |  | | |
| } |  | |  |  | | |

##### 7.1.3.3.2 Ciphering and deciphering / Correct functionality of encryption algorithm AES / SRB / DRB

7.1.3.3.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and SRB is configured with NR-PDCP }

**ensure that** {

**when** { Functionality of encryption algorithms with AES is taken into use on SRB }

**then** { UE performs correct ciphering/deciphering function in NR-PDCP entity associated with SRB }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { Functionality of encryption algorithms with AES is taken into use on DRB }

**then** {UE performs correct ciphering/deciphering function in NR-PDCP entity associated with DRB }

}

7.1.3.3.2.2 Conformance requirements

Same conformance requirement as in clause 7.1.3.3.1.2.

7.1.3.3.2.3 Test description

7.1.3.3.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.3.1.3.1 with the exception that ciphering algorithm ‘nea2 (AES)’ and ‘eea2 (AES)’ is configured.

7.1.3.3.2.3.2 Test procedure sequence

Same Test procedure sequence as in clause 7.1.3.3.1.3.2

7.1.3.3.2.3.3 Specific message contents

None

##### 7.1.3.3.3 Ciphering and deciphering / Correct functionality of encryption algorithm ZUC / SRB / DRB

7.1.3.3.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and SRB is configured with NR-PDCP}

**ensure that** {

**when** { Functionality of encryption algorithms with ZUC is taken into use on SRB }

**then** { UE performs correct ciphering/deciphering function in NR-PDCP entity associated with SRB }

}

(2)

**with** { UE in RRC\_CONNECTED state and DRB is configured with NR-PDCP}

**ensure that** {

**when** { Functionality of encryption algorithms with ZUC is taken into use on DRB }

**then** { UE performs correct ciphering/deciphering function in NR-PDCP entity associated with DRB }

}

7.1.3.3.3.2 Conformance requirements

Same conformance requirement as in clause 7.1.3.3.1.2.

7.1.3.3.3.3 Test description

7.1.3.3.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.3.1.3.1 with the exception that ciphering algorithm ‘nea3 (ZUC)’ and ‘eea3 (ZUC)’ is configured.

7.1.3.3.3.3.2 Test procedure sequence

Same Test procedure sequence as in clause 7.1.3.3.1.3.2.

7.1.3.3.3.3.3 Specific message contents

None

#### 7.1.3.4 PDCP Handover

##### 7.1.3.4.1 PDCP handover / Lossless handover / PDCP sequence number maintenance / PDCP status report to convey the information on missing or acknowledged PDCP SDUs at handover / In-order delivery and duplicate elimination in the downlink

7.1.3.4.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with default RB using RLC-AM }

**ensure that** {

**when** { UE is requested to make a lossless handover by SS }

**then** { UE creates a PDCP status report to SS }

}

(2)

**with** { UE in RRC\_CONNECTED state with default RB using RLC-AM }

**ensure that** {

**when** { UE is requested to make a lossless handover by SS }

**then** { UE retransmits the unacknowledged data }

}

(3)

**with** { UE in RRC\_CONNECTED state with default RB using RLC-AM }

**ensure that** {

**when** { UE is requested to make a lossless handover by SS }

**then** { UE achieves in-order delivery and discards a PDCP PDU already received in the downlink }

}

7.1.3.4.1.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.323, clauses 5.1.2, 5.2.2.1, 5.3, 5.4.1, 5.4.2 and 7.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.1.2]

When upper layers request a PDCP entity re-establishment, the UE shall additionally perform once the procedures described in this section. After performing the procedures in this section, the UE shall follow the procedures in subclause 5.2.

When upper layers request a PDCP entity re-establishment, the transmitting PDCP entity shall:

- for UM DRBs and AM DRBs, reset the header compression protocol for uplink and start with an IR state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and SRBs, set TX\_NEXT to the initial value;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- for UM DRBs, for each PDCP SDU already associated with a PDCP SN but for which a corresponding PDU has not previously been submitted to lower layers:

- consider the PDCP SDUs as received from upper layer;

- perform transmission of the PDCP SDUs in ascending order of the COUNT value associated to the PDCP SDU prior to the PDCP re-establishment without restarting the *discardTimer*, as specified in subclause 5.2.1;

- for AM DRBs, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to the PDCP entity re-establishment as specified below:

- perform header compression of the PDCP SDU as specified in the subclause 5.7.4;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the subclause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in subclause 5.2.1.

When upper layers request a PDCP entity re-establishment, the receiving PDCP entity shall:

- process the PDCP Data PDUs that are received from lower layers due to the re-establishment of the lower layers, as specified in the subclause 5.2.2.1;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- for SRBs and UM DRBs, if *t-Reordering* is running:

- stop and reset *t-Reordering*;

- for UM DRBs, deliver all stored PDCP SDUs to the upper layers in ascending order of associated COUNT values after performing header decompression;

- for AM DRBs, perform header decompression for all stored PDCP SDUs if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and AM DRBs, reset the header compression protocol for downlink and start with NC state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and SRBs, set RX\_NEXT and RX\_DELIV to the initial value;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure.

[TS 38.323, clause 5.2.2.1]

In this section, following definitions are used:

- HFN(State Variable): the HFN part (i.e. the number of most significant bits equal to HFN length) of the State Variable;

- SN(State Variable): the SN part (i.e. the number of least significant bits equal to PDCP SN length) of the State Variable;

- RCVD\_SN: the PDCP SN of the received PDCP Data PDU, included in the PDU header;

- RCVD\_HFN: the HFN of the received PDCP Data PDU, calculated by the receiving PDCP entity;

- RCVD\_COUNT: the COUNT of the received PDCP Data PDU = [RCVD\_HFN, RCVD\_SN].

At reception of a PDCP Data PDU from lower layers, the receiving PDCP entity shall determine the COUNT value of the received PDCP Data PDU, i.e. RCVD\_COUNT, as follows:

- if RCVD\_SN < SN(RX\_DELIV) – Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) + 1.

- else if RCVD\_SN >= SN(RX\_DELIV) + Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) – 1.

- else:

- RCVD\_HFN = HFN(RX\_DELIV);

- RCVD\_COUNT = [RCVD\_HFN, RCVD\_SN].

After determining the COUNT value of the received PDCP Data PDU = RCVD\_COUNT, the receiving PDCP entity shall:

- perform deciphering and integrity verification of the PDCP Data PDU using COUNT = RCVD\_COUNT;

- if integrity verification fails:

- indicate the integrity verification failure to upper layer;

- discard the PDCP Data PDU;

- if RCVD\_COUNT < RX\_DELIV; or

- if the PDCP Data PDU with COUNT = RCVD\_COUNT has been received before:

- discard the PDCP Data PDU;

If the received PDCP Data PDU with COUNT value = RCVD\_COUNT is not discarded above, the receiving PDCP entity shall:

- store the resulting PDCP SDU in the reception buffer;

- if RCVD\_COUNT >= RX\_NEXT:

- update RX\_NEXT to RCVD\_COUNT + 1.

- if *outOfOrderDelivery* is configured:

- deliver the resulting PDCP SDU to upper layers.

- if RCVD\_COUNT = RX\_DELIV:

- deliver to upper layers in ascending order of the associated COUNT value after performing header decompression, if not decompressed before;

- all stored PDCP SDU(s) with consecutively associated COUNT value(s) starting from COUNT = RX\_DELIV;

- update RX\_DELIV to the COUNT value of the first PDCP SDU which has not been delivered to upper layers, with COUNT value > RX\_DELIV;

- if *t-Reordering* is running, and if RX\_DELIV >= RX\_REORD:

- stop and reset *t-Reordering*.

- if *t-Reordering* is not running (includes the case when *t-Reordering* is stopped due to actions above), and RX\_DELIV < RX\_NEXT:

- update RX\_REORD to RX\_NEXT;

- start *t-Reordering*.

[TS 38.323, clause 5.3]

When the *discardTimer* expires for a PDCP SDU, or the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU. If the corresponding PDCP Data PDU has already been submitted to lower layers, the discard is indicated to lower layers.

For SRBs, when upper layers request a PDCP SDU discard, the PDCP entity shall discard all stored PDCP SDUs and PDCP PDUs.

NOTE: Discarding a PDCP SDU already associated with a PDCP SN causes a SN gap in the transmitted PDCP Data PDUs, which increases PDCP reordering delay in the receiving PDCP entity. It is up to UE implementation how to minimize SN gap after SDU discard.

[TS 38.323, clause 5.4.1]

For AM DRBs configured by upper layers to send a PDCP status report in the uplink (*statusReportRequired* in TS 38.331 [3]), the receiving PDCP entity shall trigger a PDCP status report when:

- upper layer requests a PDCP entity re-establishment;

- upper layer requests a PDCP data recovery.

If a PDCP status report is triggered, the receiving PDCP entity shall:

- compile a PDCP status report as indicated below by:

- setting the FMC field to RX\_DELIV;

- if RX\_DELIV < RX\_NEXT:

- allocating a Bitmap field of length in bits equal to the number of COUNTs from and not including the first missing PDCP SDU up to and including the last out-of-sequence PDCP SDUs, rounded up to the next multiple of 8, or up to and including a PDCP SDU for which the resulting PDCP Control PDU size is equal to 9000 bytes, whichever comes first;

- setting in the bitmap field as '0' for all PDCP SDUs that have not been received, and optionally PDCP SDUs for which decompression have failed;

- setting in the bitmap field as '1' for all PDCP SDUs that have been received;

- submit the PDCP status report to lower layers as the first PDCP PDU for transmission via the transmitting PDCP entity as specified in subclause 5.2.1..

[TS 38.323, clause 5.4.2]

For AM DRBs, when a PDCP status report is received in the downlink, the transmitting PDCP entity shall:

- consider for each PDCP SDU, if any, with the bit in the bitmap set to '1', or with the associated COUNT value less than the value of FMC field as successfully delivered, and discard the PDCP SDU as specified in the subclause 5.3.

[TS 38.323, clause 7.1]

This sub clause describes the state variables used in PDCP entities in order to specify the PDCP protocol. The state variables defined in this subclause are normative.

All state variables are non-negative integers, and take values from 0 to [232 – 1].

PDCP Data PDUs are numbered integer sequence numbers (SN) cycling through the field: 0 to [2[*pdcp-SN-Size*] – 1].

The transmitting PDCP entity shall maintain the following state variables:

a) TX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU to be transmitted. The initial value is 0.

The receiving PDCP entity shall maintain the following state variables:

a) RX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU expected to be received. The initial value is 0.

b) RX\_DELIV

This state variable indicates the COUNT value of the first PDCP SDU not delivered to the upper layers, but still waited for. The initial value is 0.

c) RX\_REORD

This state variable indicates the COUNT value following the COUNT value associated with the PDCP Data PDU which triggered *t-Reordering*.

7.1.3.4.1.3 Test description

7.1.3.4.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 except the following:

- 2 NR cells (NR Cell 1 and NR Cell 2) are configured with DRBs in RLC AM mode.

- The cell power levels are configured as per the Table 7.1.3.4.1.3.1-1.

- DRB of NR Cell 1 is configured according to Table 7.1.3.4.1.3.1-3.

Table 7.1.3.4.1.3.1-1: Time instances of cell power level in FR1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **EUTRA Cell 1** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/SCS | -85 | - | - |  |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -88 | Off |  |
| T1 | Cell-specific RS EPRE | dBm/SCS | -85 | - | - |  |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -88 | -82 |  |
| T2 | Cell-specific RS EPRE | dBm/SCS | -85 | - |  |  |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -82 | -88 |  |

Table 7.1.3.4.1.3.1-2: Time instances of cell power level in FR2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **EUTRA Cell 1** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| T0 | Cell-specific RS EPRE | dBm/SCS | -96 | - | - |  |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -91 | Off |  |
| T1 | Cell-specific RS EPRE | dBm/SCS | -96 | - | - |  |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -91 | -82 |  |
| T2 | Cell-specific RS EPRE | dBm/SCS | -96 | - |  |  |
| SS/PBCH  SSS EPRE | dBm/SCS | - | -82 | -91 |  |

Table 7.1.3.4.1.3.1-3: RLC parameters

|  |  |
| --- | --- |
| *t-PollRetransmit* | ms150 |

Table 7.1.3.4.1.3.1-4: MAC-CellGroupConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508, clause Table 4.6.3-68 | | | |
| Information Element | Value/remark | Comment | Condition |
| MAC-CellGroupConfig ::= SEQUENCE { |  |  |  |
| bsr-Config SEQUENCE { |  |  |  |
| retxBSR-Timer | sf80 |  |  |
| } |  |  |  |

7.1.3.4.1.3.2 Test procedure sequence

Table 7.1.3.4.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 5 PDCP Data PDUs and the TX\_NEXT is set to "0". | - | - | - | - |
| - | EXCEPTION: Step 2 and 3 shall be repeated for k=0 to 1(increment=1). | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#k via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k on NR Cell 1.  After having sent a PDU, the SS set TX\_NEXT = k+1. | <-- | PDCP PDU DATA #k | - | - |
| 3 | The UE sends the PDCP Data PDU#k via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k on NR Cell 1.  Data is previously received data from PDU #k. (Note 1) | --> | PDCP PDU DATA #k | - | - |
| 3A | The SS changes NR Cell 2 parameters according to the row "T1" in table 7.1.3.4.1.3.1-1(FR1) / 7.1.3.4.1.3.1-2(FR2). |  |  |  |  |
| - | EXCEPTION: Step 4 to 6 shall be repeated for m=2 to 4 (increment=1). | - | - | - | - |
| 4 | The SS is configured on NR Cell 1 not to send RLC acknowledgement (RLC ACK) to the next received RLC SDU to the UE. | - | - | - | - |
| 5 | The SS sends the PDCP Data PDU #m via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN =m.  After having sent a PDU, the SS set TX\_NEXT = m+1. (Note 6) | <-- | PDCP PDU DATA #m | - | - |
| 6 | The UE sends the PDCP Data PDU#m via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = m.  Data is previously received data from PDU #m. (Note 2) | --> | PDCP PDU DATA #m | - | - |
| 6A | Configure SS not to allocate UL grant to the UE in NR Cell 1 |  |  |  |  |
| 7 | Void | - | - | - | - |
| 8 | The SS transmits NR RRCReconfiguration message to perform SpCell change from NR Cell1 to NR Cell2  (Note 3) | <-- | *RRCReconfiguration* | - | - |
| 9 | The SS assigns UL grant during the Random Access procedure on NR Cell 2 to allow the UE to send PDCP status report.(Note 5) | - | *-* | - | - |
| - | EXCEPTION: Steps 10 and 11 can occur in any order. (Note 7) | - | - | - | - |
| 10 | The UE transmits a NR *RRCReconfigurationComplete* message.  (Note 4) | --> | *RRCReconfigurationComplete* | - | - |
| 11 | Check: Does the UE send PDCP Control PDUs via RLC-AM RB with the following content to the SS:  D/C field = 0 (PDCP control PDU) and PDU Type =000, FMC field = 5 on NR Cell 2? | --> | PDCP STATUS REPORT | 1 | P |
| 12 | The SS generates a PDCP status report message and sends it to UE: D/C field = 0 (PDCP control PDU) and PDU Type =000, FMC field = 2 on NR Cell 2. | <-- | PDCP STATUS REPORT | - | - |
| 13 | Configure the SS to allocate Default UL grants to the UE in NR Cell 2. | - | - | - | - |
| 14 | Void | - | - | - | - |
| - | EXCEPTION: Step 15 shall be repeated for m=2 to 4 (increment=1). | - | - | - | - |
| 15 | Check: Does the UE send the PDCP Data PDU #m via RLC-AM RB with the following content to the SS:  D/C field = 1 (PDCP Data PDU) and PDCP SN = m on NR Cell 2?  Note: Data is previously received data from PDU #m.  (Note 8) | --> | PDCP PDU DATA #m | 2 | P |
| 16 | The SS sends the PDCP Data PDU#5 via RLC-AM RB with the following content to the UE:  PDCP Data PDU #5 (  D/C field = 1 (PDCP Data PDU) and PDCP SN=5) on NR Cell 2. | <-- | PDCP DATA PDU#5 | - | - |
| 17 | The UE transmits a PDCP Data PDU via RLC-AM RB with the following content back to the SS:  D/C field = 1 (PDCP Data PDU) and PDCP SN=5 on NR Cell 2.  Note: Data is previously received packet in PDCP Data PDU#5.  (Note 1) | --> | PDCP DATA PDU #5 | - | - |
| 18 | TX\_NEXT is set to "6".  The SS creates a PDCP Data PDU#6 (not transmitted). | - | - | - | - |
| 19 | The TX\_NEXT is set to "7". The SS creates a PDCP Data PDU #7. | - | - | - | - |
| 20 | The SS sends PDCP Data PDU#7 via RLC-AM RB with the following content to the UE:  PDCP Data PDU#7;  D/C field = 1 (PDCP Data PDU) and PDCP SN=7 on NR Cell 2. | <-- | PDCP DATA PDU #7 | - | - |
| 21 | Check: Does the UE transmit a PDCP DATA PDU#7 on NR Cell 2? | --> | PDCP DATA PDU#7 | 3 | F |
| 21A | Configure SS not to allocate UL grant to the UE in NR Cell 1 | - | - | - | - |
| 22 | The SS changes NR Cell 1 and NR Cell 2 parameters according to row "T2" in Table 7.1.3.4.1.3.1-1(FR1) / 7.1.3.4.1.3.1-2(FR2). | - | - | - | - |
| 23 | The SS requests transmits NR RRCReconfiguration message to perform SpCell change from NR Cell2 to NR Cell1 with key change.  (Note 3) | <-- | *RRCReconfiguration* | - | - |
| 24 | SS assigns UL grant during the Random Access procedure on NR Cell 1 to allow the UE to send PDCP status report.(Note 5) | - | *-* | - | - |
| - | EXCEPTION: Steps 25 and 26 can occur in any order. (Note 7) | - | - | - | - |
| 25 | The UE transmits a NR *RRCReconfigurationComplete* message.  (Note 4) | --> | *RRCReconfigurationComplete* | - | - |
| 26 | The UE sends PDCP Control PDUs via RLC-AM RB with the following content to the SS: D/C field = 0 (PDCP control PDU) and PDU Type =000, FMC field = 6, Bitmap = 0x80 on NR Cell 1. | --> | PDCP STATUS REPORT | - | - |
| 27 | The SS generates a PDCP status report message and sends it to UE: D/C field = 0 (PDCP control PDU) and PDU Type =000, FMC field = 6 on NR Cell 1. | <-- | PDCP STATUS REPORT | - | - |
| 28 | Configure the SS to allocate Default UL grants to the UE in NR Cell 1 | - | - | - | - |
| 28A | The SS sends the PDCP Data PDU#5 via RLC-AM RB with the following content to the UE:  PDCP Data PDU #5 (  D/C field = 1 (PDCP Data PDU) and PDCP SN=5) on NR Cell 1. | <-- | PDCP DATA PDU#5 | - | - |
| 28B | Check: Does the UE transmit a PDCP Data PDU via RLC-AM RB with the following content back to the SS:  D/C field = 1 (PDCP Data PDU) and PDCP SN=5 on NR Cell 1 within the next 5 seconds? | --> | PDCP DATA PDU #5 | 3 | F |
| 29 | The SS sends the PDCP Data PDU#6 via RLC-AM RB with the following content to the UE:  PDCP Data PDU#6 (  D/C field = 1 (PDCP Data PDU) and PDCP SN=6) on NR Cell 1. | <-- | PDCP DATA PDU #6 | - | - |
| 30 | Check: Does the UE transmit a PDCP Data PDU via RLC-AM RB with the following content back to the SS?  D/C field = 1 (PDCP Data PDU) and PDCP SN=6 on NR Cell 1.  Note: Data is previously received packet in PDCP Data PDU#6  (Note 9) | --> | PDCP DATA PDU #6 | 3 | P |
| 31 | Check: Does the UE transmit PDCP Data PDU via RLC-AM RB with the following content back to the SS?  D/C field = 1 (PDCP Data PDU) and PDCP SN=7 on NR Cell 1.  Note: Data is previously received packet in PDCP Data PDU#7  (Note 9) | --> | PDCP DATA PDU #7 | 3 | P |
| Note 1: The SS acknowledges the received data.  Note 2: SS doesn’t send the RLC ACK for this data.  Note 3: For EN-DC the NR RRCReconfiguration *(Table* 7.1.3.4.1.3.3-1 with *cond EN-DC)* and *RadioBearerConfig* message (Table 7.1.3.4.1.3.3-2) are contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using conditions EN-DC\_EmbedNR\_RRCRecon, EN-DC\_PSCell\_HO and RBConfig\_KeyChange. IE sk-Counter-r15 is included with a value incremented by 1 than previous value.  Note 4: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 5: For pc\_supportOfRedCap\_r17=false, the PDCP STATUS REPORT PDU size shall be 6 octets with 3 octets of RLC header, 2 octets of MAC header and 3 octets of MAC BSR or padding, so TBS of 112 bits shall be allocated. For pc\_supportOfRedCap\_r17=true, the PDCP STATUS REPORT PDU size shall be 6 octets with 2 octets of RLC header, 2 octets of MAC header and 4 octets of MAC BSR or padding, so TBS of 112 bits shall be allocated.  Note 6: PDCP PDU with m = 2 is sent at t = 0 and the subsequent PDCP PDUs are sent at t = (m-2)\*100.  Note 7: Per 38.508-1 Table 4.6.3-66: *LogicalChannelConfig*, both SRB1 and DRB have the same logical channel priority with prioritisedBitRate as infinity.  Note 8 PDCP PDUs at step 15 (m=2 to 4) may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot).  Note 9 PDCP PDUs at steps 30 and 31 may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot). | | | | | | |

7.1.3.4.1.3.3 Specific message contents

Table 7.1.3.4.1.3.3-0: SchedulingRequest-Config (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-155 | | | |
| Information Element | Value/remark | Comment | Condition |
| sr-TransMax | n64 |  |  |

Table 7.1.3.4.1.3.3-1: *RRCReconfiguration* (steps 8, 23)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  | NR |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| } |  |  |  |
| nonCriticalExtension::= SEQUENCE { |  |  | NR |
| masterCellGroup | CellGroupConfig |  |  |
| masterKeyUpdate ::= SEQUENCE { |  |  |  |
| keySetChangeIndicator | false |  |  |
| nextHopChainingCount | 0 |  |  |
| nas-Container | Not present | Horizontal key derivation |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.1.3.3-2: *RadioBearerConfig* (Table 7.1.3.4.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | 2 | SCG DRB Id | EN-DC |
|  | Default DRB of the first PDU session |  | NR |
| reestablishPDCP | True |  |  |
| recoverPDCP | Not present |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.1.3.3-3: *PDCP-Config* (Table 7.1.3.4.1.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| statusReportRequired | True |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.1.3.3-4: *CellGroupConfig* for EN-DC(Table 7.1.3.4.1.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-19 with condition PSCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| spCellConfigCommon | ServingCellConfigCommon |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.1.3.3-4A: *CellGroupConfig* for NR/5GC(Table 7.1.3.4.1.3.3-1)

|  |
| --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-19 with condition PCell\_change |

Table 7.1.3.4.1.3.3-5: Void

Table 7.1.3.4.1.3.3-6: Void

##### 7.1.3.4.2 PDCP handover / Non-lossless handover / PDCP sequence number maintenance

7.1.3.4.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with default RB using RLC-UM }

**ensure that** {

**when** { UE is requested to make a non-lossless handover by SS }

**then** { UE transmits next PDCP Data PDU with SN value 0 }

}

(2)

**with** { UE in RRC\_CONNECTED state with default RB using RLC-UM }

**ensure that** {

**when** { UE is requested to make a non-lossless handover by SS }

**then** { UE is able to receive next PDCP Data PDU with SN value 0 }

}

7.1.3.4.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clause 5.1.2. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.1.2]

When upper layers request a PDCP entity re-establishment, the UE shall additionally perform once the procedures described in this section. After performing the procedures in this section, the UE shall follow the procedures in subclause 5.2.

When upper layers request a PDCP entity re-establishment, the transmitting PDCP entity shall:

- for UM DRBs and AM DRBs, reset the header compression protocol for uplink and start with an IR state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and SRBs, set TX\_NEXT to the initial value;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- for UM DRBs, for each PDCP SDU already associated with a PDCP SN but for which a corresponding PDU has not previously been submitted to lower layers:

- consider the PDCP SDUs as received from upper layer;

- perform transmission of the PDCP SDUs in ascending order of the COUNT value associated to the PDCP SDU prior to the PDCP re-establishment without restarting the *discardTimer*.

- for AM DRBs, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to the PDCP entity re-establishment as specified below:

- perform header compression of the PDCP SDU as specified in the subclause 5.7.4;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the subclause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer.

When upper layers request a PDCP entity re-establishment, the receiving PDCP entity shall:

- process the PDCP Data PDUs that are received from lower layers due to the re-establishment of the lower layers, as specified in the subclause 5.2.2.1;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- for UM DRBs, if *t-Reordering* is running:

- stop and reset *t-Reordering*;

- deliver all stored PDCP SDUs to the upper layers in ascending order of associated COUNT values after performing header decompression.

- for AM DRBs, perform header decompression for all stored PDCP SDUs if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and AM DRBs, reset the header compression protocol for downlink and start with NC state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and SRBs, set RX\_NEXT and RX\_DELIV to the initial value;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure.

7.1.3.4.2.3 Test description

7.1.3.4.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 except that the DRB under test is configured in RLC UM mode. For EN-DC, ciphering algorithm is configured as null on E-UTRA.

7.1.3.4.2.3.2 Test procedure sequence

Table 7.1.3.4.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 3 PDCP Data PDUs and the TX\_NEXT is set to "0". | - | - | - | - |
| - | EXCEPTION: Step 2 and 3 shall be repeated for k=0 to 1 (increment=1). | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU #k via RLC-UM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k.  After having sent a PDU, the SS set TX\_NEXT= k+1. | <-- | PDCP PDU DATA #k | - | - |
| 3 | The UE sends the PDCP Data PDU #k via RLC-UM RB with the following content to the SS:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k. | --> | PDCP PDU DATA #k | - | - |
| 4 | The SS transmits NR *RRCReconfiguration* message to trigger non-lossless handover to the same SpCell. (Note 1, Note 3 and Note4) | <-- | *RRCReconfiguration* | - | - |
| 5 | The UE transmits a NR *RRCReconfigurationComplete* message. (Note 2) | --> | *RRCReconfigurationComplete* | - | - |
| 6 | The SS sends the PDCP Data PDU #2 via RLC-UM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0.  After having sent a PDU, the SS set TX\_NEXT= 1. | <-- | PDCP PDU DATA #2 | - | - |
| 7 | Check: Does the UE send the PDCP Data PDU #2 via RLC-UM RB with the following content back to the SS:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0? | --> | PDCP PDU DATA #2 | 1, 2 | P |
| Note 1: For EN-DC the NR RRCReconfiguration message with SCG Key change (secondary to master)is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_PSCell\_HO and RBConfig\_KeyChange.  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 3: The RRCReconfiguration message triggers UE to perform the Random Access procedure, MAC reset, RLC and PDCP re-establishment.  Note 4: For NR, the RRCReconfiguration message with master key change is as per RRCReconfiguration-HO with condition RBConfig\_KeyChange according to 38.508-1 [4], Table 4.8.1-1A. | | | | | |

7.1.3.4.2.3 Specific message contents

Table 7.1.3.4.2.3-1: *RRCReconfiguration* for EN-DC (step 4, Table 7.1.3.4.2.3.2-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 with condition EN-DC\_HO. |

Table 7.1.3.4.2.3-1A: *RRCReconfiguration* for NR/5GC (step 4, Table 7.1.3.4.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.8.1-1A with condition RBConfig\_KeyChange | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| masterKeyUpdate SEQUENCE { |  |  |  |
| keySetChangeIndicator | false | K |  |
| nextHopChainingCount | 0 | Horizontal key derivation |  |
| nas-Container | not present |  |  |
| } |  |  |  |

Table 7.1.3.4.2.3-2: *RadioBearerConfig* for EN-DC (step 4, Table 7.1.3.4.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-132 with condition EN-DC\_DRB AND Re-establish\_PDCP | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| securityConfig SEQUENCE { |  |  |  |
| securityAlgorithmConfig | SecurityAlgorithmConfig |  |  |
| keyToUse | master |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.2.3-3: SecurityAlgorithmConfig for EN-DC (Table 7.1.3.4.2.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-165 | | | |
| Information Element | Value/remark | Comment | Condition |
| SecurityAlgorithmConfig ::= SEQUENCE { |  |  |  |
| cipheringAlgorithm | nea0 |  |  |
| } |  |  |  |

Table 7.1.3.4.2.3-4: *CellGroupConfig* for EN-DC (step 4, Table 7.1.3.4.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-19 with condition PSCell\_change | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 1 entry |  | EN-DC |
| RLC-Bearer-Config[1] | RLC-BearerConfig with conditions UM and DRB2 and Re-establish\_RLC | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.2.3-5: *CellGroupConfig* for NR/5GC (step 4, Table 7.1.3.4.2.3.2-1)

|  |
| --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-19 with condition PCell\_change |

##### 7.1.3.4.3 PDCP handover / DAPS handover / Status reporting / Intra-frequency

7.1.3.4.3.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state and supporting Intra-frequency DAPS handover }

**ensure that** {

**when** { UE receives an RRCReconfiguration message including a reconfigurationWithSync for Intra-frequency DAPS handover } **then** { PDCP entity associated with a DAPS bearer shall keep DL/UL reception/transmission with the source gNB }

}

(2)

**with** { UE in NR RRC\_CONNECTED state and supporting Intra-frequency DAPS handover and receiving an RRCReconfiguration message including a reconfigurationWithSync for Intra-frequency DAPS handover }

**ensure that** {

**when** { UE has performed random access procedure to the target cell successfully } **then** { UE shall perform uplink data switching }

}

(3)

**with** { UE in NR RRC\_CONNECTED state and supporting Intra-frequency DAPS handover and receiving an RRCReconfiguration message including a reconfigurationWithSync for Intra-frequency DAPS handover }

**ensure that** {

**when** { upper layer requests a uplink data switching } **then** { UE shall send a PDCP status report for the DAPS bearer }

}

(4)

**with** { UE in NR RRC\_CONNECTED state and supporting Intra-frequency DAPS handover and receiving an RRCReconfiguration message including a reconfigurationWithSync for Intra-frequency DAPS handover }

**ensure that** {

**when** { upper layer requests a PDCP entity reconfiguration and the associated RLC entity is released for a radio bearer } **then** { UE shall send a PDCP status report for the DAPS bearer }

}

7.1.3.4.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.331 clause 5.3.5.5.2 and TS 38323 clause 4.2.2, 5.4.1, 5.8, 5.9 and 5.13. Unless otherwise stated these are Rel-16 requirements.

[TS 38.331, clause 5.3.5.5.2]

The UE shall perform the following actions to execute a reconfiguration with sync.

1> if the AS security is not activated, perform the actions upon going to RRC\_IDLE as specified in 5.3.11 with the release cause '*other*' upon which the procedure ends;

…

1> If any DAPS bearer is configured:

2> create a MAC entity for the target cell group with the same configuration as the MAC entity for the source cell group;

2> for each DAPS bearer:

3> establish an RLC entity or entities for the target cell group, with the same configurations as for the source cell group;

3> establish the logical channel for the target cell group, with the same configurations as for the source cell group;

NOTE 2b: In order to understand if a DAPS bearer is configured, the UE needs to check the presence of the field *daps-Config* within the *RadioBearerConfig* IE received in *radioBearerConfig* or *radioBearerConfig2*.

2> for each SRB:

3> establish an RLC entity for the target cell group, with the same configurations as for the source cell group;

3> establish the logical channel for the target cell group, with the same configurations as for the source cell group;

3> suspend SRBs for the source cell group;

NOTE 3: Void

2> apply the value of the *newUE-Identity* as the C-RNTI in the target cell group;

2> configure lower layers for the target SpCell in accordance with the received s*pCellConfigCommon*;

2> configure lower layers for the target SpCell in accordance with any additional fields, not covered in the previous, if included in the received reconfigurationWithSync.

[TS 38.323, clause 4.2.2]

The PDCP entities are located in the PDCP sublayer. Several PDCP entities may be defined for a UE. Each PDCP entity is carrying the data of one radio bearer. A PDCP entity is associated either to the control plane or the user plane depending on which radio bearer it is carrying data for.

Figure 4.2.2.1 represents the functional view of the PDCP entity for the PDCP sublayer; it should not restrict implementation. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].

For split bearers and DAPS bearers, routing is performed in the transmitting PDCP entity.

A PDCP entity associated with DRB can be configured by upper layers TS 38.331 [3] to use header compression. In this version of the specification, the robust header compression protocol (ROHC) and the Ethernet header compression protocol (EHC) are supported. Each header compression protocol is independently configured for a DRB.



Figure 4.2.2-1: PDCP layer, functional view

Figure 4.2.2-2 represents the functional view of the PDCP entity associated with the DAPS bearer for the PDCP sublayer; it should not restrict implementation. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].

For DAPS bearers, the PDCP entity is configured with two sets of security functions and keys and two sets of header compression protocols.



Figure 4.2.2-2: PDCP layer associated with DAPS bearer, functional view

[TS 38.323, clause 5.4.1]

For AM DRBs configured by upper layers to send a PDCP status report in the uplink (*statusReportRequired* in TS 38.331 [3]), the receiving PDCP entity shall trigger a PDCP status report when:

- upper layer requests a PDCP entity re-establishment;

- upper layer requests a PDCP data recovery;

- upper layer requests a uplink data switching;

- upper layer reconfigures the PDCP entity to release DAPS and *daps-SourceRelease* is configured in TS 38.331 [3].

For UM DRBs configured by upper layers to send a PDCP status report in the uplink (*statusReportRequired* in TS 38.331 [3]), the receiving PDCP entity shall trigger a PDCP status report when:

- upper layer requests a uplink data switching.

[TS 38.323, clause 5.8]

The ciphering function includes both ciphering and deciphering and is performed in PDCP, if configured. The data unit that is ciphered is the MAC-I (see clause 6.3.4) and the data part of the PDCP Data PDU (see clause 6.3.3) except the SDAP header and the SDAP Control PDU if included in the PDCP SDU. The ciphering is not applicable to PDCP Control PDUs.

For downlink and uplink, the ciphering algorithm and key to be used by the PDCP entity are configured by upper layers TS 38.331 [3] and the ciphering method shall be applied as specified in TS 33.501 [6].

The ciphering function is activated/suspended/resumed by upper layers TS 38.331 [3]. When security is activated and not suspended, the ciphering function shall be applied to all PDCP Data PDUs indicated by upper layers TS 38.331 [3] for the downlink and the uplink, respectively.

For DAPS bearers, the PDCP entity shall perform the ciphering or deciphering for the PDCP SDU using the ciphering algorithm and key either configured for the source cell or configured for the target cell, based on to/from which cell the PDCP SDU is transmitted/received.

For downlink and uplink ciphering and deciphering, the parameters that are required by PDCP for ciphering are defined in TS 33.501 [6] and are input to the ciphering algorithm. The required inputs to the ciphering function include the COUNT value, and DIRECTION (direction of the transmission: set as specified in TS 33.501 [6]). The parameters required by PDCP which are provided by upper layers TS 38.331 [3] are listed below:

- BEARER (defined as the radio bearer identifier in TS 33.501 [6]. It will use the value RB identity –1 as in TS 38.331 [3]);

- KEY (the ciphering keys for the control plane and for the user plane are KRRCenc and KUPenc, respectively).

[TS 38.323, clause 5.9]

The integrity protection function includes both integrity protection and integrity verification and is performed in PDCP, if configured. The data unit that is integrity protected is the PDU header and the data part of the PDU before ciphering. The integrity protection is always applied to PDCP Data PDUs of SRBs. The integrity protection is applied to sidelink SRB1, SRB2 and SRB3. The integrity protection is applied to PDCP Data PDUs of DRBs (including sidelink DRBs for unicast) for which integrity protection is configured. The integrity protection is not applicable to PDCP Control PDUs.

For downlink and uplink, the integrity protection algorithm and key to be used by the PDCP entity are configured by upper layers TS 38.331 [3] and the integrity protection method shall be applied as specified in TS 33.501 [6].

The integrity protection function is activated/suspended/resumed by upper layers TS 38.331 [3]. When security is activated and not suspended, the integrity protection function shall be applied to all PDUs including and subsequent to the PDU indicated by upper layers TS 38.331 [3] for the downlink and the uplink, respectively.

NOTE 1: As the RRC message which activates the integrity protection function is itself integrity protected with the configuration included in this RRC message, this message needs first be decoded by RRC before the integrity protection verification could be performed for the PDU in which the message was received.

NOTE 2: As the PC5-S message which activates the integrity protection function is itself integrity protected with the configuration included in this PC5-S message, this message needs first be decoded by upper layer before the integrity protection verification could be performed for the PDU in which the message was received.

For DAPS bearers, the PDCP entity shall perform the integrity protection or verification for the PDCP SDU using the integrity protection algorithm and key either configured for the source cell or configured for the target cell, based on to/from which cell the PDCP SDU is transmitted/received.

For downlink and uplink integrity protection and verification, the parameters that are required by PDCP for integrity protection are defined in TS 33.501 [6] and are input to the integrity protection algorithm. The required inputs to the integrity protection function include the COUNT value, and DIRECTION (direction of the transmission: set as specified in TS 33.501 [6]). The parameters required by PDCP which are provided by upper layers TS 38.331 [3] are listed below:

- BEARER (defined as the radio bearer identifier in TS 33.501 [6]. It will use the value RB identity –1 as in TS 38.331 [3]);

- KEY (the integrity protection keys for the control plane and for the user plane are KRRCint and KUPint, respectively).

[TS 38.323, clause 5.13]

For DAPS bearers, when upper layers request uplink data switching, the transmitting PDCP entity shall:

- for AM DRBs, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by the RLC entity associated with the source cell, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to uplink data switching to the RLC entity associated with the target cell as specified below:

- perform header compression of the PDCP SDU using ROHC as specified in the clause 5.7.4;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the clause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in clause 5.2.1.

- for UM DRBs, for all PDCP SDUs which have been processed by PDCP but which have not yet been submitted to lower layers, perform transmission of the PDCP SDUs in ascending order of the COUNT values to the RLC entity associated with the target cell as specified below:

- perform header compression of the PDCP SDU using ROHC as specified in the clause 5.7.4;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the clause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in clause 5.2.1.

7.1.3.4.3.3 Test description

7.1.3.4.3.3.1 Pre-test conditions

System Simulator:

Same Pre-test conditions as in clause 7.1.3.0 except the following:

- NR Cell 1 is the Serving cell and the power level is configured to ''Serving Cell” defined in TS 38.508-1 [4] Table 6.2.2.1-3.

- NR Cell 2 is the Suitable neighbour intra-frequency cell and the power level is configured to '' Suitable neighbour intra-frequency cell” defined in TS 38.508-1 [4] Table 6.2.2.1-3.

- System information combination NR-2 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used for both NR Cells.

- Test Loop Function (On) with UE test loop mode A (message condition UE TEST LOOP MODE A to return one UL PDCP SDU per DL PDCP SDU) activated according to TS 38.508-1 [4], table 4.5.4.2-3.

UE:

- None.

Preamble:

- The UE is in 3N-A state configured with DRB#1 in RLC AM mode according to TS 38.508-1 [4], Table 4.4A.2-3.

7.1.3.4.3.3.2 Test procedure sequence

Table 7.1.3.4.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits an *RRCReconfiguration* message containing *reconfigurationWithSync* to order UE to perform DAPS handover to NR Cell 2. DRB#n of the first PDU session is configured as DAPS bearer. | <-- | NR RRC: *RRCReconfiguration* | - | - |
| - | EXCEPTION: In parallel with step 2-3, parallel behaviour defined in table 7.1.3.4.3.3.2-2 is executed repeatedly. | - | - | - | - |
| 2 | The SS sends one IP Packet to the UE via DRB#n of the first PDU session in NR Cell 1 and | <-- | PDCP PDU DATA #0 | - | - |
| 2A | The SS stops sending RLC acknowledgements. | - | - | - | - |
| 3 | Check: Does the UE loop back the IP packet received at step 2 in NR Cell 1? | --> | PDCP PDU DATA #0 | 1 | P |
| 4 | The SS transmits Random Access Response to respond to the latest preamble in NR Cell 2. | <- | Random Access Response | - | - |
| - | EXCEPTION: Steps 5-7 can occur in any order. | - | - | - | - |
| 5 | The UE transmits an *RRCReconfigurationComplete* message in NR Cell 2. | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 6 | Check: Does the UE retransmit the IP packet received at step 2 in NR Cell 2? | --> | PDCP PDU DATA #0 | 2 | P |
| 7 | Check: Does the UE send PDCP status report in NR Cell 2? (Note 1) | --> | PDCP STATUS REPORT | 3 | P |
| 8 | The SS transmits an *RRCReconfiguration* message with condition DAPS\_HO\_ReleaseSource in NR Cell 2. | <-- | NR RRC: *RRCReconfiguration* | - | - |
| - | EXCEPTION: Steps 9-10 can occur in any order. | - | - | - | - |
| 9 | The UE transmits an RRCReconfigurationComplete message in NR Cell 2. | --> | NR RRC: *RRCReconfigurationComplete* | - | - |
| 10 | Check: Does the UE send PDCP status report in NR Cell 2? (Note 1) | --> | PDCP STATUS REPORT | 4 | P |
| Note 1: D/C field = 0 (PDCP control PDU) and PDU Type =000 (PDCP status report), FMC field = 1. | | | | | |

Table 7.1.3.4.3.3.2-2: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The UE transmits preamble to NR Cell 2. | -> | (PRACH Preamble) | - | - |

7.1.3.4.3.3.3 Specific message contents

Table 7.1.3.4.3.3.3-1: *RRCReconfiguration* (step 1, Table 7.1.3.4.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.8.1-1A with Condition RBConfig\_NoKeyChange | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig with conditions DRBn and DAPS\_PDCP |  |  |
| nonCriticalExtension SEQUENCE{ |  |  |  |
| masterCellGroup | CellGroupConfig | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-2: *CellGroupConfig* (Table 7.1.3.4.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 1 entry |  |  |
| RLC-BearerConfig[1] | RLC-BearerConfig with conditions AM, DRBn | entry1 |  |
| } |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| spCellConfigCommon SEQUENCE { |  |  |  |
| physCellId | Physical Cell Identity of NR Cell 2 |  |  |
| uplinkConfigCommon | UplinkConfigCommon | Table 7.1.3.4.3.3.3-5 |  |
| } |  |  |  |
| rach-ConfigDedicated CHOICE { |  |  |  |
| uplink | RACH-ConfigDedicated | OCTET STRING (CONTAINING RACH-ConfigDedicated) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-3: *RACH-ConfigDedicated* (Table 7.1.3.4.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-129 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigDedicated ::= SEQUENCE { |  |  |  |
| cfra SEQUENCE { |  |  |  |
| occasions SEQUENCE { |  |  |  |
| rach-ConfigGeneric | RACH-ConfigGeneric | OCTET STRING (CONTAINING RACH-ConfigGeneric) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-4: *RACH-ConfigGeneric* (Table 7.1.3.4.3.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| preambleTransMax | n200 |  |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-5: UplinkConfigCommon (Table 7.1.3.4.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-201 | | | |
| Information Element | Value/remark | Comment | Condition |
| UplinkConfigCommon ::= SEQUENCE { |  |  |  |
| initialUplinkBWP | BWP-UplinkCommon | Table 7.1.3.4.3.3.3-6 |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-6: BWP-UplinkCommon (Table 7.1.3.4.3.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-14 |  |  |  |
| Information Element | Value/remark | Comment | Condition |
| BWP-UplinkCommon ::= SEQUENCE { |  |  |  |
| rach-ConfigCommon CHOICE { |  |  |  |
| setup | RACH-ConfigCommon | Table 7.1.3.4.3.3.3-7 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-7: *RACH-ConfigCommon (*Table 7.1.3.4.3.3.3-6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-128 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigCommon::= SEQUENCE { |  |  |  |
| rach-ConfigGeneric | RACH-ConfigGeneric | Table 7.1.3.4.3.3.3-8 |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-8: *RACH-ConfigGeneric (*Table 7.1.3.4.3.3.3-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| preambleTransMax | 200 |  |  |
| } |  |  |  |

Table 7.1.3.4.3.3.3-9: *RRCReconfiguration* (step 8, Table 7.1.3.4.3.3.2-1)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.8.1-1A with Condition DAPS\_HO\_ReleaseSource |

##### 7.1.3.4.4 PDCP handover / DAPS handover / Status reporting / Inter-frequency

7.1.3.4.4.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state and supporting Inter-frequency DAPS handover }

**ensure that** {

**when** { UE receives an RRCReconfiguration message including a reconfigurationWithSync for Inter-frequency DAPS handover }

**then** { PDCP entity associated with a DAPS bearer shall keep DL/UL reception/transmission with the source gNB }

}

(2)

**with** { UE in NR RRC\_CONNECTED state and supporting Inter-frequency DAPS handover and receiving an RRCReconfiguration message including a reconfigurationWithSync for Inter-frequency DAPS handover }

**ensure that** {

**when** { UE has performed random access procedure to the target cell successfully }

**then** { UE shall perform uplink data switching }

}

(3)

**with** { UE in NR RRC\_CONNECTED state and supporting Inter-frequency DAPS handover and receiving an RRCReconfiguration message including a reconfigurationWithSync for Inter-frequency DAPS handover }

**ensure that** {

**when** { upper layer requests a uplink data switching }

**then** { UE shall send a PDCP status report for the DAPS bearer }

}

(4)

**with** { UE in NR RRC\_CONNECTED state and supporting Inter-frequency DAPS handover and receiving an RRCReconfiguration message including a reconfigurationWithSync for Inter-frequency DAPS handover }

**ensure that** {

**when** { upper layer requests a PDCP entity reconfiguration and the associated RLC entity is released for a radio bearer }

**then** { UE shall send a PDCP status report for the DAPS bearer }

}

7.1.3.4.4.2 Conformance requirements

Same as test case 7.1.3.4.3.2.

7.1.3.4.4.3 Test description

7.1.3.4.4.3.1 Pre-test conditions

Same as test case 7.1.3.4.3 with the following differences:

- Cells configuration: NR Cell 3 replaces NR Cell 2.

- System information combination: NR-4 replaces NR-2.

7.1.3.4.4.3.2 Test procedure sequence

Same as test case 7.1.3.4.3 with the following differences:

- Cells configuration: NR Cell 3 replaces NR Cell 2.

7.1.3.4.4.3.3 Specific message contents

Same as test case 7.1.3.4.3 with the following differences:

- Cells configuration: NR Cell 3 replaces NR Cell 2.

#### 7.1.3.5 PDCP other

##### 7.1.3.5.1 PDCP Discard

7.1.3.5.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { the Discard Timer for a PDCP SDU expires }

**then** { UE discards the corresponding PDCP SDU }

}

7.1.3.5.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clause 5.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.3]

When the *discardTimer* expires for a PDCP SDU, or the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU. If the corresponding PDCP Data PDU has already been submitted to lower layers, the discard is indicated to lower layers.

For SRBs, when upper layers request a PDCP SDU discard, the PDCP entity shall discard all stored PDCP SDUs and PDCP PDUs.

NOTE: Discarding a PDCP SDU already associated with a PDCP SN causes a SN gap in the transmitted PDCP Data PDUs, which increases PDCP reordering delay in the receiving PDCP entity. It is up to UE implementation how to minimize SN gap after SDU discard.

[TS 38.323, clause 7.1]

This sub clause describes the state variables used in PDCP entities in order to specify the PDCP protocol. The state variables defined in this subclause are normative.

All state variables are non-negative integers, and take values from 0 to [232 – 1].

PDCP Data PDUs are numbered integer sequence numbers (SN) cycling through the field: 0 to [2[*pdcp-SN-Size*] – 1].

The transmitting PDCP entity shall maintain the following state variables:

a) TX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU to be transmitted. The initial value is 0.

The receiving PDCP entity shall maintain the following state variables:

a) RX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU expected to be received. The initial value is 0.

b) RX\_DELIV

This state variable indicates the COUNT value of the first PDCP SDU not delivered to the upper layers, but still waited for. The initial value is 0.

c) RX\_REORD

This state variable indicates the COUNT value following the COUNT value associated with the PDCP Data PDU which triggered *t-Reordering*.

[TS 38.323, clause 6.3.5]

Length: 32 bits

The COUNT value is composed of a HFN and the PDCP SN. The size of the HFN part in bits is equal to 32 minus the length of the PDCP SN.



Figure 6.3.5-1: Format of COUNT

NOTE: COUNT does not wrap around.

7.1.3.5.1.3 Test description

7.1.3.5.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with exceptions listed in Table 7.1.3.5.1.3.1-1 applicable for the configured UM DRB and Table 7.1.3.5.1.3.3-1 for SR configuration except that PDCP is configured for 18 bit SN.

Table 7.1.3.5.1.3.1-1: PDCP Settings

|  |  |
| --- | --- |
| Parameter | Value |
| Discard\_Timer | 500 ms |

7.1.3.5.1.3.2 Test procedure sequence

Table 7.1.3.5.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | EXCEPTION: The SS does not allocate UL grants unless when explicitly stated so in the procedure. | - | - | - | - |
| 1 | The SS creates 5 PDCP Data PDUs and the PDCP SN = "0" within TX\_NEXT. |  | - | - | - |
| 2 | Void |  |  |  |  |
| - | EXCEPTION: Step 3 shall be repeated for k=0 to 2 (increment=1) with the below specified PDU size sent to the UE:  Data PDU#1 = 46 bytes for k=0  Data PDU#2 = 62 bytes for k=1  Data PDU#3 = 78 bytes for k=2 | - | - | - | - |
| 3 | The SS sends a PDCP Data PDU via RLC-UM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k  After having sent a PDU, the SS sets PDCP SN is set to k+1 within TX\_NEXT. | <-- | PDCP DATA PDU (SN=k) | - | - |
| 4 | Wait for Discard\_Timer to expire.  Note: According to TS38.508-1, timer tolerance should be 10% of Discard\_Timer. | - | - | - | - |
| - | EXCEPTION: Step 5 shall be repeated for k=3 to 4 (increment=1) with the below specified PDU size sent to the UE:  Data PDU#4 = 94 bytes for k=3  Data PDU#5 = 110 bytes for k=4 | - | - | - | - |
| 5 | The SS sends a PDCP Data PDU via RLC-UM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k  After having sent a PDU, the SS sets PDCP SN is set to k+1 within TX\_NEXT. | <-- | PDCP DATA PDU (SN=k) | - | - |
| 6 | The SS resumes normal UL grant allocation. | - | - | - | - |
| 7 | Check: Does UE transmit a PDCP Data PDU # 4 of size 94 bytes? (Note1) (Note 2) | --> | PDCP Data PDU # 4 | 1 | P |
| 8 | Check: Does UE transmit a PDCP Data PDU # 5 of size 110 bytes? (Note1) (Note 2) | --> | PDCP Data PDU # 5 | 1 | P |
| Note 1 PDCP Data PDU contents are checked to verify that the UL PDU is same as the DL PDU. According to the Note in TS 38.323 [19] clause 5.3 in case of PDCP SDUs being discarded it is up to the UE implementation which SN to be used and therefore the SN cannot be checked.  Note 2 PDCP PDUs at steps 7 and 8 may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot). | | | | | |

7.1.3.5.1.3.3 Specific message contents

Table 7.1.3.5.1.3.3-1: SchedulingRequest-Config (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-155 | | | |
| Information Element | Value/remark | Comment | Condition |
| sr-TransMax | n64 |  |  |

##### 7.1.3.5.1a NR NTN / PDCP Discard / discardTimerExt2 configured

7.1.3.5.1a.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state on a cell which provides access by NR NTN }

**ensure that** {

**when** { *discardTimerExt2* is configured }

**then** { UE discards the PDCP SDU considering value signalled in discardTimerExt2 and ignores *discardTimer* }

}

7.1.3.5.1a.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clause 5.3, 7.1, 6.3.5, 7.3 and TS 38.331, clause 6.3.2. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.3]

When the *discardTimer* expires for a PDCP SDU, or the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU. If the corresponding PDCP Data PDU has already been submitted to lower layers, the discard is indicated to lower layers.

For SRBs, when upper layers request a PDCP SDU discard, the PDCP entity shall discard all stored PDCP SDUs and PDCP PDUs.

NOTE: Discarding a PDCP SDU already associated with a PDCP SN causes a SN gap in the transmitted PDCP Data PDUs, which increases PDCP reordering delay in the receiving PDCP entity. It is up to UE implementation how to minimize SN gap after SDU discard.

[TS 38.323, clause 7.1]

This clause describes the state variables used in PDCP entities in order to specify the PDCP protocol. The state variables defined in this clause are normative.

All state variables are non-negative integers, and take values from 0 to [232 – 1].

PDCP Data PDUs are numbered integer sequence numbers (SN) cycling through the field: 0 to [2[*pdcp-SN-SizeUL*] – 1] or 0 to [2[*pdcp-SN-SizeDL*] – 1] or 0 to [2[*sl-PDCP-SN-Size*] – 1].

The transmitting PDCP entity shall maintain the following state variables:

a) TX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU to be transmitted. The initial value is 0, except for SRBs configured with state variables continuation. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

The receiving PDCP entity shall maintain the following state variables:

a) RX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU expected to be received. The initial value is 0, except for sidelink broadcast and groupcast, for SRBs configured with state variables continuation, and for broadcast MRBs. For NR sidelink communication for broadcast and groupcast or sidelink SRB4 for NR sidelink discovery, the initial value of the SN part of RX\_NEXT is (x +1) modulo (2[*sl-PDCP-SN-Size*]), where x is the SN of the first received PDCP Data PDU. For broadcast MRBs, the initial value of the SN part of RX\_NEXT is (x +1) modulo (2[*PDCP-SN-SizeDL*]), where x is the SN of the first received PDCP Data PDU. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

NOTE 1: For NR sidelink communication for broadcast and groupcast or sidelink SRB4 for NR sidelink discovery, it is up to UE implementation to select the HFN part for RX\_NEXT such that initial value of RX\_DELIV should be a positive value.

NOTE 2: For broadcast MRBs, the initial value of the HFN part of RX\_NEXT is set by UE implementation.

b) RX\_DELIV

This state variable indicates the COUNT value of the first PDCP SDU not delivered to the upper layers, but still waited for. The initial value is 0, except for sidelink broadcast and groupcast, for SRBs configured with state variables continuation, and for MRBs. For NR sidelink communication for broadcast and groupcast or sidelink SRB4 for NR sidelink discovery, the initial value of the SN part of RX\_DELIV is (x – 0.5 × 2[*sl-PDCP-SN-Size*–1]) modulo (2[*sl-PDCP-SN-Size*]), where x is the SN of the first received PDCP Data PDU. For broadcast MRBs, the initial value of the SN part of RX\_DELIV is set to (x – 0.5 × 2[*PDCP-SN-SizeDL*–1]) modulo (2[*PDCP-SN-SizeDL*]), where x is the SN of the first received PDCP Data PDU. For multicast MRBs, the initial value of RX\_DELIV is set, if provided, by *initialRX-DELIV* in TS 38.331 [3]. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

NOTE 3: For broadcast MRBs, the initial value of the HFN part of RX\_DELIV is set by UE implementation.

c) RX\_REORD

This state variable indicates the COUNT value following the COUNT value associated with the PDCP Data PDU which triggered *t-Reordering*. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

[TS 38.323, clause 6.3.5]

Length: 32 bits

The COUNT value is composed of a HFN and the PDCP SN. The size of the HFN part in bits is equal to 32 minus the length of the PDCP SN.



Figure 6.3.5-1: Format of COUNT

NOTE: COUNT does not wrap around.

[TS 38.323, clause 7.3]

The transmitting PDCP entity shall maintain the following timers:

a) *discardTimer*

This timer is configured only for DRBs. The duration of the timer is configured by upper layers TS 38.331 [3]. In the transmitter, a new timer is started upon reception of an SDU from upper layer.

[TS 38.331, clause 6.3.2]

***discardTimerExt2***

Value in ms of *discardTimerExt* specified in TS 38.323 [5]. Value *ms2000* corresponds to 2000 ms. If this field is present, the field *discardTimer* and *discardTimerExt* are ignored and *discardTimerExt2* is used instead.

7.1.3.5.1a.3 Test description

7.1.3.5.1a.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with exceptions listed in Table 7.1.3.5.1a.3.1-1 applicable for the configured UM DRB and Table 7.1.3.5.1a.3.3-1 for SR configuration.

Table 7.1.3.5.1a.3.1-1: PDCP Settings

|  |  |
| --- | --- |
| Parameter | Value |
| discardTimer | 500 ms |
| discardTimerExt2-r17 | 2000ms |

System Simulator:

- NR Cell 1 as specified in TS 38.508-1 [4] Table 4.4.2.1.

- System information combination NR-28 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used.

UE:

- The pre-configured UE location is defined in TS 38.508-1 [4] Clause 4.5C.

7.1.3.5.1a.3.2 Test procedure sequence

Table 7.1.3.5.1a.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| - | EXCEPTION: The SS does not allocate UL grants unless when explicitly stated so in the procedure. | - | - | - | - |
| 1 | The SS sends a PDCP Data PDU via RLC-UM RB. Data PDU = 46 bytes. | <-- | PDCP DATA PDU (SN=0) | - | - |
| 2 | Wait for discardTimer to expire.  Note: According to TS 38.508-1 [4], timer tolerance should be 10% of discardTimer. | - | - | - | - |
| 3 | The SS resumes normal UL grant allocation. | - | - | - | - |
| 4 | Check: Does UE transmit a PDCP Data PDU of size 46 bytes? (Note1) | --> | PDCP Data PDU | 1 | P |
| 5 | Configure SS not to allocate UL grant to the UE. | - | - | - | - |
| 6 | The SS sends a PDCP Data PDU via RLC-UM RB. Data PDU = 62 bytes. | <-- | PDCP DATA PDU (SN=1) | - | - |
| 7 | Wait for discardTimerExt2-r17 to expire.  Note: According to TS 38.508-1 [4], timer tolerance should be 10% of discardTimerExt2-r17. | - | - | - | - |
| 8 | The SS sends a PDCP Data PDU via RLC-UM RB. Data PDU = 94 bytes. | <-- | PDCP DATA PDU (SN=2) | - | - |
| 9 | The SS resumes normal UL grant allocation. | - | - | - | - |
| 10 | Check: Does UE transmit a PDCP Data PDU of size 94 bytes? (Note1) | --> | PDCP Data PDU | 1 | P |
| Note 1 PDCP Data PDU contents are checked to verify that the UL PDU is same as the DL PDU. According to the Note in TS 38.323 [19] clause 5.3 in case of PDCP SDUs being discarded it is up to the UE implementation which SN to be used and therefore the SN cannot be checked. | | | | | |

7.1.3.5.1a.3.3 Specific message contents

Table 7.1.3.5.1a.3.3-1: SchedulingRequest-Config (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-155 | | | |
| Information Element | Value/remark | Comment | Condition |
| sr-ProhibitTimer | ms64 |  |  |
| sr-TransMax | n64 |  |  |

##### 7.1.3.5.2 PDCP Uplink Routing / Split DRB

7.1.3.5.2.1 Test Purpose

(1)

**with** { UE in RRC\_CONNECTED state with SCG activated with a Split DRB established and total amount of PDCP data volume is less than *ul-DataSplitThreshold* and not yet transmitted RLC data volume in the two associated RLC entities }

**ensure that** {

**when** { UE has PDCP SDUs available for transmission }

**then** { the UE transmits the PDCP SDUs on the Primary RLC entity }

}

(2)

**with** { UE in RRC\_CONNECTED state with SCG activated with a Split DRB established and total amount of PDCP data volume is not less than *ul-DataSplitThreshold* and not yet transmitted RLC data volume in the two associated RLC entities }

**ensure that** {

**when** { UE has PDCP SDUs available for transmission }

**then** { the UE transmits the PDCP SDUs on the primary or secondary RLC entity }

}

7.1.3.5.2.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clause 5.2.1. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.2.1]

At reception of a PDCP SDU from upper layers, the transmitting PDCP entity shall:

- start the *discardTimer* associated with this PDCP SDU (if configured).

For a PDCP SDU received from upper layers, the transmitting PDCP entity shall:

- associate the COUNT value corresponding to TX\_NEXT to this PDCP SDU;

NOTE 1: Associating more than half of the PDCP SN space of contiguous PDCP SDUs with PDCP SNs, when e.g., the PDCP SDUs are discarded or transmitted without acknowledgement, may cause HFN desynchronization problem. How to prevent HFN desynchronization problem is left up to UE implementation.

- perform header compression of the PDCP SDU as specified in the subclause 5.7.4;

- perform integrity protection, and ciphering using the TX\_NEXT as specified in the subclause 5.9 and 5.8, respectively;

- set the PDCP SN of the PDCP Data PDU to TX\_NEXT modulo 2[*pdcp-SN-Size*];

- increment TX\_NEXT by one;

- submit the resulting PDCP Data PDU to lower layer as specified below.

When submitting a PDCP Data PDU to lower layer, the transmitting PDCP entity shall:

- if the transmitting PDCP entity is associated with one RLC entity:

- submit the PDCP Data PDU to the associated RLC entity.

- else, if the transmitting PDCP entity is associated with two RLC entities:

- if the PDCP duplication is activated:

- if the PDCP PDU is a PDCP Data PDU:

- duplicate the PDCP Data PDU and submit the PDCP Data PDU to both associated RLC entities.

- else:

- if the two associated RLC entities belong to the different Cell Groups; and

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 36.322 [5]) in the two associated RLC entities is equal to or larger than *ul-DataSplitThreshold*:

- submit the PDCP Data PDU to either the primary RLC entity or the secondary RLC entity;.

- else:

- submit the PDCP Data PDU to the primary RLC entity.

NOTE 2: If the transmitting PDCP entity is associated with two RLC entities, the UE should minimize the amount of PDCP PDUs submitted to lower layers before receiving request from lower layers and minimize the PDCP SN gap between PDCP PDUs submitted to two associated RLC entities to minimize PDCP reordering delay in the receiving PDCP entity.

7.1.3.5.2.3 Test description

7.1.3.5.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with exceptions listed in Table 7.1.3.5.2.3.1-1 and Generic procedure parameter DC bearer(*MCG and split*).

For NR/5GC, NR Cell 1 is the PCell and NR Cell 10 is the PSCell and same Pre-test conditions as in clause 7.1.3.0 using generic procedure parameter Connectivity (NR-DC) with DC bearer(*MCG and split)*.

Table 7.1.3.5.2.3.1-1: PDCP Settings

|  |  |
| --- | --- |
| Parameter | Value |
| Discard\_Timer | 500 ms |
| ul-DataSplitThreshold | b100 |

7.1.3.5.2.3.2 Test procedure sequence

Table 7.1.3.5.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 0A | SS transmits NR *RRCReconfiguration* message to configure the primary path on the MCG Cell. | <-- | *RRCReconfiguration* | - | - |
| 0B | UE transmits *RRCReconfigurationComplete* (Note 2). | --> | *RRCReconfigurationComplete* | - | - |
| 1 | The SS sends a PDCP Data PDU on the split DRB on AM RLC entity configured for SCG on PSCell.  Data PDU = 64 bytes. | <-- | PDCP DATA PDU | - | - |
| - | EXCEPTION: In parallel with step 2, UE may execute parallel behaviour defined in table 7.1.3.5.2.3.2-2. | - | - | - | - |
| 2 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 1 | P |
| 2A | SS transmits NR *RRCReconfiguration* message to configure the primary path on the SCG Cell. | <-- | *RRCReconfiguration* | - | - |
| 2B | UE transmits *RRCReconfigurationComplete* (Note 2). | --> | *RRCReconfigurationComplete* | - | - |
| 2C | The SS sends a PDCP Data PDU on the split DRB on AM RLC entity configured for SCG on PSCell.  Data PDU = 64 bytes. | <-- | PDCP DATA PDU | - | - |
| - | EXCEPTION: In parallel with step 2D, UE may execute parallel behaviour defined in table 7.1.3.5.2.3.2-2. | - | - | - | - |
| 2D | Check: Does UE transmit a PDCP Data PDU on the primary AM RLC entity? | --> | PDCP DATA PDU | 1 | P |
| 3 | The SS sends a PDCP Data PDU on the split DRB on AM RLC entity configured for SCG on PSCell.  Data PDU = 164 bytes. | <-- | PDCP DATA PDU | - | - |
| - | EXCEPTION: Steps 4a1 to 4b2 describe optional behaviour that depends on the UE uplink path | - | - | - | - |
| 4a1 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 2 | P |
| 4a2 | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary entity | --> | PDCP DATA PDU | 2 | F |
| 4b1 | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary entity? | --> | PDCP DATA PDU | 2 | P |
| 4b2 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 2 | F |
| 5 | SS transmits NR *RRCReconfiguration* message to configure new split DRB parameters, where the ul-DataSplitThreshold is equal to 0 bytes (Note 1). | <-- | *RRCReconfiguration* | - | - |
| 6 | UE transmits *RRCReconfigurationComplete* (Note 2). | --> | *RRCReconfigurationComplete* | - | - |
| 7 | The SS sends a PDCP Data PDU on the split DRB on AM RLC entity configured for SCG on PSCell.  Data PDU = 64 bytes | <-- | PDCP Data PDU | - | - |
| - | EXCEPTION: Steps 8a1 to 8b2 describe optional behaviour that depends on the UE uplink path | - | - | - | - |
| 8a1 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 2 | P |
| 8a2 | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary entity? | --> | PDCP DATA PDU | 2 | F |
| 8b1 | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary? | --> | PDCP DATA PDU | 2 | P |
| 8b2 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary? | --> | PDCP DATA PDU | 2 | F |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR *RRCReconfigurationComplete* message is contained in *RRCConnectionReconfigurationComplete*. | | | | | |

Table 7.1.3.5.2.3.2-2: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary entity in next 2 seconds?  NOTE: 2 seconds is sufficient time to discard PDCP PDU. | --> | PDCP DATA PDU | 1 | F |

7.1.3.5.2.3.3 Specific message contents

Table 7.1.3.5.2.3.3-0A: *RRCConnectionReconfiguration* (step 0A, step 2A, step 5, Table 7.1.3.5.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE{ |  |  |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.2.3.3-0B: *RRCReconfiguration* (step 0A, step 2C, step 5, Table 7.1.3.5.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| radioBearerConfig2 | OCTET STRING including RadioBearerConfig |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.2.3.3-1: *RadioBearerConfig* (Table 7.1.3.5.2.3.3-0A and Table 7.1.3.5.2.3.3-0B)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| pdcp-Config SEQUENCE { |  |  |  |
| moreThanOneRLC SEQUENCE { |  |  |  |
| primaryPath SEQUENCE { |  |  |  |
| cellGroup | 0 |  | Step 0A |
| 1 |  | Step 2A |
| logicalChannel | LogicalChannelIdentity |  |  |
| } |  |  |  |
| ul-DataSplitThreshold | b0 |  | Step 5 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.3.5.3 PDCP Data Recovery

7.1.3.5.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with a DRB established using RLC-AM }

**ensure that** {

**when** { network requests reconfiguration and recovery of the DRB (without handover) }

**then** { UE reconfigures the DRB and performs retransmission of all the PDCP PDUs previously submitted to re-established AM RLC entity in ascending order of the associated COUNT values from the first PDCP PDU for which the successful delivery has not been confirmed by lower layers }

}

7.1.3.5.3.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.2.1, 5.4.1 and 5.5; TS 38.331, clause 5.3.5.4.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.2.1]

At reception of a PDCP SDU from upper layers, the transmitting PDCP entity shall:

- start the *discardTimer* associated with this PDCP SDU (if configured).

For a PDCP SDU received from upper layers, the transmitting PDCP entity shall:

- associate the COUNT value corresponding to TX\_NEXT to this PDCP SDU;

NOTE 1: Associating more than half of the PDCP SN space of contiguous PDCP SDUs with PDCP SNs, when e.g., the PDCP SDUs are discarded or transmitted without acknowledgement, may cause HFN desynchronization problem. How to prevent HFN desynchronization problem is left up to UE implementation.

- perform header compression of the PDCP SDU as specified in the subclause 5.7.4;

- perform integrity protection, and ciphering using the TX\_NEXT as specified in the subclause 5.9 and 5.8, respectively;

- set the PDCP SN of the PDCP Data PDU to TX\_NEXT modulo 2[*pdcp-SN-Size*];

- increment TX\_NEXT by one;

- submit the resulting PDCP Data PDU to lower layer as specified below.

When submitting a PDCP PDU to lower layer, the transmitting PDCP entity shall:

- if the transmitting PDCP entity is associated with one RLC entity:

- submit the PDCP PDU to the associated RLC entity;

- else, if the transmitting PDCP entity is associated with two RLC entities:

- if *pdcp-Duplication* is configured and activated:

- duplicate the PDCP Data PDU and submit the PDCP Data PDU to both associated RLC entities;

- else, if *pdcp-Duplication* is configured but not activated:

- submit the PDCP Data PDU to the primary RLC entity;

- else:

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 38.322 [5]) in the two associated RLC entities is less than *ul-DataSplitThreshold*:

- submit the PDCP PDU to the primary RLC entity;

- else:

- submit the PDCP PDU to either the primary RLC entity or the secondary RLC entity.

NOTE 2: If the transmitting PDCP entity is associated with two RLC entities, the UE should minimize the amount of PDCP PDUs submitted to lower layers before receiving request from lower layers and minimize the PDCP SN gap between PDCP PDUs submitted to two associated RLC entities to minimize PDCP reordering delay in the receiving PDCP entity.

[TS 38.323, clause 5.4.1]

For AM DRBs configured by upper layers to send a PDCP status report in the uplink (*statusReportRequired* in TS 38.331 [3]), the receiving PDCP entity shall trigger a PDCP status report when:

- upper layer requests a PDCP entity re-establishment;

- upper layer requests a PDCP data recovery.

If a PDCP status report is triggered, the receiving PDCP entity shall:

- compile a PDCP status report as indicated below by:

- setting the FMC field to RX\_DELIV;

- if RX\_DELIV < RX\_NEXT:

- allocating a Bitmap field of length in bits equal to the number of COUNTs from and not including the first missing PDCP SDU up to and including the last out-of-sequence PDCP SDUs, rounded up to the next multiple of 8, or up to and including a PDCP SDU for which the resulting PDCP Control PDU size is equal to 9000 bytes, whichever comes first;

- setting in the bitmap field as '0' for all PDCP SDUs that have not been received, and optionally PDCP SDUs for which decompression have failed;

- setting in the bitmap field as '1' for all PDCP SDUs that have been received;

- submit the PDCP status report to lower layers as the first PDCP PDU for transmission.

[TS 38.323, clause 5.4.2]

For AM DRBs, when a PDCP status report is received in the downlink, the transmitting PDCP entity shall:

- consider for each PDCP SDU, if any, with the bit in the bitmap set to '1', or with the associated COUNT value less than the value of FMC field as successfully delivered, and discard the PDCP SDU as specified in the subclause 5.3.

[TS 38.323, clause 5.5]

For AM DRBs, when upper layers request a PDCP data recovery for a radio bearer, the transmitting PDCP entity shall:

- perform retransmission of all the PDCP Data PDUs previously submitted to re-established or released AM RLC entity in ascending order of the associated COUNT values for which the successful delivery has not been confirmed by lower layers.

After performing the above procedures, the transmitting PDCP entity shall follow the procedures in subclause 5.2.1.

7.1.3.5.3.3 Test description

7.1.3.5.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 except that DRB is configured in RLC AM mode according to Table 7.1.3.5.3.3.1-1.

For NR 5GC, NRCell 1 is the PCell and NR Cell 10 is the PSCell and same Pre-test conditions as in clause 7.1.3.0 using generic procedure parameter Connectivity (*NR-DC*).

Table 7.1.3.5.3.3.1-1: RLC parameters

|  |  |
| --- | --- |
| *t-PollRetransmit* | ms150 |

7.1.3.5.3.3.2 Test procedure sequence

Table 7.1.3.5.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Void | - | - | - | - |
| 2 | The SS creates 3 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| - | EXCEPTION: Steps 2A and 4 shall be repeated for k=0 to 2 (increment=1). | - | - | - | - |
| 2A | The SS is configured on PSCell to not send RLC acknowledgement (RLC ACK) to the UE. | - | - | - | - |
| 3 | The SS sends the PDCP Data PDU #k on SCG DRB on (PSCell):  D/C field = 1 (PDCP Data PDU) and PDCP SN = k.  After having sent a PDU, the SS sets Next\_PDCP\_TX\_SN= k+1. | <-- | PDCP PDU DATA #k | - | - |
| 4 | The UE sends the PDCP Data PDU #k on the AM RLC entity configured for PSCell:  D/C field = 1 (PDCP Data PDU) and PDCP SN = k.  Data is previously received data from PDU #k. | --> | PDCP PDU DATA #k | - | - |
| 4A | The SS does not allocate any UL grant. | - | - | - | - |
| 5 | The SS transmits a NR *RRCReconfiguration*. (Note 1). | <-- | *RRCReconfiguration* | - | - |
| 6 | The SS assigns 1 UL grant of sufficient size. (Note 4) | - | *-* | - | - |
| - | EXCEPTION: Steps 7 and 8 can occur in any order. (Note 3) | - | - | - | - |
| 7 | The UE transmits a NR RRCReconfigurationComplete.  (Note 2) | --> | RRCReconfigurationComplete | - | - |
| 8 | The UE sends PDCP Control PDUs via RLC-AM RB entity configured for PSCell Connectivity (EN-DC) and PCell for Connectivity (NR-DC)with the following content to the SS:  D/C field = 0 (PDCP control PDU) and PDU Type =000, FMC field = 3. | --> | PDCP STATUS REPORT | - | - |
| 8A | After 100 ms the SS allocates 3 UL grants every 20ms of sufficient size to enable the UE to return each received PDCP PDU in one looped back PDCP PDU on PSCell for Connectivity (EN-DC) and PCell for Connectivity (NR-DC). | - | - | - | - |
| - | EXCEPTION: Step 9 shall be repeated for k=0 to 2 (increment=1). | - | - | - | - |
| 9 | Check: Does the UE send the PDCP Data PDU #k via the AM RLC entity configured for PSCell for Connectivity EN-DC and PCell for Connectivity (NR-DC).  D/C field = 1 (PDCP Data PDU) and PDCP SN = k.  Data is previously received data from PDU #k ? | --> | PDCP DATA PDU #k | 1 | P |
| Note 1: For EN-DC the NR *RRCReconfiguration* message is contained in *RRCConnectionReconfiguration.*  Note 2: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 3: Per 38.508-1 Table 4.6.3-66: LogicalChannelConfig, both SRB1 and DRB have the same logical channel priority with prioritisedBitRate as infinity.  Note 4: For EN-DC, 104-bits of grant size is provided to include 10 bytes of PDCP Status report MAC PDU+ 3 bytes of Short BSR and/or Padding. For NR-DC, 272-bits of grant size to include 5 bytes of RLC STATUS MAC PDU, 10 bytes of PDCP Status report MAC PDU, 14 bytes of RRCReconfigurationComplete MAC PDU, 2 bytes of Short BSR and 3 bytes of Padding. | | | | | |

7.1.3.5.3.3.3 Specific message contents

Table 7.1.3.5.3.3.3-1: *RRCConnectionReconfiguration* (step 5, Table 7.1.3.5.3.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.6.1-8 with condition MCG\_and\_SCG | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE{ |  |  |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nr-Config-r15 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| nr-SecondaryCellGroupConfig-r15 | OCTET STRING including the *RRCReconfiguration-PDCP* message and the IE secondaryCellGroup |  |  |
| } |  |  |  |
| } |  |  |  |
| nr-RadioBearerConfig1-r15 | OCTET STRING including RadioBearerConfig-PDCP-ENDC |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.3.3.3-2: RRCReconfiguration-PDCP(Table 7.1.3.5.3.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| radioBearerConfig | Not present |  | NR-DC |
| secondaryCellGroup | CellGroupConfig-PDCP-ENDC |  | EN-DC |
| Not present |  | NR-DC |
| nonCriticalExtension SEQUENCE { |  |  | NR-DC |
| masterCellGroup | CellGroupConfig with condition DRBn as per 38.508-1[4] Table 4.6.3-19 | SCG DRBn added in master cell group |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| mrdc-SecondaryCellGroupConfig CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| mrdc-SecondaryCellGroup CHOICE { |  |  |  |
| nr-SCG | RRCReconfiguration-SCGRLCreEst | OCTET STRING (CONTAINING RRCReconfiguration) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| radioBearerConfig2 | RadioBearerConfig-PDCPsplit |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.3.3.3-2A: RRCReconfiguration-SCGRLCreEst(Table 7.1.3.5.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 with condition NR-DC\_SCG | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| secondaryCellGroup | | CellGroupConfig-SCG-RLC | OCTET STRING (CONTAINING CellGroupConfig) |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.5.3.3.3-2B: *CellGroupConfig-PDCP-ENDC* (Table 7.1.3.5.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 1 entry |  |  |
| RLC-BearerConfig[1] | RLC-BearerConfig with conditions AM and DRB2 and Re-establish\_RLC | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.3.3.3-2C: *CellGroupConfig-SCG-RLC* (Table 7.1.3.5.3.3.3-2A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition NR-DC\_SCG | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..maxLCH)) OF RLC-BearerConfig { | 1 entry |  |  |
| RLC-BearerConfig[1] | RLC-BearerConfig with conditions AM and DRBn and Re-establish\_RLC |  |  |
| } |  |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig | Not present |  |  |
| spCellConfig | Not present |  |  |
| } |  |  |  |

Table 7.1.3.5.3.3.3-3: *RadioBearerConfig-PDCP-ENDC* (Table 7.1.3.5.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| srb3-ToRelease | Not present |  |  |
| drb-ToAddModList | Not present |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | 6 |  |  |
| sdap-Config | Not present |  |  |
| } |  |  |  |
| drb-Identity | 2 |  |  |
|  |  |  |
| reestablishPDCP | Not present |  |  |
| recoverPDCP | true |  |  |
| pdcp-Config | PDCP-Config-Split |  |  |
|  |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-ToReleaseList | Not present |  |  |
| } |  |  |  |

Table 7.1.3.5.3.3.3-3A: RadioBearerConfig-PDCPsplit (Table 7.1.3.5.3.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  |  |  |
| cnAssociation | Not present |  |  |
| drb-Identity | DRB-Identity with condition DRBn | SCG DRBn |  |
| reestablishPDCP | Not present |  |  |
| recoverPDCP | true |  |  |
| pdcp-Config | PDCP-Config-Split |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.3.3.3-4: PDCP-Config-Split (Table 7.1.3.5.3.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-99 with condition Split | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| moreThanOneRLC SEQUENCE { |  |  |  |
| primaryPath SEQUENCE { |  |  |  |
| cellGroup | 1 |  | EN-DC |
|  | 0 | MCG Path | NR-DC |
| } |  |  |  |
| ul-DataSplitThreshold | infinity |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.3.5.4 PDCP reordering / Maximum re-ordering delay below t-Reordering / t-Reordering timer operations

7.1.3.5.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state using RLC-AM }

**ensure that** {

**when** { a PDCP PDU is received from the lower layers and the COUNT value of the received PDCP Data PDU is out of the re-ordering window }

**then** { UE discards the PDCP PDU }

}

(2)

**with** { UE in RRC\_CONNECTED state using RLC-AM }

**ensure that** {

**when** { a PDCP PDU is received from the lower layers **and** the COUNT value of the received PDCP Data PDU is within the re-ordering window }

**then** { UE stores the resulting PDCP SDU }

}

(3)

**with** { UE in RRC\_CONNECTED state using RLC-AM, **and** the RX\_DELIV is not equal to the COUNT value of the RX\_NEXT (there is missing PDCP PDUs) }

**ensure that** {

**when** { a PDCP PDU is received from the lower layers **and** the RCVD\_COUNT = RX\_DELIV }

**then** { UE delivers the resulting PDCP SDU and all stored PDCP SDUs with consecutive COUNT value to upper layer, in ascending order }

}

(4)

**with** { UE in RRC\_CONNECTED state using RLC-AM **and** the associated PDCP *t-Reordering* timer is running }

**ensure that** {

**when** { RX\_DELIV >= RX\_REORD }

**then** { UE stops and resets *t-Reordering* timer }

}

(5)

**with** { UE in RRC\_CONNECTED state using RLC-AM **and** the associated PDCP *t-Reordering* timer is running }

**ensure that** {

**when** { the *t-Reordering* timer expires }

**then** { UE delivers all stored PDCP SDUs to upper layer }

}

(6)

**with** { UE in RRC\_CONNECTED state using RLC-AM **and** the associated PDCP *t-Reordering* timer is running }

**ensure that** {

**when** { the *t-Reordering* is reconfigured by upper layers }

**then** { UE stops and resets *t-Reordering* timer }

}

7.1.3.5.4.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 38.323, clause 5.2.2.1, 5.2.2.2 and 5.2.2.3. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.2.2.1]

In this section, following definitions are used:

- HFN(State Variable): the HFN part (i.e. the number of most significant bits equal to HFN length) of the State Variable;

- SN(State Variable): the SN part (i.e. the number of least significant bits equal to PDCP SN length) of the State Variable;

- RCVD\_SN: the PDCP SN of the received PDCP Data PDU, included in the PDU header;

- RCVD\_HFN: the HFN of the received PDCP Data PDU, calculated by the receiving PDCP entity;

- RCVD\_COUNT: the COUNT of the received PDCP Data PDU = [RCVD\_HFN, RCVD\_SN].

At reception of a PDCP Data PDU from lower layers, the receiving PDCP entity shall determine the COUNT value of the received PDCP Data PDU, i.e. RCVD\_COUNT, as follows:

- if RCVD\_SN < SN(RX\_DELIV) – Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) + 1.

- else if RCVD\_SN >= SN(RX\_DELIV) + Window\_Size:

- RCVD\_HFN = HFN(RX\_DELIV) – 1.

- else:

- RCVD\_HFN = HFN(RX\_DELIV);

- RCVD\_COUNT = [RCVD\_HFN, RCVD\_SN].

After determining the COUNT value of the received PDCP Data PDU = RCVD\_COUNT, the receiving PDCP entity shall:

- perform deciphering and integrity verification of the PDCP Data PDU using COUNT = RCVD\_COUNT;

- if integrity verification fails:

- indicate the integrity verification failure to upper layer;

- discard the PDCP Data PDU;

- if RCVD\_COUNT < RX\_DELIV; or

- if the PDCP Data PDU with COUNT = RCVD\_COUNT has been received before:

- discard the PDCP Data PDU;

If the received PDCP Data PDU with COUNT value = RCVD\_COUNT is not discarded above, the receiving PDCP entity shall:

- store the resulting PDCP SDU in the reception buffer;

- if RCVD\_COUNT >= RX\_NEXT:

- update RX\_NEXT to RCVD\_COUNT + 1.

- if *outOfOrderDelivery* is configured:

- deliver the resulting PDCP SDU to upper layers.

- if RCVD\_COUNT = RX\_DELIV:

- deliver to upper layers in ascending order of the associated COUNT value after performing header decompression, if not decompressed before;

- all stored PDCP SDU(s) with consecutively associated COUNT value(s) starting from COUNT = RX\_DELIV;

- update RX\_DELIV to the COUNT value of the first PDCP SDU which has not been delivered to upper layers, with COUNT value > RX\_DELIV;

- if *t-Reordering* is running, and if RX\_DELIV >= RX\_REORD:

- stop and reset *t-Reordering*.

- if *t-Reordering* is not running (includes the case when *t-Reordering* is stopped due to actions above), and RX\_DELIV < RX\_NEXT:

- update RX\_REORD to RX\_NEXT;

- start *t-Reordering*.

[TS 38.323, clause 5.2.2.2]

When *t-Reordering* expires, the receiving PDCP entity shall:

- deliver to upper layers in ascending order of the associated COUNT value after performing header decompression, if not decompressed before:

- all stored PDCP SDU(s) with associated COUNT value(s) < RX\_REORD;

- all stored PDCP SDU(s) with consecutively associated COUNT value(s) starting from RX\_REORD;

- update RX\_DELIV to the COUNT value of the first PDCP SDU which has not been delivered to upper layers, with COUNT value >= RX\_REORD;

- if RX\_DELIV < RX\_NEXT:

- update RX\_REORD to RX\_NEXT;

- start *t-Reordering*.

[TS 38.323, clause 5.2.2.3]

When the value of the *t-Reordering* is reconfigured by upper layers while the *t-Reordering* is running, the receiving PDCP entity shall:

- update RX\_REORD to RX\_NEXT;

- stop and restart *t-Reordering*.

7.1.3.5.4.3 Test description

7.1.3.5.4.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 exception of PDCP parameters according to Table 7.1.3.5.4.3.1-1.

Table 7.1.3.5.4.3.1-1: PDCP parameters

|  |  |
| --- | --- |
| t-Reordering | ms300 |

7.1.3.5.4.3.2 Test procedure sequence

Table 7.1.3.5.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS sends the PDCP SDU #X  D/C field = 1 (PDCP Data PDU) and PDCP SN = X (Note 1) (Note 6) | <-- | (PDCP SDU #X) | - | - |
| 2 | Check: Does the UE transmit a PDCP SDU via the AM RLC entity in the next 1s? | --> | (PDCP SDU) | 1 | F |
| 3 | The SS sends the PDCP SDU #1  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1.  The UE starts *t-Reordering*. | <-- | (PDCP SDU #1) | - | - |
| 4 | The SS sends the PDCP SDU #2  D/C field = 1 (PDCP Data PDU) and PDCP SN =2. | <-- | (PDCP SDU #2) | - | - |
| 5 | Wait for 100ms (< configured *t-Reordering*). | - | - | - | - |
| 6 | The SS sends the PDCP SDU #0  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | (PDCP SDU #0) | - | - |
| 7 | Check: Does the UE transmit the PDCP SDU #0 via the AM RLC entity  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0?  (Note 4) | --> | (PDCP SDU #0) | 2, 3 | P |
| 8 | Check: Does the UE transmit the PDCP SDU #1 via the AM RLC entity  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1?  (Note 4) | --> | (PDCP SDU #1) | 2, 3 | P |
| 9 | Check: Does the UE transmit the PDCP SDU #2 via the AM RLC entity  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2?  (Note 4) | --> | (PDCP SDU #2) | 2, 3 | P |
| 10 | The SS sends the PDCP SDU #4  D/C field = 1 (PDCP Data PDU) and PDCP SN = 4.  The UE starts *t-Reordering*. | <-- | (PDCP SDU #4) | - | - |
| 11 | Wait for 100ms (< configured *t-Reordering*) | - | - | - | - |
| 12 | The SS sends the PDCP SDU #7  D/C field = 1 (PDCP Data PDU) and PDCP SN = 7. | <-- | (PDCP SDU #7) | - | - |
| 13 | The SS sends the PDCP SDU #3  D/C field = 1 (PDCP Data PDU) and PDCP SN = 3.  The UE restarts *t-Reordering* timer.  Note T1 | <-- | (PDCP SDU #3) | - | - |
| 14 | Check: Does the UE transmit the PDCP SDU #3 via the AM RLC entity?  (Note 5) | --> | (PDCP SDU #3) | 3 | P |
| 15 | Check: Does the UE transmit the PDCP SDU #4 via the AM RLC entity?  (Note 5) | --> | (PDCP SDU #4) | 3 | P |
| 16 | Check 1: Does the UE transmit the PDCP SDU #7 with PDCP SN=5 via the AM RLC entity after *t-Reordering* expiry?  Note T2  Check 2: Is (T2 – T1) > *t-Reordering*? | --> | (PDCP SDU #7) | 4,5 | P |
| 17 | The SS sends the PDCP SDU #9  D/C field = 1 (PDCP Data PDU) and PDCP SN = 9.  The UE starts *t-Reordering*. | <-- | (PDCP SDU #9) | - | - |
| 18 | Wait for 100ms (< configured *t-Reordering*) | - | - | - | - |
| 19 | The SS reconfigures the *t-Reordering* by sending a NR *RRCReconfiguration* message.  The UE restarts *t-Reordering* timer. (Note 2)  Note T3 | <-- | *RRCReconfiguration* | - | - |
| 20 | The UE transmits a NR *RRCReconfigurationComplete* message.  (Note 3) | --> | *RRCReconfigurationComplete* | - | - |
| 21 | Check 1: Does the UE transmit the PDCP SDU #9 with PDCP SN=6 via the AM RLC entity after *t-Reordering* expiry?  Note T4  Check 2: Is (T4 – T3) > *t-Reordering*? | --> | (PDCP SDU #9) | 6 | P |
| Note 1: The Reordering Window size is 131072 when 18 bit SN length is used.  Note 2: For EN-DC the NR RRCReconfiguration message is contained in RRCConnectionReconfiguration 36.508 [7], Table 4.6.1-8 using condition EN-DC\_Embed\_RBConfig.  Note 3: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 4: PDCP SDUs at steps 7, 8 and 9 may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot)  Note 5: PDCP SDUs at steps 14 and 15 may be received by the SS in the same slot or in multiple slots (max one MAC PDU in a slot).  Note 6: X=131072 for pc\_supportOfRedCap\_r17=false and X=2048 for pc\_supportOfRedCap\_r17=true. | | | | | |

7.1.3.5.4.3.3 Specific message contents

Table 7.1.3.5.4.3.3-1: *RRCReconfiguration* (step 19, Table 7.1.3.5.4.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  | Not EN-DC |
| secondaryCellGroup | CellGroupConfig |  | EN-DC |
| } |  |  |  |
| RRCReconfiguration-v1530-IEs::= SEQUENCE { |  |  |  |
| masterCellGroup | CellGroupConfig |  | Not-EN-DC |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.4.3.3-2: *RadioBearerConfig* (Table 7.1.3.5.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation path: 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/Remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList ::= SEQUENCE (SIZE 1..2)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| pdcp-Config SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| outOfOrderDelivery | False |  |  |
| } |  |  |  |
| t-Reordering | ms750 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.3.5.5 PDCP Duplication

7.1.3.5.5.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and pdcpDuplication is configured and activated}

**ensure that** {

**when** { UE has PDCP SDUs available for transmission}

**then** { the UE transmits the PDCP SDUs on both the associated RLC entities }

}

(2)

**with** { UE in RRC\_CONNECTED state and pdcpDuplication is configured and not activated }

**ensure that** {

**when** { UE receives MAC Control Element to Activate PDCP Duplication on a DRB configured with PDCP duplication }

**then** { the UE activates PDCP Duplication on the PDCP associated with the DRB }

}

(3)

**with** { UE in RRC\_CONNECTED state and pdcpDuplication is configured }

**ensure that** {

**when** { UE has PDCP SDUs available for transmission }

**then** { the UE transmits the PDCP SDUs on the primary RLC entity}

}

(4)

**with** { UE in RRC\_CONNECTED state and pdcpDuplication is configured and activated}

**ensure that** {

**when** { the UE had transmited the PDCP SDUs on both the associated RLC entities and successful delivery of a PDCP Data PDU is confirmed by one of the two associated AM RLC entities}

**then** { the other AM RLC entity discards the duplicated PDCP Data PDU}

}

7.1.3.5.5.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321:5.10, 6.1.3.10 and TS 38.323:5.2.1, 5.11.1, 5.11.2 and TS 38.331: 5.3.5.6.4. Unless otherwise stated these are Rel-15 requirements.

[TS 38.323, clause 5.2.1]

When submitting a PDCP PDU to lower layer, the transmitting PDCP entity shall:

- if the transmitting PDCP entity is associated with one RLC entity:

- submit the PDCP PDU to the associated RLC entity;

- else, if the transmitting PDCP entity is associated with two RLC entities:

- if the PDCP duplication is activated:

- if the PDCP PDU is a PDCP Data PDU:

- duplicate the PDCP Data PDU and submit the PDCP Data PDU to both associated RLC entities;

- else:

- submit the PDCP Control PDU to the primary RLC entity;

- else:

- if the two associated RLC entities belong to the different Cell Groups; and

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 38.322 [5]) in the two associated RLC entities is equal to or larger than *ul-DataSplitThreshold*:

- submit the PDCP PDU to either the primary RLC entity or the secondary RLC entity;

- else:

- submit the PDCP PDU to the primary RLC entity.

[TS 38.331, clause 5.3.5.6.4]

The UE shall:

1> for each *drb-Identity* value included in the *drb-ToReleaseList* that is part of the current UE configuration; or

1> for each *drb-Identity* value that is to be released as the result of full configuration according to 5.3.5.11:

2> release the PDCP entity and the *drb-Identity*;

2> if SDAP entity associated with this DRB is configured:

3> indicate the release of the DRB to SDAP entity associated with this DRB (TS 37.324 [24], clause 5.3.3);

2> if the UE is operating in EN-DC:

3> if a new bearer is not added either with NR or E-UTRA with same *eps-BearerIdentity*:

4> indicate the release of the DRB and the *eps-BearerIdentity* of the released DRB to upper layers.

NOTE 1: The UE does not consider the message as erroneous if the *drb-ToReleaseList* includes any *drb-Identity* value that is not part of the current UE configuration.

NOTE 2: Whether or not the RLC and MAC entities associated with this PDCP entity are reset or released is determined by the *CellGroupConfig*.

[TS 38.323, clause 5.11.1]

For the PDCP entity configured with *pdcp-Duplication*, the transmitting PDCP entity shall:

- for SRBs:

- activate the PDCP duplication;

- for DRBs:

- if the activation of PDCP duplication is indicated:

- activate the PDCP duplication;

- if the deactivation of PDCP duplication is indicated:

- deactivate the PDCP duplication.

[TS 38.323, clause 5.11.2]

For the PDCP entity configured with *pdcp-Duplication*, the transmitting PDCP entity shall:

- if the successful delivery of a PDCP Data PDU is confirmed by one of the two associated AM RLC entities:

- indicate to the other AM RLC entity to discard the duplicated PDCP Data PDU;

- if the deactivation of PDCP duplication is indicated:

- indicate to the secondary RLC entity to discard all duplicated PDCP Data PDUs.

[TS 38.321, clause 5.10]

If one or more DRBs are configured with PDCP duplication, the network may activate and deactivate the PDCP duplication for the configured DRB(s).

The PDCP duplication for the configured DRB(s) is activated and deactivated by:

- receiving the Duplication Activation/Deactivation MAC CE described in subclause 6.1.3.11;

- indication by RRC.

The MAC entity shall for each DRB configured with PDCP duplication:

1> if a Duplication Activation/Deactivation MAC CE is received activating the PDCP duplication of the DRB:

2> indicate the activation of PDCP duplication of the DRB to upper layers.

1> if a Duplication Activation/Deactivation MAC CE is received deactivating the PDCP duplication of the DRB:

2> indicate the deactivation of PDCP duplication of the DRB to upper layers.

7.1.3.5.5.3 Test description

7.1.3.5.5.3.1 Pre-test conditions

System Simulator:

- For NR 5GC NR Cell 1 and NR Cell 10

UE:

- None

Preamble:

- Same Pre-test conditions as in clause 7.1.3.0 and Generic procedure parameter DC bearer (MCG and split).

- For NR 5GC, Same Pre-test conditions as in clause 7.1.3.0 using generic procedure parameter Connectivity (*NR-DC*), Bearers(MCG(s) and Split),

7.1.3.5.5.3.2 Test procedure sequence

Table 7.1.3.5.5.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Void | - | - | - | - |
| 2 | SS transmits a Duplication Activation MAC CE to activate PDCP Duplication for split DRB. | <-- | MAC PDU (Duplication Activation MAC Control Element) | - | - |
| 2A | The SS is configured not to send RLC ACK for the next PDU on split DRB. (Note 6) | - | - | - | - |
| 3 | The SS sends a PDCP Data PDU on the split DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| - | EXCEPTION: Steps 4-4A below occur in any sequence | - | - | - | - |
| 4 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 3 | P |
| 4A | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary entity? | --> | PDCP DATA PDU | 2 | P |
| 4B-4C | Void | - | - | - | - |
| 5 | SS transmits a Duplication Deactivation MAC CE to deactivate PDCP Duplication for split DRB. | <-- | MAC PDU (Duplication Deactivation MAC Control Element) | - | - |
| 6 | The SS sends a PDCP Data PDU on the split DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| 7 | Check: Does UE transmit a PDCP Data PDU on the AM RLC entity configured on the AM RLC primary entity? | --> | PDCP DATA PDU | 3 | P |
| 8 | The SS transmits an NR *RRCReconfiguration* message to activate parameters for PdcpDuplication(Note 2) | <-- | *RRCReconfiguration* | - | - |
| 8A | UE responses NR *RRCReconfigurationComplete* message.(Note 3) | --> | *RRCReconfigurationComplete* | - | - |
| 8AA | The SS is configured not to send RLC ACK for the next PDU on split DRB. (Note 6) | - | - | - | - |
| 8B | The SS sends a PDCP Data PDU on the split DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| - | EXCEPTION: Steps 8C-8D below occur in any sequence | - | - | - | - |
| 8C | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 1 | P |
| 8D | Check: Does UE transmit a PDCP Data PDU on the AM RLC secondary entity? | --> | PDCP DATA PDU | 1 | P |
| 8E-8F | Void | - | - | - | - |
| 9 | The SS stops allocating any UL grant for the AM RLC secondary entity(Note 1) | - | - | - | - |
| 10 | The SS sends a PDCP Data PDU on the split DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| 11 | UE transmits a PDCP Data PDU on the AM RLC primary entity | --> | PDCP DATA PDU | - | - |
| 12 | The SS resumes normal UL grant allocation for the AM RLC secondary entity. | - | - | - | - |
| 13 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary or secondary entity in next five seconds? | --> | PDCP DATA PDU | 4 | F |
| Note 1: Discard of RLC SDU is not possible if submitted to lower layers. Therefore, Grant is not provided so that RLC SDU is not submitted to lower layers.  Note 2: For EN-DC the NR RRCReconfiguration is contained in *RRCConnectionReconfiguration* Table 7.1.3.5.5.3.3-4.  Note 3: For EN-DC the NR RRCReconfigurationComplete message is contained in RRCConnectionReconfigurationComplete.  Note 4: Void  Note 5: Void  Note 6: SS is configured not to send RLC ACK for the next PDU on split DRB to ensure that UE side primary or secondary entities do not discard the PDU before PDSCH transmission upon receipt of RLC ACK on one of the entities. This may cause UE side entities to retransmit the PDU but it shall be ignored by SS side RLC entity as it has already been received though not acknowledged due to SS side RLC being configured in test mode. | | | | | |

7.1.3.5.5.3.3 Specific message contents

Table 7.1.3.5.5.3.3-0A: *RRCConnectionReconfiguration* (step 8, Table 7.1.3.5.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE{ |  |  |  |
| rrcConnectionReconfiguration-r8 ::= SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nr-RadioBearerConfig1-r15 | OCTET STRING including *RadioBearerConfig-PDCP* |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.5.3.3-0B: *RRCReconfiguration* (step 8, Table 7.1.3.5.5.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| radioBearerConfig2 | OCTET STRING including *RadioBearerConfig-PDCP* |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.5.3.3-1: *RadioBearerConfig-PDCP* (Table 7.1.3.5.5.3.3-0A and Table 7.1.3.5.5.3.3-0B , Step 8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [7], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| srb3-ToRelease | Not present |  |  |
| drb-ToAddModList | Not present |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | 2 |  | EN-DC |
|  | SCG DRBn |  | NR |
| pdcp-Config | PDCP-Config-Split |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-ToReleaseList | Not present |  |  |
| } |  |  |  |

Table 7.1.3.5.5.3.3-2: PDCP-Config-Split (Table 7.1.3.5.5.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table 4.6.3-99 condition Split | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| moreThanOneRLC SEQUENCE { |  |  |  |
| primaryPath SEQUENCE { |  |  |  |
| cellGroup | 1 |  | EN-DC |
|  | 0 |  | NR |
| } |  |  |  |
| ul-DataSplitThreshold | infinity |  |  |
| pdcp-Duplication | true |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |

##### 7.1.3.5.6 PDCP Duplication / 3 RLC entities

###### 7.1.3.5.6.1 PDCP Duplication / 3 RLC entities / Intra-band Contiguous CA

7.1.3.5.6.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state and PDCP CA duplication is configured and activated }

**ensure that** {

**when** { UE has a PDCP SDU available for transmission }

**then** { the UE transmits the PDCP SDU on all the associated RLC entities }

}

(2)

**Void**

(3)

**with** { UE in RRC\_CONNECTED state and PDCP CA duplication is configured }

**ensure that** {

**when** { UE has a PDCP SDU available for transmission }

**then** { the UE transmits the PDCP SDU on the primary RLC entity }

}

(4)

**with** { UE in RRC\_CONNECTED state and PDCP CA duplication is configured and activated }

**ensure that** {

**when** { the UE had transmitted the PDCP SDU on all the associated RLC entities and successful delivery of a PDCP Data PDU is confirmed by one of the associated AM RLC entities }

**then** { the other AM RLC entities discard the duplicated PDCP Data PDU }

}

(5)

**with** { UE in RRC\_CONNECTED state and PDCP CA duplication is configured and activated }

**ensure that** {

**when** { UE receives MAC Control Element to deactivate PDCP Duplication on one of the associated RLC entity configured with PDCP duplication }

**then** { the UE deactivates the PDCP duplication for the indicated associated RLC entity }

7.1.3.5.6.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.321:5.10, 6.1.3.11, 6.1.3.32, TS 38.323:5.2.1, 5.11.1, 5.11.2 and TS 38.331: 5.3.5.6.4. Unless otherwise stated these are Rel-16 requirements.

[TS 38.323, clause 5.2.1]

When submitting a PDCP PDU to lower layer, the transmitting PDCP entity shall:

- if the transmitting PDCP entity is associated with one RLC entity:

- submit the PDCP PDU to the associated RLC entity;

- else, if the transmitting PDCP entity is associated with at least two RLC entities:

- if the PDCP duplication is activated for the RB:

- if the PDCP PDU is a PDCP Data PDU:

- duplicate the PDCP Data PDU and submit the PDCP Data PDU to the associated RLC entities activated for PDCP duplication;

- else:

- submit the PDCP Control PDU to the primary RLC entity;

- else (i.e. the PDCP duplication is deactivated for the RB):

- if the split secondary RLC entity is configured; and

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 38.322 [5]) in the primary RLC entity and the split secondary RLC entity is equal to or larger than *ul-DataSplitThreshold*:

- submit the PDCP PDU to either the primary RLC entity or the split secondary RLC entity;

- else, if the transmitting PDCP entity is associated with the DAPS bearer:

- if the uplink data switching has not been requested:

- submit the PDCP PDU to the RLC entity associated with the source cell;

- else:

- if the PDCP PDU is a PDCP Data PDU:

- submit the PDCP Data PDU to the RLC entity associated with the target cell;

- else:

- if the PDCP Control PDU is associated with source cell:

- submit the PDCP Control PDU to the RLC entity associated with the source cell;

- else:

- submit the PDCP Control PDU to the RLC entity associated with the target cell;

- else:

- submit the PDCP PDU to the primary RLC entity.

[TS 38.323, clause 5.11.1]

For the PDCP entity configured with *pdcp-Duplication*, the transmitting PDCP entity shall:

- for SRBs:

- activate the PDCP duplication;

- for DRBs:

- if the activation of PDCP duplication is indicated for the DRB:

- activate the PDCP duplication for the DRB;

- if the activation of PDCP duplication is indicated for at least one associated RLC entities:

- activate the PDCP duplication for the indicated associated RLC entities;

- activate the PDCP duplication for the DRB;

- if the deactivation of PDCP duplication is indicated for the DRB:

- deactivate the PDCP duplication for the DRB;

- if the deactivation of PDCP duplication is indicated for at least one associated RLC entities:

- deactivate the PDCP duplication for the indicated associated RLC entities;

- if all associated RLC entities other than the primary RLC entity are deactivated for PDCP duplication:

- deactivate the PDCP duplication for the DRB.

[TS 38.323, clause 5.11.2]

For the PDCP entity configured with *pdcp-Duplication*, the transmitting PDCP entity shall:

- if the successful delivery of a PDCP Data PDU is confirmed by one of the associated AM RLC entities:

- indicate to the other AM RLC entities to discard the duplicated PDCP Data PDU;

- if the deactivation of PDCP duplication is indicated for the DRB:

- indicate to the RLC entities other than the primary RLC entity to discard all duplicated PDCP Data PDUs;

- if the deactivation of PDCP duplication is indicated for at least one associated RLC entities:

- indicate to the RLC entities deactivated for PDCP duplication to discard all duplicated PDCP Data PDUs.

[TS 38.321, clause 5.10]

If one or more DRBs are configured with PDCP duplication, the network may activate and deactivate the PDCP duplication for all or a subset of associated RLC entities for the configured DRB(s).

The PDCP duplication for the configured DRB(s) is activated and deactivated by:

- receiving the Duplication Activation/Deactivation MAC CE described in clause 6.1.3.11;

- receiving the Duplication RLC Activation/Deactivation MAC CE described in clause 6.1.3.32;

- indication by RRC.

The PDCP duplication for all or a subset of associated RLC entities for the configured DRB(s) is activated and deactivated by:

- receiving the Duplication RLC Activation/Deactivation MAC CE described in clause 6.1.3.32;

- indication by RRC.

The MAC entity shall for each DRB configured with PDCP duplication:

1> if a Duplication Activation/Deactivation MAC CE is received activating the PDCP duplication of the DRB:

2> indicate the activation of PDCP duplication of the DRB to upper layers.

1> if a Duplication Activation/Deactivation MAC CE is received deactivating the PDCP duplication of the DRB:

2> indicate the deactivation of PDCP duplication of the DRB to upper layers.

1> if a Duplication RLC Activation/Deactivation MAC CE is received activating PDCP duplication for associated RLC entities of a DRB configured with PDCP duplication:

2> indicate the activation of PDCP duplication for the indicated secondary RLC entity(ies) of the DRB to upper layers.

1> if a Duplication RLC Activation/Deactivation MAC CE is received deactivating PDCP duplication for associated RLC entities of a DRB configured with PDCP duplication:

2> indicate the deactivation of PDCP duplication for the indicated secondary RLC entity(ies) of the DRB to upper layers.

[TS 38.331, clause 5.3.5.6.4]

The UE shall:

1> for each *drb-Identity* value included in the *drb-ToReleaseList* that is part of the current UE configuration; or

1> for each *drb-Identity* value that is to be released as the result of full configuration according to 5.3.5.11:

2> release the PDCP entity and the *drb-Identity*;

2> if SDAP entity associated with this DRB is configured:

3> indicate the release of the DRB to SDAP entity associated with this DRB (TS 37.324 [24], clause 5.3.3);

2> if the UE is operating in EN-DC:

3> if a new bearer is not added either with NR or E-UTRA with same *eps-BearerIdentity*:

4> indicate the release of the DRB and the *eps-BearerIdentity* of the released DRB to upper layers.

NOTE 1: The UE does not consider the message as erroneous if the *drb-ToReleaseList* includes any *drb-Identity* value that is not part of the current UE configuration.

NOTE 2: Whether or not the RLC and MAC entities associated with this PDCP entity are reset or released is determined by the *CellGroupConfig*.

7.1.3.5.6.1.3 Test description

7.1.3.5.6.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1 is the PCell, NR Cell 3 and NR Cell 6 are the SCells.

UE:

- None

Preamble:

- Same Pre-test conditions as in clause 7.1.3.0.

7.1.3.5.6.1.3.2 Test procedure sequence

Table 7.1.3.5.6.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS transmits an NR *RRCReconfiguration* message to add 2 SCells and to configure parameters for PDCP CA duplication | <-- | *RRCReconfiguration* | - | - |
| 1A | UE transmits NR *RRCReconfigurationComplete* message. | --> | *RRCReconfigurationComplete* | - | - |
| 1B | The SS transmits a SCell Activation MAC-CE on PCell (NR Cell 1) to activate NR SCells (NR Cell 3 and NR Cell 6). | <-- | MAC PDU (SCell Activation/Deactivation MAC CE of one octet (C1=1)) | - | - |
| 2 | The SS sends a PDCP Data PDU on the DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| 3 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 3 | P |
| 3A | SS transmits a MAC CE to activate PDCP Duplication for all AM RLC entities associated to the DRB. | <-- | MAC PDU (Duplication RLC Activation MAC Control Element) | - | - |
| 3B | The SS is configured not to send RLC ACK on all 3 RLC entities. (Note 2) | - | - | - | - |
| 3C | The SS sends a PDCP Data PDU on the DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
|  | EXCEPTION: Steps 3D, 4 & 4A below can occur in any order. | - | - | - | - |
| 3D | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary entity? | --> | PDCP DATA PDU | 1 | P |
| 4 | Check: Does UE transmit a PDCP Data PDU on the associated AM RLC entity on the SCell (NR Cell 3)? | --> | PDCP DATA PDU | 1 | P |
| 4A | Check: Does UE transmit a PDCP Data PDU on the associated AM RLC entity on the SCell (NR Cell 6)? | --> | PDCP DATA PDU | 1 | P |
| 5 | The SS transmits a MAC CE to deactivate PDCP Duplication for the AM RLC entity associated with the DRB on SCell (NR Cell 6). | <-- | MAC PDU (Duplication RLC Deactivation MAC Control Element) | - | - |
| 5A | The SS is configured not to send RLC ACK on all 3 RLC entities. | - | - | - | - |
| 6 | The SS sends a PDCP Data PDU on the DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| - | EXCEPTION: Steps 6A-6B below can occur in any order. | - | - | - | - |
| 6A | The UE transmits a PDCP Data PDU on the activated primary AM RLC entity. | --> | PDCP DATA PDU | - | - |
| 6B | The UE transmits a PDCP Data PDU on the activated secondary AM RLC entity. | --> | PDCP DATA PDU | - | - |
| 7 | Check: Does UE transmit a PDCP Data PDU on the deactivated AM RLC entity by step 5? | --> | PDCP DATA PDU | 5 | F |
| 8-14 | Void | - | - | - | - |
| 15 | The SS stops allocating any UL grant on the SCells.(Note 1) | - | - | - | - |
| 16 | The SS sends a PDCP Data PDU on the DRB on the AM RLC primary entity. | <-- | PDCP DATA PDU | - | - |
| 17 | UE transmits a PDCP Data PDU on the AM RLC primary entity | --> | PDCP DATA PDU | - | - |
| 18 | The SS resumes normal UL grant allocation on the SCells. | - | - | - | - |
| - | EXCEPTION: Steps 19-21 below can occur in any order in the next five seconds. | - | - | - | - |
| 19 | Check: Does UE transmit a PDCP Data PDU on the AM RLC primary? | --> | PDCP DATA PDU | 4 | F |
| 20 | Check: Does UE transmit a PDCP Data PDU on the associated AM RLC entity on the SCell (NR Cell 3)? | --> | PDCP DATA PDU | 4 | F |
| 21 | Check: Does UE transmit a PDCP Data PDU on the associated AM RLC entity on the SCell (NR Cell 6)? | --> | PDCP DATA PDU | 4 | F |
| Note 1: Discard of RLC SDU is not possible if submitted to lower layers. Therefore, Grant is not provided so that RLC SDU is not submitted to lower layers.  Note 2: SS is configured not to send RLC ACK for the next PDU on all RLC entities to ensure that UE side primary or secondary entities do not discard the PDU before PDSCH transmission upon receipt of RLC ACK on one of the entities. This may cause UE side entities to retransmit the PDU but it shall be ignored by SS side RLC entity as it has already been received though not acknowledged due to SS side RLC being configured in test mode. | | | | | |

7.1.3.5.6.1.3.3 Specific message contents

Table 7.1.3.5.6.1.3.3-1: *Void*

Table 7.1.3.5.6.1.3.3-1A: *RRCReconfiguration* (Step 1, Table 7.1.3.5.6.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-13 with condition SCell\_add | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| radioBearerConfig | | RadioBearerConfig-DRB |  |  |
| nonCriticalExtension SEQUENCE { | |  |  |  |
| masterCellGroup | | CellGroupConfig-SCells |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.5.6.1.3.3-1B: *RadioBearerConfig-DRB* (Table 7.1.3.5.6.1.3.3-1A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| srb3-ToRelease | Not present |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | DRBi |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.6.1.3.3-1C: CellGroupConfig-SCells (Table 7.1.3.5.6.1.3.3-1A)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition SCell\_add | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| rlc-BearerToAddModList SEQUENCE (SIZE(1..max LC-ID)) OF RLC-BearerConfig { | 3 entries |  |  |
| RLC-BearerConfig[1] | RLC-BearerConfig-1 | entry 1  Table 7.1.3.5.6.1.3.3-3  RLC entity 1 (primary) |  |
| RLC-BearerConfig[2] | RLC-BearerConfig-2 | entry 2  Table 7.1.3.5.6.1.3.3-4  RLC entity 2 (secondary) |  |
| RLC-BearerConfig[3] | RLC-BearerConfig-3 | entry 3  Table 7.1.3.5.6.1.3.3-5  RLC entity 3 (secondary) |  |
| } |  |  |  |
| mac-CellGroupConfig | Not present |  |  |
| physicalCellGroupConfig | Not present |  |  |
| spCellConfig | Not present |  |  |
| sCellToAddModList SEQUENCE (SIZE (1..maxNrofSCells)) OF SCellConfig { | 2 entries |  |  |
| SCellConfig[1] SEQUENCE { |  | entry 1 |  |
| sCellIndex | SCellIndex for NR Cell 3 |  |  |
| sCellConfigCommon | ServingCellConfigCommon as per TS 38.508-1 [4] Table 4.6.3-168 |  |  |
| sCellConfigDedicated | ServingCellConfig as per TS 38.508-1 [4] Table 4.6.3-167 |  |  |
| } |  |  |  |
| SCellConfig[2] SEQUENCE { |  | entry 2 |  |
| sCellIndex | SCellIndex for NR Cell 6 |  |  |
| sCellConfigCommon | ServingCellConfigCommon as per TS 38.508-1 [4] Table 4.6.3-168 |  |  |
| sCellConfigDedicated | ServingCellConfig as per TS 38.508-1 [4] Table 4.6.3-167 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.6.1.3.3-2: PDCP-Config (Table 7.1.3.5.6.1.3.3-1B)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| t-Reordering | Not present |  |  |
| moreThanTwoRLC-DRB-r16 SEQUENCE { |  |  |  |
| duplicationState-r16 SEQUENCE (SIZE (3)) | 3 bits |  |  |
| duplicationState-r16[1] | true |  |  |
| duplicationState-r16[2] | true |  |  |
| duplicationState-r16[3] | false |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.6.1.3.3-3: *RLC-BearerConfig-1* (Table 7.1.3.5.6.1.3.3-1C)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-148 with Condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-BearerConfig ::= SEQUENCE { |  |  |  |
| logicalChannelIdentity | LogicalChannelIdentity with condition DRB j | ID of primary logical channel |  |
| servedRadioBearer CHOICE { |  |  |  |
| drb-Identity | DRB-Identity with condition DRB j | DRB |  |
| } |  |  |  |
| rlc-Config CHOICE { |  |  |  |
| am SEQUENCE { |  |  |  |
| ul-AM-RLC SEQUENCE { |  |  |  |
| maxRetxThreshold | t32 | To ensure RLC failure happens before RLF |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| mac-LogicalChannelConfig SEQUENCE { |  |  |  |
| ul-SpecificParameters SEQUENCE { |  |  |  |
| allowedServingCells SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF ServCellIndex { | 1 entry |  |  |
| ServCellIndex[1] | ServCellIndex of NR Cell 1 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.6.1.3.3-4: *RLC-BearerConfig-2* (Table 7.1.3.5.6.1.3.3-1C)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-148 with Condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-BearerConfig ::= SEQUENCE { |  |  |  |
| logicalChannelIdentity | LogicalChannelIdentity with condition DRB j+1 | To ensure ID of secondary logical channel ID is different with existing logical channel and the primary logical channel |  |
| servedRadioBearer CHOICE { |  |  |  |
| drb-Identity | DRB-Identity with condition DRB j | DRB |  |
| } |  |  |  |
| rlc-Config CHOICE { |  |  |  |
| am SEQUENCE { |  |  |  |
| ul-AM-RLC SEQUENCE { |  |  |  |
| maxRetxThreshold | t1 | To ensure RLC failure happens before RLF |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| mac-LogicalChannelConfig SEQUENCE { |  |  |  |
| ul-SpecificParameters SEQUENCE { |  |  |  |
| allowedServingCells SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF ServCellIndex { | 1 entry |  |  |
| ServCellIndex[1] | ServCellIndex of NR Cell 3 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.6.1.3.3-5: *RLC-BearerConfig-3* (Table 7.1.3.5.6.1.3.3-1C)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-148 with Condition AM | | | |
| Information Element | Value/remark | Comment | Condition |
| RLC-BearerConfig ::= SEQUENCE { |  |  |  |
| logicalChannelIdentity | LogicalChannelIdentity with condition DRB j+2 | To ensure ID of secondary logical channel ID is different with existing logical channel and the primary logical channel |  |
| servedRadioBearer CHOICE { |  |  |  |
| drb-Identity | DRB-Identity with condition DRB j | DRB |  |
| } |  |  |  |
| rlc-Config CHOICE { |  |  |  |
| am SEQUENCE { |  |  |  |
| ul-AM-RLC SEQUENCE { |  |  |  |
| maxRetxThreshold | t1 | To ensure RLC failure happens before RLF |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| mac-LogicalChannelConfig SEQUENCE { |  |  |  |
| ul-SpecificParameters SEQUENCE { |  |  |  |
| allowedServingCells SEQUENCE (SIZE (1..maxNrofServingCells-1)) OF ServCellIndex { | 1 entry |  |  |
| ServCellIndex[1] | ServCellIndex of NR Cell 6 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

###### 7.1.3.5.6.2 PDCP Duplication / 3 RLC entities / Intra-band non-Contiguous CA

The scope and description of the present TC is the same as test case 7.1.3.5.6.1 with the following differences:

- CA configuration: Intra-band non-Contiguous CA replaces Intra-band Contiguous CA.

##### 7.1.3.5.7 Ethernet header compression and decompression / Correct functionality of ethernet header compression and decompression

7.1.3.5.7.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { SS sends PDCP Data PDU containing EHC compressed ethernet packet with Context ID A and with full ethernet header A to UE }

**then** { UE sends PDCP Control PDU to SS containing EHC feedback packet with Context ID A }

}

(2)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { SS sends PDCP Data PDU containing EHC compressed ethernet packet with Context ID A and with full ethernet header A to UE }

**then** { UE sends PDCP Data PDU to SS containing EHC compressed ethernet packet with Context ID B and with full ethernet header A generated from the looped back ethernet packet }

}

(3)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { SS sends PDCP Data PDU containing EHC compressed ethernet packet with Context ID A and without ethernet header to UE }

**then** { UE sends PDCP Data PDU to SS containing EHC compressed ethernet packet with Context ID B and with full ethernet header A generated from the looped back ethernet packet with decompressed ethernet header }

}

(4)

**with** { UE in RRC\_CONNECTED state }

**ensure that** {

**when** { SS has sent PDCP Control PDU to UE containing EHC feedback packet with Context ID B and SS sends PDCP Data PDU to UE containing EHC compressed ethernet packet with Context ID A without ethernet header to UE }

**then** { UE sends PDCP Data PDU to SS containing EHC compressed ethernet packet with Context ID B and without ethernet header generated from the looped back ethernet packet with decompressed ethernet header }

}

7.1.3.5.7.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clause 5.12. These are Rel-16 requirements.

[TS 38.323, clause 5.12.2]

PDCP entities associated with DRBs can be configured by upper layers TS 38.331 [3] to use EHC. Each PDCP entity carrying user plane data may be configured to use EHC. Every PDCP entity uses at most one EHC compressor instance and at most one EHC decompressor instance.

[TS 38.323, clause 5.12.3]

The usage and definition of the parameters shall be as specified below.

- MAX\_CID\_EHC\_UL: This is the maximum CID value that can be used for uplink. One CID value shall always be reserved for uncompressed flows. The parameter MAX\_CID\_EHC\_UL is configured by upper layers (*maxCID-EHC-UL* in TS 38.331 [3]);

[TS 38.323, clause 5.12.4]

If EHC is configured, the EHC protocol generates two types of output packets:

- EHC compressed packets (i.e. EHC full header packets and EHC compressed header packets), each associated with one PDCP SDU;

- standalone packets not associated with a PDCP SDU, i.e. EHC feedback.

An EHC compressed packet is associated with the same PDCP SN and COUNT value as the related PDCP SDU. The header compression is not applicable to the SDAP header and the SDAP Control PDU if included in the PDCP SDU.

EHC feedback are not associated with a PDCP SDU. They are not associated with a PDCP SN and are not ciphered.

[TS 38.323, clause 5.12.5]

If EHC is configured by upper layers for PDCP entities associated with user plane data, the PDCP Data PDUs are decompressed by the EHC protocol after performing deciphering as explained in clause 5.8. The header decompression is not applicable to the SDAP header and the SDAP Control PDU if included in the PDCP Data PDU.

[TS 38.323, clause 5.12.6.1]

When an EHC feedback is generated by the EHC protocol, the transmitting PDCP entity shall:

- submit to lower layers the corresponding PDCP Control PDU as specified in clause 6.2.3.3 i.e. without associating a PDCP SN, nor performing ciphering.

[TS 38.323, clause 5.12.6.2]

At reception of a PDCP Control PDU for EHC feedback from lower layers, the receiving PDCP entity shall:

- deliver the corresponding EHC feedback to the EHC protocol without performing deciphering.

7.1.3.5.7.3 Test description

7.1.3.5.7.3.1 Pre-test conditions

Pre-test conditions as in clause 7.1.3.0 with condition pc\_NG\_RAN\_NR, PDN/PDU session type Ethernet used in 4.5A.2 and message with condition UM used for step 7 in 4.5.4.2 according to [4] for primary DRB.

7.1.3.5.7.3.2 Test procedure sequence

Table 7.1.3.5.7.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | SS transmits an *RRCReconfiguration* message to configure DRB to use ethernet header compression. | <-- | *RRCReconfiguration* | - | - |
| 2 | UE transmits *RRCReconfigurationComplete* message to confirm that reconfiguration with ethernet header compression configuration is completed. | --> | *RRCReconfigurationComplete* | - | - |
| 3 | SS transmits PDCP Data PDU containing EHC compressed ethernet packet with Context ID A and with full ethernet header information A. | <-- | PDCP Data PDU #0 | - | - |
| 4 | Check: Does UE transmit PDCP Control PDU containing unciphered EHC feedback packet with Context ID A? | --> | PDCP Control PDU #0 | 1 | P |
| 5 | Check: Does UE transmit PDCP Data PDU containing EHC compressed ethernet packet with Context ID B and with full ethernet header information A? | --> | PDCP Data PDU #0 | 2 | P |
| 6 | SS transmits PDCP Data PDU containing EHC compressed ethernet packet with Context ID A and without ethernet header information. | <-- | PDCP Control PDU #0 | - | - |
| 7 | Check: Does UE transmit PDCP Data PDU containing EHC compressed ethernet packet with Context ID B and with full ethernet header information A? | --> | PDCP Data PDU #1 | 3 | P |
| 8 | SS transmits PDCP Control PDU containing unciphered EHC feedback packet with Context ID B. | <-- | PDCP Control PDU #1 | - | - |
| 9 | SS transmits PDCP Data PDU containing EHC compressed ethernet packet with Context ID A and without ethernet header information. | <-- | PDCP Data PDU #2 | - | - |
| 10 | Check: Does UE transmit PDCP Data PDU containing EHC compressed ethernet packet with Context ID B and without ethernet header information? | --> | PDCP Data PDU #2 | 4 | P |
| Note 1: PDCP PDUs will be checked before and after decompressor on the NW side for test steps 5, 7 and 10.  Note 2: The value of Context ID A and Context ID B can be any value. However, value of Context ID A and Context ID B shall stay the same in all steps. | | | | | |

7.1.3.5.7.3.3 Specific message contents

Table 7.1.3.5.7.3.3-1: *RRCReconfiguration (step 1, Table 7.1.3.5.7.3.2-1)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [4], clause 4.6.1, table 4.6.1-13 RRCReconfiguration | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { | |  |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcReconfiguration SEQUENCE { | |  |  |  |
| radioBearerConfig | | RadioBearerConfig-EHC |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.5.7.3.3-2: *RadioBearerConfig-EHC (Table 7.1.3.5.7.3.3-1)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [12], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | DRB-Identity for DRB created in pre-test conditions |  |  |
| pdcp-Config | PDCP-Config-EHC |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.5.7.3.3-3: *PDCP-Config-EHC*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS38.331 [12], clause 6.3.2 | | | |
| Information Element | | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { | |  |  |  |
| ethernetHeaderCompression-r16 SEQUENCE { | |  |  |  |
| ehc-Common-r16 SEQUENCE { | |  |  |  |
| ehc-CID-Length-r16 | | bits15 |  |  |
| } | |  |  |  |
| ehc-Downlink-r16 SEQUENCE { | |  |  |  |
| drb-ContinueEHC-DL-r16 | | true |  |  |
| } | |  |  |  |
| ehc-Uplink-r16 SEQUENCE { | |  |  |  |
| maxCID-EHC-UL-r16 | | 32767 |  |  |
| drb-ContinueEHC-UL-r16 | | true |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

#### 7.1.3.6 PDCP UDC

##### 7.1.3.6.1 PDCP UDC / No dictionary

7.1.3.6.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { pre-defined dictionary is not configured }

**then** { UE set the compression buffer to all zeros }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB with UDC configuration }

**then** { UE sets FU to 1 and compresses the data for each transmitted PDU and calculates the checksum correctly}

}

7.1.3.6.1.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.14.2, annex B.1, B.2.1 and B.2.2. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.14.2]

The PDCP entities associated with DRBs can be configured by upper layers, see TS 38.331 [3], to use UDC. If UDC is configured, the UE shall apply UDC compression function (details see Annex B) to process the received PDCP SDU from upper layers corresponding to the configured DRB. The size of compression buffer is configured by upper layers via *bufferSize*. If pre-defined dictionary is configured by upper layers, the UE shall first set the compression buffer to all zeros and then prefill the configured pre-defined dictionary in the compression buffer upon configuration of UDC. If pre-defined dictionary is not configured by upper layers, UE shall set the compression buffer to all zeros.

[TS 38.323, annex B.1]

A UDC packet consists of a UDC header and a UDC data block. A UDC data block contains either DEFLATE compressed blocks generated by UDC protocol or original PDCP SDU for SDU not compressed by UDC protocol; the type is specified in FU field (details see Annex B.2.2.1) in UDC header. The FR field (details see Annex B.2.2.2) and the Checksum field (details see Annex B.2.2.3) in UDC header are used only if FU field is set to 1.

If reset procedure is triggered, after performing the reset, the FR field in UDC header of the first compressed PDU shall be set to 1.

NOTE: UE is allowed not to compress the PDCP SDUs if the UL data rate before compression is higher than what the UE is capable of.

[TS 38.323, annex B.2.1]

Figure B.2.1-1 shows the format of UDC Header and UDC Data Block.



Figure B.2.1-1: UDC header and UDC data block format

[TS 38.323, annex B.2.2.1]

Length: 1 bit

Indication of whether this packet is compressed by UDC protocol or not. Value '1' means the packet is compressed by UDC protocol.

Table B.2.2.1-1: FU field

|  |  |
| --- | --- |
| Bit | Description |
| 0 | Packet is not compressed using UDC protocol |
| 1 | Packet is compressed using UDC protocol |

[TS 38.323, annex B.2.2.2]

Length: 1 bit

Indication of whether UDC compression buffer is reset or not. Value '1' means this is the first compressed packet after UDC buffer reset.

Table B.2.2.2-1: FR field

|  |  |
| --- | --- |
| Bit | Description |
| 0 | Compression buffer is not reset. |
| 1 | Compression buffer has been reset. |

[TS 38.323, annex B.2.2.3]

Length: 4 bits

This field contains the validation bits for the compression buffer content: The checksum is calculated by the content of current compression buffer before the current packet is put into buffer.

The checksum is derived from the values of the first 4 bytes and the last 4 bytes in the whole compression buffer. The calculation is described as follows:

- Each byte is divided into two 4-bit numbers.

- The 16 4-bit numbers are added together to obtain a sum;

- The checksum is one's complement of the right-most 4 bits (i.e. 4 LSB) of the sum.

An example of checksum calculation is shown in Annex B.2.3.

7.1.3.6.1.3 Test description

7.1.3.6.1.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with UDC configuration.

7.1.3.6.1.3.2 Test procedure sequence

Table 7.1.3.6.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 5 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#0 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | PDCP PDU | - | - |
| 3 | Check: Does UE send the PDCP Data PDU#0 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111?  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | 1, 2 | P |
| 4 | The SS sends the PDCP Data PDU#1 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1. | <-- | PDCP PDU | - | - |
| 5 | Check: Does UE send the PDCP Data PDU#1 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 1, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #1 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 6 | The SS sends the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2. | <-- | PDCP PDU | - | - |
| 7 | Check: Does UE send the PDCP Data PDU#2 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #2 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 8 | The SS sends the PDCP Data PDU#3 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 3. | <-- | PDCP PDU | - | - |
| 9 | Check: Does UE send the PDCP Data PDU#3 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 3, FU = 1, FR = 0, the value of Checksum is checked (Note 2).  Data is previously received data from PDU #3 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 10 | The SS sends the PDCP Data PDU#4 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 4. | <-- | PDCP PDU | - | - |
| 11 | Check: Does UE send the PDCP Data PDU#4 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 4, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #4 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| Note 1: The SS acknowledges the received data.  Note 2: The SS compares the received value of Checksum and calculated value of Checksum based on the compression buffer. | | | | | |

7.1.3.6.1.3.3 Specific message contents

None.

##### 7.1.3.6.2 PDCP UDC / Pre-defined dictionary

7.1.3.6.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { pre-defined dictionary is configured }

**then** { UE prefill the configured pre-defined dictionary in the compression buffer }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB with UDC configuration }

**then** { UE sets FU to 1 and compresses the data for each transmitted PDU and calculates the checksum correctly}

}

7.1.3.6.2.2 Conformance requirements

Same as conformance requirements in clause 7.1.3.6.1.2

7.1.3.6.2.3 Test description

7.1.3.6.2.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with UDC configuration exception of PDCP parameters according to Table 7.1.3.6.2.3.1-1.

Table 7.1.3.6.2.3.1-1: PDCP parameters

|  |  |
| --- | --- |
| PDCP-Config uplinkDataCompression-r17 setup newSetup dictionary-r17 | sip-SDP |

7.1.3.6.2.3.2 Test procedure sequence

Table 7.1.3.6.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 5 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#0 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | PDCP PDU | - | - |
| 3 | Check: Does UE send the PDCP Data PDU#0 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, the value of Checksum is calculated on pre-defined dictionary?  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | 1, 2 | P |
| 4 | The SS sends the PDCP Data PDU#1 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1. | <-- | PDCP PDU | - | - |
| 5 | Check: Does UE send the PDCP Data PDU#1 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 1, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #1 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 6 | The SS sends the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2. | <-- | PDCP PDU | - | - |
| 7 | Check: Does UE send the PDCP Data PDU#2 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #2 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 8 | The SS sends the PDCP Data PDU#3 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 3. | <-- | PDCP PDU | - | - |
| 9 | Check: Does UE send the PDCP Data PDU#3 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 3, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #3 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 10 | The SS sends the PDCP Data PDU#4 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 4. | <-- | PDCP PDU | - | - |
| 11 | Check: Does UE send the PDCP Data PDU#4 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 4, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #4 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| Note 1: The SS acknowledges the received data.  Note 2: The SS compares the received value of Checksum and calculated value of Checksum based on the compression buffer. | | | | | |

7.1.3.6.2.3.3 Specific message contents

None.

##### 7.1.3.6.3 PDCP UDC / checksum error / Reset

7.1.3.6.3.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE receiving the checksum error notification }

**then** { UE resets the UDC buffer and sets the FR field in UDC header of the first compressed PDU to 1 }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE transmits a PDCP Data SDU on a DRB with UDC configuration }

**then** { UE sets FU to 1, and compresses the data for each transmitted PDU and calculates the checksum correctly }

}

7.1.3.6.3.2 Conformance requirements

Same as conformance requirements in clause 7.1.3.6.1.2

7.1.3.6.3.3 Test description

7.1.3.6.3.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with UDC configuration.

7.1.3.6.3.3.2 Test procedure sequence

Table 7.1.3.6.3.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 3 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#0 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | PDCP PDU | - | - |
| 3 | Check: Does UE send the PDCP Data PDU#0 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111?  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 4 | The SS sends the PDCP Data PDU#1 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1. | <-- | PDCP PDU | - | - |
| 5 | Check: Does UE send the PDCP Data PDU#1 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 1, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #1 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| 6 | The SS sends the PDCP Control PDU for UDC feedback packet with the following content to the UE:  D/C field = 0 (Control PDU)  PDU type = 100 (UDC feedback packet)  FE = 1 (Checksum Error Notification) | <-- | UDC feedback packet | - | - |
| 7 | The SS sends the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2. | <-- | PDCP PDU | - | - |
| 8 | Check: Does the UE send the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 1, Checksum = 1111?  Data is previously received data from PDU #2 after decompression. (Note 1) | --> | PDCP PDU | 1 | P |
| Note 1: The SS acknowledges the received data.  Note 2: The SS compares the received value of Checksum and calculated value of Checksum based on the compression buffer. | | | | | |

7.1.3.6.3.3.3 Specific message contents

None.

##### 7.1.3.6.4 PDCP UDC/ Handover/ Intra-frequency

7.1.3.6.4.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE receives an RRCReconfiguration message including a reconfigurationWithSync for Intra-frequency handover and drb-ContinueUDC is not configured }

**then** { UE maintains its previous UDC configuration for the DRB and resets the UDC buffer and sets the FR field in UDC header of the first compressed PDU to 1 }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE receives an RRCReconfiguration message including a reconfigurationWithSync for Intra-frequency handover and drb-ContinueUDC is configured }

**then** { UE maintains its previous UDC configuration for the DRB and continues to use the previous UDC buffer }

}

7.1.3.6.4.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.1.2, TS 38.331, clauses 5.3.5.6.5. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.1.2]

When upper layers request a PDCP entity re-establishment, the UE shall additionally perform once the procedures described in this clause for Uu or PC5 interface. After performing the procedures in this clause, the UE shall follow the procedures in clause 5.2.

When upper layers request a PDCP entity re-establishment, the transmitting PDCP entity shall:

- for UM DRBs and AM DRBs, reset the ROHC protocol for uplink and start with an IR state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and AM DRBs, reset the EHC protocol for uplink if *drb-ContinueEHC-UL* is not configured in TS 38.331 [3];

- for AM DRBs, reset the UDC compression buffer to all zeros and prefill the dictionary if *drb-ContinueUDC* is not configured in TS 38.331 [3];

- for SRBs and UM DRBs, set TX\_NEXT to the initial value;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- for UM DRBs, for each PDCP SDU already associated with a PDCP SN but for which a corresponding PDU has not previously been submitted to lower layers, and;

- for AM DRBs for Uu interface whose PDCP entities were suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, for each PDCP SDU already associated with a PDCP SN:

- consider the PDCP SDUs as received from upper layer;

- perform transmission of the PDCP SDUs in ascending order of the COUNT value associated to the PDCP SDU prior to the PDCP re-establishment without restarting the *discardTimer*, as specified in clause 5.2.1;

- for AM DRBs whose PDCP entities were not suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to the PDCP entity re-establishment as specified below:

- perform header compression of the PDCP SDU using ROHC as specified in the clause 5.7.4 and/or using EHC as specified in the clause 5.12.4;

- If *drb-ContinueUDC* is configured and if the PDCP SDU has been compressed before:

- submit the PDCP SDU previously compressed to integrity protection and ciphering function;

- else:

- perform uplink data compression of the PDCP SDU as specified in clause 5.14.4, and submit the PDCP SDU to integrity protection and ciphering function;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the clause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in clause 5.2.1.

[TS 38.331, clause 5.3.5.6.5]

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is part of the current UE configuration and not configured as DAPS bearer:

2> if the *reestablishPDCP* is set:

3> if target RAT of handover is E-UTRA/5GC; or

3> if the UE is connected to E-UTRA/5GC:

4> if the UE is capable of E-UTRA/5GC but not capable of NGEN-DC:

5> if the PDCP entity of this DRB is not configured with *cipheringDisabled:*

6> configure the PDCP entity with the ciphering algorithm and KUPenc key configured/derived as specified in TS 36.331 [10], clause 5.4.2.3, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> else (i.e., a UE capable of NGEN-DC):

5> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:

6> configure the PDCP entity with the ciphering algorithm and KUPenc key associated with the master key (KeNB) or the secondary key (S-KgNB), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

3> else (i.e., UE connected to NR or UE connected to E-UTRA/EPC (in EN-DC or capable of EN-DC)):

4> if the PDCP entity of this DRB is not configured with *cipheringDisabled:*

5> configure the PDCP entity with the ciphering algorithm and KUPenc key associated with the master key (KeNB/ KgNB) or the secondary key (S-KgNB/S-KeNB), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> if the PDCP entity of this DRB is configured with *integrityProtection*:

5> configure the PDCP entity with the integrity protection algorithms according to *securityConfig* and apply the KUPint key associated with the master key (KeNB/KgNB) or the secondary key (S-KgNB) as indicated in *keyToUse*;

3> if *drb-ContinueROHC* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueROHC* is configured;

3> if *drb-ContinueEHC-DL* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueEHC-DL* is configured;

3> if *drb-ContinueEHC-UL* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueEHC-UL* is configured;

3> if *drb-ContinueUDC* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueUDC* is configured;

3> re-establish the PDCP entity of this DRB as specified in TS 38.323 [5], clause 5.1.2;

7.1.3.6.4.3 Test description

7.1.3.6.4.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with UDC configuration except the following:

- 2 NR cells (NR Cell 1 and NR Cell 2) are configured with DRBs in RLC AM mode.

- The cell power levels are configured as per the Table 7.1.3.6.4.3.1-1.

Table 7.1.3.6.4.3.1-1: Time instances of cell power level in FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | -82 |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | -88 |  |

Table 7.1.3.6.4.3.1-2: Time instances of cell power level in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | -91 | -82 |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | 91 |  |

7.1.3.6.4.3.2 Test procedure sequence

Table 7.1.3.6.4.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 5 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#0 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | PDCP PDU | - | - |
| 3 | UE sends the PDCP Data PDU#0 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111.  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 4 | The SS sends the PDCP Data PDU#1 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1. | <-- | PDCP PDU | - | - |
| 5 | UE sends the PDCP Data PDU#1 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 1, FU = 1, FR = 0, the value of Checksum is checked (Note 2).  Data is previously received data from PDU #1 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 6 | The SS changes NR Cell 2 parameters according to the row "T1" in table 7.1.3.6.4.3.1-1(FR1) / 7.1.3.6.4.3.1-2(FR2). |  |  |  |  |
| 7 | The SS transmits NR RRCReconfiguration message to perform SpCell change from NR Cell1 to NR Cell 2 | <-- | *RRCReconfiguration* | - | - |
| 8 | UE transmits an RRCReconfigurationComplete message on NR Cell 2. | --> | *RRCReconfigurationComplete* | - | - |
| 9 | The SS sends the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2. | <-- | PDCP PDU | - | - |
| 10 | CHECK: Does UE send the PDCP Data PDU#2 via RLC-AM RB on NR Cell 2 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 1, Checksum = 1111?  Data is previously received data from PDU #2 after decompression. (Note 1) | --> | PDCP PDU | 1 | P |
| 11 | The SS sends the PDCP Data PDU#3 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 3. | <-- | PDCP PDU | - | - |
| 12 | UE sends the PDCP Data PDU#3 via RLC-AM RB on NR Cell 2 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 3, FU = 1, FR = 0, the value of Checksum is checked (Note 2).  Data is previously received data from PDU #3 after decompression. (Note 1) | 🡪 | PDCP PDU | - | - |
| 13 | SS adjusts the cell-specific reference signal level according to row "T2". |  |  |  |  |
| 14 | The SS transmits NR RRCReconfiguration message to perform SpCell change from NR Cell 2 to NR Cell 1 | <-- | *RRCReconfiguration* | - | - |
| 15 | UE transmits an RRCReconfigurationComplete message on NR Cell 1. | --> | *RRCReconfigurationComplete* | - | - |
| 16 | The SS sends the PDCP Data PDU#4 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 4. | <-- | PDCP PDU | - | - |
| 17 | CHECK: Does UE send the PDCP Data PDU#4 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 4, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #4 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| Note 1: The SS acknowledges the received data.  Note 2: The SS compares the received value of Checksum and calculated value of Checksum based on the compression buffer. | | | | | |

7.1.3.6.4.3.3 Specific message contents

Table 7.1.3.6.4.3.3-1: *RRCReconfiguration* (steps 7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | OCTET STRING (CONTAINING CellGroupConfig) |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.4.3.3-2: *RadioBearerConfig* (Table 7.1.3.6.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | Default DRB of the first PDU session |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.4.3.3-3: Void

Table 7.1.3.6.4.3.3-4: *CellGroupConfig* (7.1.3.6.4.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition PCell\_change and CFRA | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| spCellConfigCommon SEQUENCE { | Same as default ServingCellConfigCommon |  |  |
| physCellId | Physical cell Id of NR Cell 2 |  |  |
| } |  |  |  |
| rach-ConfigDedicated CHOICE { |  |  |  |
| Uplink | RACH-ConfigDedicated |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.4.3.3-5: *RRCReconfiguration* (steps 14)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.1-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | OCTET STRING (CONTAINING CellGroupConfig) |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.4.3.3-6: *RadioBearerConfig* (Table 7.1.3.6.4.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | Default DRB of the first PDU session |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.4.3.3-7: *PDCP-Config* (Table 7.1.3.6.4.3.3-6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| uplinkDataCompression-r17 CHOICE { |  |  |  |
| setup CHOICE { |  |  |  |
| drb-ContinueUDC | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.4.3.3-8: *CellGroupConfig* (7.1.3.6.4.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition PCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| spCellConfigCommon SEQUENCE { | Same as default ServingCellConfigCommon |  |  |
| physCellId | Physical cell Id of NR Cell 1 |  |  |
| } |  |  |  |
| rach-ConfigDedicated | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.3.6.5 PDCP UDC/ Handover/ Inter-frequency

7.1.3.6.5.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE receives an RRCReconfiguration message including a reconfigurationWithSync for Inter-frequency handover and drb-ContinueUDC is not configured }

**then** { UE maintains its previous UDC configuration for the DRB and resets the UDC buffer and sets the FR field in UDC header of the first compressed PDU to 1 }

}

(2)

**with** { UE in RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE receives an RRCReconfiguration message including a reconfigurationWithSync for Inter-frequency handover and drb-ContinueUDC is configured }

**then** { UE maintains its previous UDC configuration for the DRB and continues to use the previous UDC buffer }

}

7.1.3.6.5.2 Conformance requirements

Same as conformance requirements in clause 7.1.3.6.4.2

7.1.3.6.5.3 Test description

7.1.3.6.5.3.1 Pre-test conditions

Same as test case 7.1.3.6.4 with the following differences:

- Cells configuration: NR Cell 3 replaces NR Cell 2.

7.1.3.6.5.3.2 Test procedure sequence

Same as test case 7.1.3.6.4 with the following differences:

- Cells configuration: NR Cell 3 replaces NR Cell 2.

7.1.3.6.5.3.3 Specific message contents

Same as test case 7.1.3.6.4 with the following differences:

- Cells configuration: NR Cell 3 replaces NR Cell 2.

##### 7.1.3.6.6 PDCP UDC/ RRC resume

7.1.3.6.6.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_INACTIVE state with PDCP UDC configured }

**ensure that** {

**when** { UE receives an RRCResume message and drb-ContinueUDC is not configured }

**then** { UE maintains its previous UDC configuration for the DRB and resets the UDC buffer and sets the FR field in UDC header of the first compressed PDU to 1 }

}

(2)

**with** { UE in RRC\_INACTIVE state with PDCP UDC configured }

**ensure that** {

**when** { UE receives an RRCResume message and drb-ContinueUDC is configured }

**then** { UE maintains its previous UDC configuration for the DRB and continues to use the previous UDC buffer }

}

7.1.3.6.6.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.1.2, TS 38.331, clauses 5.3.5.6.5, 5.3.8.3, 5.3.13.3. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.1.2]

When upper layers request a PDCP entity re-establishment, the UE shall additionally perform once the procedures described in this clause for Uu or PC5 interface. After performing the procedures in this clause, the UE shall follow the procedures in clause 5.2.

When upper layers request a PDCP entity re-establishment, the transmitting PDCP entity shall:

- for UM DRBs and AM DRBs, reset the ROHC protocol for uplink and start with an IR state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and AM DRBs, reset the EHC protocol for uplink if *drb-ContinueEHC-UL* is not configured in TS 38.331 [3];

- for AM DRBs, reset the UDC compression buffer to all zeros and prefill the dictionary if *drb-ContinueUDC* is not configured in TS 38.331 [3];

- for SRBs and UM DRBs, set TX\_NEXT to the initial value;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- for UM DRBs, for each PDCP SDU already associated with a PDCP SN but for which a corresponding PDU has not previously been submitted to lower layers, and;

- for AM DRBs for Uu interface whose PDCP entities were suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, for each PDCP SDU already associated with a PDCP SN:

- consider the PDCP SDUs as received from upper layer;

- perform transmission of the PDCP SDUs in ascending order of the COUNT value associated to the PDCP SDU prior to the PDCP re-establishment without restarting the *discardTimer*, as specified in clause 5.2.1;

- for AM DRBs whose PDCP entities were not suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to the PDCP entity re-establishment as specified below:

- perform header compression of the PDCP SDU using ROHC as specified in the clause 5.7.4 and/or using EHC as specified in the clause 5.12.4;

- If *drb-ContinueUDC* is configured and if the PDCP SDU has been compressed before:

- submit the PDCP SDU previously compressed to integrity protection and ciphering function;

- else:

- perform uplink data compression of the PDCP SDU as specified in clause 5.14.4, and submit the PDCP SDU to integrity protection and ciphering function;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the clause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in clause 5.2.1.

[TS 38.331, clause 5.3.5.6.5]

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is part of the current UE configuration and not configured as DAPS bearer:

2> if the *reestablishPDCP* is set:

3> if target RAT of handover is E-UTRA/5GC; or

3> if the UE is connected to E-UTRA/5GC:

4> if the UE is capable of E-UTRA/5GC but not capable of NGEN-DC:

5> if the PDCP entity of this DRB is not configured with *cipheringDisabled:*

6> configure the PDCP entity with the ciphering algorithm and KUPenc key configured/derived as specified in TS 36.331 [10], clause 5.4.2.3, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> else (i.e., a UE capable of NGEN-DC):

5> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:

6> configure the PDCP entity with the ciphering algorithm and KUPenc key associated with the master key (KeNB) or the secondary key (S-KgNB), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

3> else (i.e., UE connected to NR or UE connected to E-UTRA/EPC (in EN-DC or capable of EN-DC)):

4> if the PDCP entity of this DRB is not configured with *cipheringDisabled:*

5> configure the PDCP entity with the ciphering algorithm and KUPenc key associated with the master key (KeNB/ KgNB) or the secondary key (S-KgNB/S-KeNB), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> if the PDCP entity of this DRB is configured with *integrityProtection*:

5> configure the PDCP entity with the integrity protection algorithms according to *securityConfig* and apply the KUPint key associated with the master key (KeNB/KgNB) or the secondary key (S-KgNB) as indicated in *keyToUse*;

3> if *drb-ContinueROHC* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueROHC* is configured;

3> if *drb-ContinueEHC-DL* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueEHC-DL* is configured;

3> if *drb-ContinueEHC-UL* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueEHC-UL* is configured;

3> if *drb-ContinueUDC* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueUDC* is configured;

3> re-establish the PDCP entity of this DRB as specified in TS 38.323 [5], clause 5.1.2;

[TS 38.331, clause 5.3.8.3]

1> if the *RRCRelease* includes *suspendConfig*:

2> reset MAC and release the default MAC Cell Group configuration, if any;

2> apply the received *suspendConfig* except the received *nextHopChainingCount*;

2> if the *sdt-Config* is configured:

3> for each of the DRB in the *sdt-DRB-List*:

4> consider the DRB to be configured for SDT;

3> if *sdt-SRB2-Indication* is configured:

4> consider the SRB2 to be configured for SDT;

3> for each RLC bearer that is not suspended:

4> re-establish the RLC entity as specified in TS 38.322 [4];

3> for SRB2 (if it is resumed) and for SRB1:

4> trigger the PDCP entity to perform SDU discard as specified in TS 38.323 [5];

3> if *sdt-MAC-PHY-CG-Config* is configured:

4> configure the PCell with the configured grant resources for SDT and instruct the MAC entity to start the *cg-SDT-TimeAlignmentTimer*;

2> if *srs-PosRRC-Inactive* is configured:

3> apply the configuration and instruct MAC to start the *inactivePosSRS-TimeAlignmentTimer*;

NOTE 1b: The Network should provide full configuration to UE for SRS for Positioning in RRC\_INACTIVE.

2> remove all the entries within the MCG and the SCG *VarConditionalReconfig*, if any;

2> for each *measId* of the MCG *measConfig* and for each *measId* of the SCG *measConfig*, if configured, if the associated *reportConfig* has a *reportType* set to *condTriggerConfig*:

3> for the associated *reportConfigId*:

4> remove the entry with the matching *reportConfigId* from the *reportConfigList* within the *VarMeasConfig*;

3> if the associated *measObjectId* is only associated to a *reportConfig* with *reportType* set to *condTriggerConfig*:

4> remove the entry with the matching *measObjectId* from the *measObjectList* within the *VarMeasConfig*;

3> remove the entry with the matching *measId* from the *measIdList* within the *VarMeasConfig*;

2> re-establish RLC entities for SRB1;

2> if the *RRCRelease* message with *suspendConfig* was received in response to an *RRCResumeRequest* or an *RRCResumeRequest1*:

3> stop the timer T319 if running;

3> in the stored UE Inactive AS context:

4> replace the KgNB and KRRCint keys with the current KgNB and KRRCint keys;

4> replace the *nextHopChainingCount* with the value of *nextHopChainingCount* received in the *RRCRelease* message*;*

4> replace the *cellIdentity* with the *cellIdentity* of the cell the UE has received the *RRCRelease* message;

4> if the *suspendConfig* contains the *sl-UEIdentityRemote* (i.e. the UE is a L2 U2N Remote UE):

5> replace the C-RNTI with the value of the *sl-UEIdentityRemote*;

5> replace the physical cell identitywith the value of the *sl-PhysCellId* in *sl-ServingCellInfo* contained in the discovery message received from the connected L2 U2N Relay UE;

4> else:

5> replace the C-RNTI with the C-RNTI used in the cell (see TS 38.321 [3]) the UE has received the *RRCRelease* message;

5> replace the physical cell identitywith the physical cell identity of the cell the UE has received the *RRCRelease* message;

3> replace the *nextHopChainingCount* with the value associated with the current KgNB;

3> stop the timer T319a if running and consider SDT procedure is not ongoing;

2> else:

3> store in the UE Inactive AS Context the *nextHopChainingCount* received in the *RRCRelease* message*,* the current KgNB and KRRCint keys, the ROHC state, the EHC context(s), the UDC state, the stored QoS flow to DRB mapping rules, the application layer measurement configuration, the C-RNTI used in the source PCell, the *cellIdentity* and the physical cell identity of the source PCell, the *spCellConfigCommon* within *ReconfigurationWithSync* of the NR PSCell (if configured) and all other parameters configured except for:

- parameters within *ReconfigurationWithSync* of the PCell;

- parameters within *ReconfigurationWithSync* of the NR PSCell, if configured;

- parameters within *MobilityControlInfoSCG* of the E-UTRA PSCell, if configured;

- *servingCellConfigCommonSIB*;

- *sl-L2RelayUE-Config*, if configured;

- *sl-L2RemoteUE-Config*, if configured;

[TS 38.331, clause 5.3.13.3]

The UE shall set the contents of *RRCResumeRequest* or *RRCResumeRequest1* message as follows:

1> if field *useFullResumeID* is signalled in *SIB1*:

2> select *RRCResumeRequest1* as the message to use;

2> set the *resumeIdentity* to the stored *fullI-RNTI* value;

1> else:

2> select *RRCResumeRequest* as the message to use;

2> set the *resumeIdentity* to the stored *shortI-RNTI* value;

1> restore the RRC configuration, RoHC state, the EHC context(s), the UDC state, the stored QoS flow to DRB mapping rules and the KgNB and KRRCint keys from the stored UE Inactive AS context except for the following:

- masterCellGroup;

- mrdc-SecondaryCellGroup, if stored; and

- pdcp-Config;

7.1.3.6.6.3 Test description

7.1.3.6.6.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with UDC configuration.

7.1.3.6.6.3.2 Test procedure sequence

Table 7.1.3.6.6.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 5 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#0 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | PDCP PDU | - | - |
| 3 | UE sends the PDCP Data PDU#0 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111.  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 4 | The SS sends the PDCP Data PDU#1 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1. | <-- | PDCP PDU | - | - |
| 5 | UE sends the PDCP Data PDU#1 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 1, FU = 1, FR = 0, the value of Checksum is checked (Note 2).  Data is previously received data from PDU #1 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 6 | The SS transmits an *RRCRelease* message with *suspendConfig* | <-- | NR RRC: *RRCRelease* | - | - |
| 7 | The SS transmits a *Paging* message including a matched identities (correct fullI-RNTI). | <-- | NR RRC: *Paging* | - | - |
| 8 | The UE transmits an *RRCResumeRequest* message to resume RRC Connection by setting resumeIdentity to the stored shortI-RNTI value. | --> | NR RRC: *RRCResumeRequest* | - | - |
| 9 | The SS transmits an *RRCResume* message without uplinkDataCompression. | <-- | NR RRC: *RRCResume* | - | - |
| 10 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 11 | The SS sends the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2. | <-- | PDCP PDU | - | - |
| 12 | CHECK: Does UE send the PDCP Data PDU#2 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 1, Checksum = 1111?  Data is previously received data from PDU #2 after decompression. (Note 1) | --> | PDCP PDU | 1 | P |
| 13 | The SS sends the PDCP Data PDU#3 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 3. | <-- | PDCP PDU | - | - |
| 14 | UE sends the PDCP Data PDU#3 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 3, FU = 1, FR = 0, the value of Checksum is checked (Note 2).  Data is previously received data from PDU #3 after decompression. (Note 1) | 🡪 | PDCP PDU | - | - |
| 15 | The SS transmits an *RRCRelease* message with *suspendConfig* | <-- | NR RRC: *RRCRelease* | - | - |
| 16 | The SS transmits a *Paging* message including a matched identities (correct fullI-RNTI). | <-- | NR RRC: *Paging* | - | - |
| 17 | The UE transmits an *RRCResumeRequest* message to resume RRC Connection by setting resumeIdentity to the stored shortI-RNTI value. | --> | NR RRC: *RRCResumeRequest* | - | - |
| 18 | The SS transmits an *RRCResume* message with drb-ContinueUDC. | <-- | NR RRC: *RRCResume* | - | - |
| 19 | The UE transmits an *RRCResumeComplete* message. | --> | NR RRC: *RRCResumeComplete* | - | - |
| 20 | The SS sends the PDCP Data PDU#4 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 4. | <-- | PDCP PDU | - | - |
| 21 | CHECK: Does UE send the PDCP Data PDU#4 via RLC-AM RB with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 4, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #4 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| Note 1: The SS acknowledges the received data.  Note 2: The SS compares the received value of Checksum and calculated value of Checksum based on the compression buffer. | | | | | |

7.1.3.6.6.3.3 Specific message contents

Table 7.1.3.6.6.3.3-1: Paging (step 7, 16)

|  |
| --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.1-9 with condition NR\_RRC\_RESUME |

Table 7.1.3.6.6.3.3-2: *RRCResume* (step 9)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.1-17 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResume ::= SEQUENCE { | |  |  |  |
| rrc-TransactionIdentifier | | RRC-TransactionIdentifier |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcResume SEQUENCE { | |  |  |  |
| radioBearerConfig | | RadioBearerConfig |  |  |
| masterCellGroup | | OCTET STRING (CONTAINING CellGroupConfig) | CellGroupConfig with condition RESUME |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.6.6.3.3-3: *RadioBearerConfig* (Table 7.1.3.6.6.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | Default DRB of the first PDU session |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.6.3.3-4: Void

Table 7.1.3.6.6.3.3-5: *RRCResume* (step 18)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] Table 4.6.1-17 | | | |
| Information Element | | Value/remark | Comment | Condition |
| RRCResume ::= SEQUENCE { | |  |  |  |
| rrc-TransactionIdentifier | | RRC-TransactionIdentifier |  |  |
| criticalExtensions CHOICE { | |  |  |  |
| rrcResume SEQUENCE { | |  |  |  |
| radioBearerConfig | | RadioBearerConfig |  |  |
| masterCellGroup | | OCTET STRING (CONTAINING CellGroupConfig) | CellGroupConfig with condition RESUME |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 7.1.3.6.6.3.3-6: *RadioBearerConfig* (Table 7.1.3.6.6.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | Default DRB of the first PDU session |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.6.3.3-7: *PDCP-Config* (Table 7.1.3.6.6.3.3-6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| uplinkDataCompression-r17 CHOICE { |  |  |  |
| setup CHOICE { |  |  |  |
| drb-ContinueUDC | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.6.3.3-8: *CellGroupConfig* (7.1.3.6.6.3.3-2, 7.1.3.6.6.3.3-5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition PCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| spCellConfigCommon SEQUENCE { | Same as default ServingCellConfigCommon |  |  |
| physCellId | Physical cell Id of NR Cell 1 |  |  |
| } |  |  |  |
| rach-ConfigDedicated | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.3.6.7 PDCP UDC/ RRC reestablishment

7.1.3.6.7.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state with PDCP UDC configured and upon detecting radio link failure UE sends RRCReestablishmentRequest message }

**ensure that** {

**when** { UE receives the first RRCReconfiguration message after successful completion of the RRC re-establishment procedure and drb-ContinueUDC is not configured }

**then** { UE maintains its previous UDC configuration for the DRB and resets the UDC buffer and sets the FR field in UDC header of the first compressed PDU to 1 }

}

(2)

**with** { UE in NR RRC\_CONNECTED state with PDCP UDC configured }

**ensure that** {

**when** { UE receives the first RRCReconfiguration message after successful completion of the RRC re-establishment procedure and drb-ContinueUDC is configured }

**then** { UE maintains its previous UDC configuration for the DRB and continues to use the previous UDC buffer }

}

7.1.3.6.7.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.1.2, TS 38.331, clauses 5.3.5.6.5, 5.3.7.2, 5.3.5.3. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.1.2]

When upper layers request a PDCP entity re-establishment, the UE shall additionally perform once the procedures described in this clause for Uu or PC5 interface. After performing the procedures in this clause, the UE shall follow the procedures in clause 5.2.

When upper layers request a PDCP entity re-establishment, the transmitting PDCP entity shall:

- for UM DRBs and AM DRBs, reset the ROHC protocol for uplink and start with an IR state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and AM DRBs, reset the EHC protocol for uplink if *drb-ContinueEHC-UL* is not configured in TS 38.331 [3];

- for AM DRBs, reset the UDC compression buffer to all zeros and prefill the dictionary if *drb-ContinueUDC* is not configured in TS 38.331 [3];

- for SRBs and UM DRBs, set TX\_NEXT to the initial value;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- for UM DRBs, for each PDCP SDU already associated with a PDCP SN but for which a corresponding PDU has not previously been submitted to lower layers, and;

- for AM DRBs for Uu interface whose PDCP entities were suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, for each PDCP SDU already associated with a PDCP SN:

- consider the PDCP SDUs as received from upper layer;

- perform transmission of the PDCP SDUs in ascending order of the COUNT value associated to the PDCP SDU prior to the PDCP re-establishment without restarting the *discardTimer*, as specified in clause 5.2.1;

- for AM DRBs whose PDCP entities were not suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to the PDCP entity re-establishment as specified below:

- perform header compression of the PDCP SDU using ROHC as specified in the clause 5.7.4 and/or using EHC as specified in the clause 5.12.4;

- If *drb-ContinueUDC* is configured and if the PDCP SDU has been compressed before:

- submit the PDCP SDU previously compressed to integrity protection and ciphering function;

- else:

- perform uplink data compression of the PDCP SDU as specified in clause 5.14.4, and submit the PDCP SDU to integrity protection and ciphering function;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the clause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in clause 5.2.1.

[TS 38.331, clause 5.3.5.6.5]

…

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is part of the current UE configuration and not configured as DAPS bearer:

2> if the *reestablishPDCP* is set:

3> if target RAT of handover is E-UTRA/5GC; or

3> if the UE is connected to E-UTRA/5GC:

4> if the UE is capable of E-UTRA/5GC but not capable of NGEN-DC:

5> if the PDCP entity of this DRB is not configured with *cipheringDisabled:*

6> configure the PDCP entity with the ciphering algorithm and KUPenc key configured/derived as specified in TS 36.331 [10], clause 5.4.2.3, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> else (i.e., a UE capable of NGEN-DC):

5> if the PDCP entity of this DRB is not configured with *cipheringDisabled*:

6> configure the PDCP entity with the ciphering algorithm and KUPenc key associated with the master key (KeNB) or the secondary key (S-KgNB), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

3> else (i.e., UE connected to NR or UE connected to E-UTRA/EPC (in EN-DC or capable of EN-DC)):

4> if the PDCP entity of this DRB is not configured with *cipheringDisabled:*

5> configure the PDCP entity with the ciphering algorithm and KUPenc key associated with the master key (KeNB/ KgNB) or the secondary key (S-KgNB/S-KeNB), as indicated in *keyToUse*, i.e. the ciphering configuration shall be applied to all subsequent PDCP PDUs received and sent by the UE;

4> if the PDCP entity of this DRB is configured with *integrityProtection*:

5> configure the PDCP entity with the integrity protection algorithms according to *securityConfig* and apply the KUPint key associated with the master key (KeNB/KgNB) or the secondary key (S-KgNB) as indicated in *keyToUse*;

3> if *drb-ContinueROHC* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueROHC* is configured;

3> if *drb-ContinueEHC-DL* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueEHC-DL* is configured;

3> if *drb-ContinueEHC-UL* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueEHC-UL* is configured;

3> if *drb-ContinueUDC* is included in *pdcp-Config*:

4> indicate to lower layer that *drb-ContinueUDC* is configured;

3> re-establish the PDCP entity of this DRB as specified in TS 38.323 [5], clause 5.1.2;

[TS 38.331, clause 5.3.7.2]

Upon initiation of the procedure, the UE shall:

1> stop timer T310, if running;

1> stop timer T312, if running;

1> stop timer T304, if running;

1> start timer T311;

1> stop timer T316, if running;

1> if UE is not configured with *attemptCondReconfig*:

2> reset MAC;

2> release *spCellConfig*, if configured;

2> suspend all RBs, and BH RLC channels for IAB-MT, and Uu Relay RLC channels for L2 U2N Relay UE, except SRB0 and broadcast MRBs;

[TS 38.331, clause 5.3.5.3]

…

1> else(*RRCReconfiguration* was received via SRB1):

2> if the UE is in NR-DC and;

2> if the *RRCReconfiguration* does not include the *mrdc-SecondaryCellGroupConfig*:

3> if the *RRCReconfiguration* includes the *scg-State*:

4> perform SCG deactivation as specified in 5.3.5.13b;

3> else:

4> perform SCG activation without SN message as specified in 5.3.5.13b1;

2> if the *reconfigurationWithSync* was included in *spCellConfig* of an MCG:

3> if *ta-Report* is configured with value *enabled* and the UE supports TA reporting:

4> indicate TA report initiation to lower layers;

2> submit the *RRCReconfigurationComplete* message via SRB1 to lower layers for transmission using the new configuration;

2> if this is the first *RRCReconfiguration* message after successful completion of the RRC re-establishment procedure:

3> resume SRB2, SRB4, DRBs, multicast MRB, and BH RLC channels for IAB-MT, that are suspended;

7.1.3.6.7.3 Test description

7.1.3.6.7.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0 with UDC configuration except the following:

- 2 NR cells (NR Cell 1 and NR Cell 2) are configured with DRBs in RLC AM mode.

- The cell power levels are configured as per the Table 7.1.3.6.7.3.1-1 (FR1) or Table 7.1.3.6.7.3.1-2 (FR2).

Table 7.1.3.6.7.3.1-1: Time instances of cell power level in FR1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -88 |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -88 | Off |  |

Table 7.1.3.6.7.3.1-2: Time instances of cell power level in FR2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **Unit** | **NR Cell 1** | **NR Cell 2** | **Remark** |
| T0 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | Off |  |
| T1 | SS/PBCH  SSS EPRE | dBm/SCS | Off | -82 |  |
| T2 | SS/PBCH  SSS EPRE | dBm/SCS | -82 | Off |  |

7.1.3.6.7.3.2 Test procedure sequence

Table 7.1.3.6.7.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS creates 5 PDCP Data PDUs and the Next\_PDCP\_TX\_SN is set to "0". | - | - | - | - |
| 2 | The SS sends the PDCP Data PDU#0 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 0. | <-- | PDCP PDU | - | - |
| 3 | UE sends the PDCP Data PDU#0 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111.  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 4 | The SS sends the PDCP Data PDU#1 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 1. | <-- | PDCP PDU | - | - |
| 5 | UE sends the PDCP Data PDU#1 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 1, FU = 1, FR = 0, the value of Checksum is checked (Note 2).  Data is previously received data from PDU #1 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 6 | The SS changes NR Cell 1and NR Cell 2 parameters according to the row "T1" in table 7.1.3.6.7.3.1-1/2 in order that the radio link quality of NR Cell 1 is degraded, and NR Cell 2 is suitable for camping. | - | - | - | - |
| 7 | UE sends *RRCReestablishmentRequest* message on NR Cell 2. | --> | NR RRC: *RRCReestablishmentRequest* | - | - |
| 8 | The SS transmits *RRCReestablishment* message. | <-- | NR RRC: *RRCReestablishment* | - | - |
| 9 | The UE transmits *RRCReestablishmentComplete* message. | --> | NR RRC:  *RRCReestablishmentComplete* | - | - |
| 10 | The SS transmits an *RRCReconfiguration* message to resume existing radio bearer. | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 11 | UE transmits an *RRCReconfigurationComplete* message. | --> | NR RRC: *RRCReconfigurationtComplete* | - | - |
| 12 | The SS sends the PDCP Data PDU#2 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 2. | <-- | PDCP PDU | - | - |
| 13 | CHECK: Does UE send the PDCP Data PDU#2 via RLC-AM RB on NR Cell 2 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 1, Checksum = 1111?  Data is previously received data from PDU #2 after decompression. (Note 1) | --> | PDCP PDU | 1 | P |
| 14 | The SS sends the PDCP Data PDU#3 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 3. | <-- | PDCP PDU | - | - |
| 15 | CHECK: Does UE send the PDCP Data PDU#4 via RLC-AM RB on NR Cell 2 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #3 after decompression. (Note 1) | --> | PDCP PDU | - | - |
| 16 | The SS changes NR Cell 1 and NR Cell 2 parameters according to the row "T2" in table 7.1.3.6.7.3.1-1/2 in order that the radio link quality of NR Cell 2 is degraded, and NR Cell 1 is suitable for camping. | - | - | - | - |
| 17 | UE sends *RRCReestablishmentRequest* message on NR Cell 1. | --> | NR RRC: *RRCReestablishmentRequest* | - | - |
| 18 | The SS transmits *RRCReestablishment* message. | <-- | NR RRC: *RRCReestablishment* | - | - |
| 19 | The UE transmits *RRCReestablishmentComplete* message. | --> | NR RRC:  *RRCReestablishmentComplete* | - | - |
| 20 | The SS transmits an *RRCReconfiguration* message to resume existing radio bearer. | <-- | NR RRC: *RRCReconfiguration* | - | - |
| 21 | UE transmits an *RRCReconfigurationComplete* message. | --> | NR RRC: *RRCReconfigurationtComplete* | - | - |
| 22 | The SS sends the PDCP Data PDU#4 via RLC-AM RB with the following content to the UE:  D/C field = 1 (PDCP Data PDU) and PDCP SN = 4. | <-- | PDCP PDU | - | - |
| 23 | CHECK: Does UE send the PDCP Data PDU#4 via RLC-AM RB on NR Cell 1 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 2, FU = 1, FR = 0, the value of Checksum is checked (Note 2)?  Data is previously received data from PDU #4 after decompression. (Note 1) | --> | PDCP PDU | 2 | P |
| Note 1: The SS acknowledges the received data.  Note 2: The SS compares the received value of Checksum and calculated value of Checksum based on the compression buffer. | | | | | |

7.1.3.6.7.3.3 Specific message contents

Table 7.1.3.6.7.3.3-1: *RRCReestablishmentRequest* (step 7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4] table 4.6.1-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReestablishmentRequest ::= SEQUENCE { |  |  |  |
| ue-Identity SEQUENCE { |  |  |  |
| c-RNTI | the value of the C-RNTI of the UE |  |  |
| physCellId | PhysicalCellIdentity of NR Cell 2 |  |  |
| shortMAC-I | The same value as the 16 least significant bits of the XMAC-I value calculated by SS |  |  |
| } |  |  |  |
| reestablishmentCause | otherFailure |  |  |
| } |  |  |  |

Table 7.1.3.6.7.3.3-2: RRCReconfiguration (step 10)

|  |
| --- |
| Derivation Path: TS 38.508-1[4], table 4.6.1-13 with condition REEST |

Table 7.1.3.6.7.3.3-3: *RRCReconfiguration* (step 20)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], table 4.6.1-13 with condition REEST | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration ::= SEQUENCE { |  |  |  |
| radioBearerConfig | RadioBearerConfig |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| masterCellGroup | OCTET STRING (CONTAINING CellGroupConfig) |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.7.3.3-4: *RadioBearerConfig* (Table 7.1.3.6.7.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | Default DRB of the first PDU session |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.7.3.3-5: *PDCP-Config* (Table 7.1.3.6.7.3.3-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| uplinkDataCompression-r17 CHOICE { |  |  |  |
| setup CHOICE { |  |  |  |
| drb-ContinueUDC | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.7.3.3-6: *CellGroupConfig* (7.1.3.6.7.3.3-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 4.6.3-19 with condition PCell\_change | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| reconfigurationWithSync SEQUENCE { |  |  |  |
| spCellConfigCommon SEQUENCE { | Same as default ServingCellConfigCommon |  |  |
| physCellId | Physical cell Id of NR Cell 1 |  |  |
| } |  |  |  |
| rach-ConfigDedicated | Not Present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

##### 7.1.3.6.8 PDCP UDC/ PSCell addition / SCG DRB with UDC configuration/ NR-DC

7.1.3.6.8.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives an RRCReconfiguration message to add an NR SCG DRB with UDC }

**then** { UE configures the PSCell with SCG DRB and transmits the PDCP SDUs on that DRB with UDC }

}

7.1.3.6.8.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.14.2, TS 38.331, clauses 5.3.5.3, 5.3.5.5.1, 5.3.5.5.7, 5.3.5.6.4 and 5.3.5.6.5. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.14.2]

The PDCP entities associated with DRBs can be configured by upper layers, see TS 38.331 [3], to use UDC. If UDC is configured, the UE shall apply UDC compression function (details see Annex B) to process the received PDCP SDU from upper layers corresponding to the configured DRB. The size of compression buffer is configured by upper layers via *bufferSize*. If pre-defined dictionary is configured by upper layers, the UE shall first set the compression buffer to all zeros and then prefill the configured pre-defined dictionary in the compression buffer upon configuration of UDC. If pre-defined dictionary is not configured by upper layers, UE shall set the compression buffer to all zeros.

[TS 38.331, clause 5.3.5.3]

The UE shall perform the following actions upon reception of the *RRCReconfiguration*:

…

1> if the *RRCReconfiguration* includes the *secondaryCellGroup*:

2> perform the cell group configuration for the SCG according to 5.3.5.5;

1> if the *RRCReconfiguration* includes the *mrdc-SecondaryCellGroupConfig:*

2> if the *mrdc-SecondaryCellGroupConfig* is set to *setup*:

3> if the *mrdc-SecondaryCellGroupConfig* includes *mrdc-ReleaseAndAdd*:

4> perform MR-DC release as specified in clause 5.3.5.10;

3> if the received *mrdc-SecondaryCellGroup* is set to *nr-SCG*:

4> perform the RRC reconfiguration according to 5.3.5.3 for the *RRCReconfiguration* message included in *nr-SCG*;

3> if the received *mrdc-SecondaryCellGroup* is set to *eutra-SCG*:

4> perform the RRC connection reconfiguration as specified in TS 36.331 [10], clause 5.3.5.3 for the *RRCConnectionReconfiguration* message included in *eutra-SCG*;

[TS 38.331, clause 5.3.5.5.1]

…

1> if the *CellGroupConfig* contains the *spCellConfig*:

2> configure the SpCell as specified in 5.3.5.5.7;

[TS 38.331, clause 5.3.5.5.7]

The UE shall:

…

2> if the *SpCellConfig* contains *spCellConfigDedicated*:

3> configure the SpCell in accordance with the *spCellConfigDedicated*;

3> consider the bandwidth part indicated in *firstActiveUplinkBWP-Id*, if included in the *spCellConfigDedicated,* to be the active uplink bandwidth part;

3> if the *firstActiveDownlinkBWP-Id* is included in the *spCellConfigDedicated*:

4> if the *SpCellConfig* is included in an *RRCReconfiguration* message contained in an NR or E-UTRA RRC message indicating that the SCG is deactivated:

5> consider the bandwidth part indicated in *firstActiveDownlinkBWP-Id* to be the bandwidth part for Radio Link Monitoring, Beam Failure Detection and measurements;

4> else:

5> consider the bandwidth part indicated in *firstActiveDownlinkBWP-Id* to be the active downlink bandwidth part;

3> if any of the reference signal(s) that are used for radio link monitoring are reconfigured by the received *spCellConfigDedicated*:

4> stop timer T310 for the corresponding SpCell, if running;

4> stop timer T312 for the corresponding SpCell, if running;

4> reset the counters N310 and N311.

[TS 38.331, clause 5.3.5.6.5]

The UE shall:

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is not part of the current UE configuration (DRB establishment including the case when full configuration option is used):

2> establish a PDCP entity and configure it in accordance with the received *pdcp-Config*;

7.1.3.6.8.3 Test description

7.1.3.6.8.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0.

- NR Cell 1 is the PCell and NR Cell 10 is the PSCell.

- System information combination NR-4 as defined in TS 38.508-1 [4] clause 4.4.3.1.2 is used in NR cells.

Preamble:

- The UE is in state RRC\_CONNECTED using generic procedure parameter Connectivity (*NR-DC*) and NR-DC bearers (*MCG(s) and SCG*) in TS 38.508-1 [4] clause 4.5.4.

7.1.3.6.8.3.2 Test procedure sequence

Table 7.1.3.6.8.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Void | - |  | - | - |
| 2 | Void | - |  | - | - |
| 3 | The SS sends a PDCP Data PDU#0 on the DRB on AM RLC entity configured for SCG on PSCell. | <-- | PDCP PDU | - | - |
| 4 | CHECK: Does UE sends the PDCP Data PDU#0 via RLC-AM RB on NR Cell 10 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111?  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | 1 | P |
| Note 1: The SS acknowledges the received data. | | | | | |

7.1.3.6.8.3.3 Specific message contents

Table 7.1.3.6.8.3.3-1: *RRCReconfiguration* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.1-13 with condition NR-DC | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| rrcReconfiguration SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| radioBearerConfig2 | OCTET STRING (CONTAINING RadioBearerConfig\_SCG) |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.8.3.3-2: *RadioBearerConfig\_SCG* (Table 7.1.3.6.8.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 with condition SCG\_DRB and DRB2 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | DRB-Identity using condition DRB2 |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.8.3.3-3: *PDCP-Config* (Table 7.1.3.6.8.3.3-2)

|  |
| --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-99 with condition UDC |

##### 7.1.3.6.9 PDCP UDC/ PSCell addition / SCG DRB with UDC configuration/ NE-DC

7.1.3.6.9.1 Test Purpose (TP)

(1)

**with** { UE in NR RRC\_CONNECTED state }

**ensure that** {

**when** { UE receives an RRCReconfiguration message to add an E-UTRA SCG DRB with UDC }

**then** { UE configures the PSCell with SCG DRB and transmits the PDCP SDUs on that DRB with UDC }

}

7.1.3.6.9.2 Conformance requirements

References: The conformance requirements covered in the present TC are specified in: TS 38.323, clauses 5.14.2, TS 38.331, clauses 5.3.5.3, 5.3.5.5.1, 5.3.5.5.7, 5.3.5.6.4, 5.3.5.6.5, TS 36.331, clauses 5.3.5.3, 5.3.10.3e, 5.3.10.10. Unless otherwise stated these are Rel-17 requirements.

[TS 38.323, clause 5.14.2]

The PDCP entities associated with DRBs can be configured by upper layers, see TS 38.331 [3], to use UDC. If UDC is configured, the UE shall apply UDC compression function (details see Annex B) to process the received PDCP SDU from upper layers corresponding to the configured DRB. The size of compression buffer is configured by upper layers via *bufferSize*. If pre-defined dictionary is configured by upper layers, the UE shall first set the compression buffer to all zeros and then prefill the configured pre-defined dictionary in the compression buffer upon configuration of UDC. If pre-defined dictionary is not configured by upper layers, UE shall set the compression buffer to all zeros.

[TS 38.331, clause 5.3.5.3]

The UE shall perform the following actions upon reception of the *RRCReconfiguration*:

…

1> if the *RRCReconfiguration* includes the *secondaryCellGroup*:

2> perform the cell group configuration for the SCG according to 5.3.5.5;

1> if the *RRCReconfiguration* includes the *mrdc-SecondaryCellGroupConfig:*

2> if the *mrdc-SecondaryCellGroupConfig* is set to *setup*:

3> if the *mrdc-SecondaryCellGroupConfig* includes *mrdc-ReleaseAndAdd*:

4> perform MR-DC release as specified in clause 5.3.5.10;

3> if the received *mrdc-SecondaryCellGroup* is set to *nr-SCG*:

4> perform the RRC reconfiguration according to 5.3.5.3 for the *RRCReconfiguration* message included in *nr-SCG*;

3> if the received *mrdc-SecondaryCellGroup* is set to *eutra-SCG*:

4> perform the RRC connection reconfiguration as specified in TS 36.331 [10], clause 5.3.5.3 for the *RRCConnectionReconfiguration* message included in *eutra-SCG*;

[TS 38.331, clause 5.3.5.5.1]

…

1> if the *CellGroupConfig* contains the *spCellConfig*:

2> configure the SpCell as specified in 5.3.5.5.7;

[TS 38.331, clause 5.3.5.5.7]

The UE shall:

…

2> if the *SpCellConfig* contains *spCellConfigDedicated*:

3> configure the SpCell in accordance with the *spCellConfigDedicated*;

3> consider the bandwidth part indicated in *firstActiveUplinkBWP-Id*, if included in the *spCellConfigDedicated,* to be the active uplink bandwidth part;

3> if the *firstActiveDownlinkBWP-Id* is included in the *spCellConfigDedicated*:

4> if the *SpCellConfig* is included in an *RRCReconfiguration* message contained in an NR or E-UTRA RRC message indicating that the SCG is deactivated:

5> consider the bandwidth part indicated in *firstActiveDownlinkBWP-Id* to be the bandwidth part for Radio Link Monitoring, Beam Failure Detection and measurements;

4> else:

5> consider the bandwidth part indicated in *firstActiveDownlinkBWP-Id* to be the active downlink bandwidth part;

3> if any of the reference signal(s) that are used for radio link monitoring are reconfigured by the received *spCellConfigDedicated*:

4> stop timer T310 for the corresponding SpCell, if running;

4> stop timer T312 for the corresponding SpCell, if running;

4> reset the counters N310 and N311.

[TS 38.331, clause 5.3.5.6.5]

The UE shall:

1> for each *drb-Identity* value included in the *drb-ToAddModList* that is not part of the current UE configuration (DRB establishment including the case when full configuration option is used):

2> establish a PDCP entity and configure it in accordance with the received *pdcp-Config*;

[TS 36.331, clause 5.3.5.3]

If the *RRCConnectionReconfiguration* message does not include the *mobilityControlInfo* and theUE is able to comply with the configuration included in this message, the UE shall:

…

1> if the received *RRCConnectionReconfiguration* includes the *scg-Configuration*; or

1> if the current UE configuration includes one or more split DRBs configured with *pdcp-Config* and the received *RRCConnectionReconfiguration* includes *radioResourceConfigDedicated* including *drb-ToAddModList*:

2> perform SCG reconfiguration as specified in 5.3.10.10;

[TS 36.331, clause 5.3.10.3e]

The UE shall:

1> for each *sCellGroupIndex* value included in the *sCellGroupToAddModList* that is part of the current UE configuration (SCell group modification):

2> for each *sCellIndex* value included in the *sCellToReleaseList* that is part of the SCell group indicated by *sCellGroupIndex* (SCell deletion from SCell group):

3> consider the *sCellConfigCommon* of the SCell group to be not applicable for the SCell*;*

3> consider the SCell not to be part of the SCell group indicated by *sCellGroupIndex*

2> for each *sCellIndex* value included in the *sCellToAddModList* that is not part of the SCell group indicated by *sCellGroupIndex* (SCell addition to SCell group):

3> consider the SCell to be part of the SCell group indicated by *sCellGroupIndex;*

3> apply the SCell configuration for parameters not already configured as part of the current SCell configuration in accordance with the *sCellConfigCommon* for the SCell group;

2> if *sCellConfigCommon* is included (modify the SCell group configuration):

3> for each SCell that is part of the current SCell group indicated by *sCellGroupIndex*:

4> apply the SCell configuration for parameters not already configured as part of the current SCell configuration in accordance with the *sCellConfigCommon* for the SCell group;

1> for each *sCellGroupIndex* value included in the *sCellGroupToAddModList* that is not part of the current UE configuration (SCell group addition):

2> for each *sCellIndex* value included in the *sCellToAddModList* (SCell addition to the group):

3> consider the SCell to be part of the SCell group indicated by *sCellGroupIndex*

3> apply the SCell configuration for parameters not already configured as part of the current SCell configuration in accordance with the *sCellConfigCommon* for the SCell group;

[TS 36.331, clause 5.3.10.10]

The UE shall:

…

1> else:

2> if *scg-ConfigPartMCG* is received and includes the *scg-Counter*:

3> update the S-KeNB key based on the KeNB key and using the received *scg-Counter* value, as specified in TS 33.401 [32];

3> derive the KUPenc key associated with the *cipheringAlgorithmSCG* included in *mobilityControlInfoSCG* within the received *scg-ConfigPartSCG*, as specified in TS 33.401 [32];

3> configure lower layers to apply the ciphering algorithm and the KUPenc key;

2> if *scg-ConfigPartSCG* is received and includes the *radioResourceConfigDedicatedSCG*:

3> reconfigure the dedicated radio resource configuration for the SCG as specified in 5.3.10.11;

2> if the current UE configuration includes one or more split or SCG DRBs and the received *RRCConnectionReconfiguration* message includes *radioResourceConfigDedicated* including *drb-ToAddModList*:

3> reconfigure the SCG or split DRB by *drb-ToAddModList* as specified in 5.3.10.12;

2> if *scg-ConfigPartSCG* is received and includes *measConfigSN*:

3> for *measConfigSN* perform the actions as specified in 5.5.2 for *measConfig* unless explicitly stated otherwise;

2> if *scg-ConfigPartSCG* is received and includes the *sCellToReleaseListSCG*:

3> perform SCell release for the SCG as specified in 5.3.10.3a;

2> if *scg-ConfigPartSCG* is received and includes the *pSCellToAddMod*:

3> perform PSCell addition or modification as specified in 5.3.10.3c;

NOTE 0: This procedure is also used to release the PSCell e.g. PSCell change, SI change for the PSCell.

2> if *scg-ConfigPartSCG* is received and includes the *sCellToAddModListSCG*:

3> perform SCell addition or modification as specified in 5.3.10.3b;

2> configure lower layers in accordance with mobilityControlInfoSCG, if received;

2> if *rach-SkipSCG* is configured:

3> configure lower layers to apply the *rach-SkipSCG* for the target SCG, as specified in TS 36.213 [23] and TS 36.321 [6];

2> if *scg-ConfigPartSCG* is received and includes the *mobilityControlInfoSCG* (i.e. SCG change):

3> resume all SCG DRBs and resume SCG transmission for split DRBs, if suspended;

3> stop timer T313, if running;

3> start timer T307 with the timer value set to *t307,* as included in the *mobilityControlInfoSCG*, if *makeBeforeBreakSCG* is not configured;

3> start synchronising to the DL of the target PSCell;

3> initiate the random access procedure on the PSCell, as specified in TS 36.321 [6], if *rach-SkipSCG* is not configured:

NOTE 1: The UE is not required to determine the SFN of the target PSCell by acquiring system information from that cell before performing RACH access in the target PSCell.

3> the procedure ends, except that the following actions are performed when MAC successfully completes the random access procedure on the PSCell or when MAC indicates the successful reception of a PDCCH transmission addressed to C-RNTI and if *rach-skipSCG* is configured:

4> stop timer T307;

4> release *rach-SkipSCG*;

4> apply the parts of the CQI reporting configuration, the scheduling request configuration and the sounding RS configuration that do not require the UE to know the SFN of the target PSCell, if any;

4> apply the parts of the measurement and the radio resource configuration that require the UE to know the SFN of the target PSCell (e.g. periodic CQI reporting, scheduling request configuration, sounding RS configuration), if any, upon acquiring the SFN of the target PSCell;

NOTE 2: Whenever the UE shall setup or reconfigure a configuration in accordance with a field that is received it applies the new configuration, except for the cases addressed by the above statements.

7.1.3.6.9.3 Test description

7.1.3.6.9.3.1 Pre-test conditions

Same Pre-test conditions as in clause 7.1.3.0.

- NR Cell 1 is the PCell and EUTRA Cell 1 is the PSCell.

- System information combination NR-1 as defined in TS 38.508-1 [4] clause 4.4.3.1.3 is used in NR cell 1.

Preamble:

- The UE is in state RRC\_CONNECTED using generic procedure parameter Connectivity (NE-DC) with DC bearer(MCG and SCG) in TS 38.508-1 [4] clause 4.5.4.

7.1.3.6.9.3.2 Test procedure sequence

Table 7.1.3.6.9.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Void | - |  | - | - |
| 2 | Void | - |  | - | - |
| 3 | The SS sends a PDCP Data PDU#0 on the DRB on AM RLC entity configured for SCG on PSCell. | <-- | PDCP PDU | - | - |
| 4 | CHECK: Does UE sends the PDCP Data PDU#0 via RLC-AM RB on NR Cell 10 with the following content:  D/C field = 1 (PDCP Data PDU) , PDCP SN = 0, FU = 1, FR = 0, Checksum = 1111?  Data is previously received data from PDU #0 after decompression. (Note 1) | --> | PDCP PDU | 1 | P |
| Note 1: The SS acknowledges the received data. | | | | | |

7.1.3.6.9.3.3 Specific message contents

Table 7.1.3.6.9.3.3-1: *RRCReconfiguration* (Preamble)

|  |
| --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.1-13 with condition NE-DC |

Table 7.1.3.6.9.3.3-2: *RRCConnectionReconfiguration* (Table 7.1.3.6.9.3.3-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 36.508 [7], Table 4.6.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE{ |  |  |  |
| rrcConnectionReconfiguration-r8 SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  | RRCConnectionReconfiguration-v1250-IEs |  |
| nonCriticalExtension SEQUENCE { |  | RRCConnectionReconfiguration-v1310-IEs |  |
| nonCriticalExtension SEQUENCE { |  | RRCConnectionReconfiguration-v1430-IEs |  |
| nonCriticalExtension SEQUENCE { |  | RRCConnectionReconfiguration-v1510-IEs |  |
| nr-RadioBearerConfig1-r15 | OCTET STRING (CONTAINING RadioBearerConfig\_SCG) |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.9.3.3-3: *RadioBearerConfig\_SCG* (Table 7.1.3.6.9.3.3-2)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-132 with condition SCG\_DRB | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| drb-Identity | DRB ID used for NE-DC SCG |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.3.6.9.3.3-4: *PDCP-Config* (Table 7.1.3.6.9.3.3-3)

|  |
| --- |
| Derivation Path: 38.508-1 [4], Table: 4.6.3-99 with condition UDC |

### 7.1.4 SDAP

#### 7.1.4.1 SDAP Data Transfer and PDU Header Handling UL/DL

7.1.4.1.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with multiple DRB's established, each mapping more than one QoS flow }

**ensure** **that** {

**when** { UE receives an SDAP PDU with SDAP header }

**then** { UE SDAP entity retrieves the SDAP SDU from the SDAP PDU and delivers it to upper layer }

}

(2)

**with** { UE in RRC\_CONNECTED state with multiple DRB's established configured with UL SDAP header, each mapping more than one QoS flow configured by RRC }

**ensure** **that** {

**when** { UE has to transmit a SDAP PDU with header to be included }

**then** {UE builds an SDAP PDU from the SDAP SDU including the header, and maps it to the DRB as per stored DRB mapping rule for the QoS flow }

}

(3)

**with** { UE in RRC\_CONNECTED state with multiple DRB's and QoS flows established }

**ensure that** {

**when** { UE receives a SDAP PDU with SDAP header and RDI fields set to 1 }

**then** { UE stores the QoS flow to DRB mapping of the DL SDAP PDU as the QoS flow to DRB mapping rule for the UL and uses it for further UL SDAP PDU transmissions }

}

(4)

**with** { UE in RRC\_CONNECTED state with multiple DRB's and QoS flows established }

**ensure that** {

**when** { UE receives a SDAP PDU with SDAP header and RDI field set to 1 and the stored QoS flow to DRB mapping rule for the QoS flow is different from the QoS flow to DRB mapping of the DL SDAP data PDU }

**then** { UE stores the QoS flow to DRB mapping of the DL SDAP PDU as the QoS flow to DRB mapping rule for the UL, to be used for further UL SDAP PDU transmissions and transmits an end-marker control PDU for the QoS flow on the old DRB }

}

(5)

**with** { UE in RRC\_CONNECTED state with multiple DRB's and QoS flows established with QoS flow to DRB mapping }

**ensure that** {

**when** { UE receives a message which configures a new QoS flow to DRB mapping, different from the existing mapping }

**then** { UE stores the QoS flow to DRB mapping to be used for further UL SDAP PDU transmissions and transmits an end-marker control PDU for the QoS flow on the old DRB }

}

7.1.4.1.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 37.324, clauses 5.2.1, 5.2.2, 5.3.1, 5.3.2, 6.2.2.1, 6.2.2.2, 6.2.2.3, 6.2.3 and 6.3.4, TS 24.501 clause 6.2.5.1.3. Unless otherwise stated these are Rel-15 requirements.

[TS 37.324 clause 5.2.1]

At the reception of an SDAP SDU from upper layer for a QoS flow, the transmitting SDAP entity shall:

- if there is no stored QoS flow to DRB mapping rule for the QoS flow as specified in the subclause 5.3:

- map the SDAP SDU to the default DRB;

- else:

- map the SDAP SDU to the DRB according to the stored QoS flow to DRB mapping rule;

- if the DRB to which the SDAP SDU is mapped is configured by RRC (3GPP TS 38.331 [3]) with the presence of SDAP header,

- construct the UL SDAP data PDU as specified in the subclause 6.2.2.3;

- else:

- construct the UL SDAP data PDU as specified in the subclause 6.2.2.1;

- submit the constructed UL SDAP data PDU to the lower layers.

NOTE 1: UE behaviour is not defined if there is neither a default DRB nor a stored QoS flow to DRB mapping rule for the QoS flow.

NOTE 2: Default DRB is always configured with UL SDAP header (3GPP TS 38.331 [3]).

[TS 37.324 clause 5.2.2]

At the reception of an SDAP data PDU from lower layers for a QoS flow, the receiving SDAP entity shall:

- if the DRB from which this SDAP data PDU is received is configured by RRC (3GPP TS 38.331 [3]) with the presence of SDAP header:

- perform reflective QoS flow to DRB mapping as specified in the subclause 5.3.2;

- perform RQI handling as specified in the subclause 5.4;

- retrieve the SDAP SDU from the DL SDAP data PDU as specified in the subclause 6.2.2.2.

- else:

- retrieve the SDAP SDU from the DL SDAP data PDU as specified in the subclause 6.2.2.1;

- deliver the retrieved SDAP SDU to the upper layer.

[TS 37.324 clause 5.3.1]

When RRC (3GPP TS 38.331 [3]) configures an UL QoS flow to DRB mapping rule for a QoS flow, the SDAP entity shall:

- if the SDAP entity has already been established and there is no stored QoS flow to DRB mapping rule for the QoS flow and a default DRB is configured:

- construct an end-marker control PDU, as specified in the subclause 6.2.3, for the QoS flow;

- map the end-marker control PDU to the default DRB;

- submit the end-marker control PDU to the lower layers.

- if the stored UL QoS flow to DRB mapping rule is different from the configured QoS flow to DRB mapping rule for the QoS flow and the DRB according to the stored QoS flow to DRB mapping rule is configured by RRC (3GPP TS 38.331 [3]) with the presence of UL SDAP header:

- construct an end-marker control PDU, as specified in the subclause 6.2.3, for the QoS flow;

- map the end-marker control PDU to the DRB according to the stored QoS flow to DRB mapping rule;

- submit the end-marker control PDU to the lower layers.

- store the configured UL QoS flow to DRB mapping rule for the QoS flow.

When RRC (3GPP TS 38.331 [3]) releases an UL QoS flow to DRB mapping rule for a QoS flow, the SDAP entity shall:

- remove the UL QoS flow to DRB mapping rule for the QoS flow.

[TS 37.324 clause 5.3.2]

For each received DL SDAP dataPDU with RDI set to 1, the SDAP entity shall:

- process the QFI field in the SDAP header and determine the QoS flow;

- if there is no stored QoS flow to DRB mapping rule for the QoS flow and a default DRB is configured:

- construct an end-marker control PDU, as specified in the subclause 6.2.3, for the QoS flow;

- map the end-marker control PDU to the default DRB;

- submit the end-marker control PDU to the lower layers;

- if the stored QoS flow to DRB mapping rule for the QoS flow is different from the QoS flow to DRB mapping of the DL SDAP data PDU and the DRB according to the stored QoS flow to DRB mapping rule is configured by RRC (3GPP TS 38.331 [3]) with the presence of UL SDAP header:

- construct an end-marker control PDU, as specified in the subclause 6.2.3, for the QoS flow;

- map the end-marker control PDU to the DRB according to the stored QoS flow to DRB mapping rule;

- submit the end-marker control PDU to the lower layers;

- store the QoS flow to DRB mapping of the DL SDAP data PDU as the QoS flow to DRB mapping rule for the UL.

[TS 37.324 clause 6.2.2.1]

An SDAP PDU consists only of a data field and does not consist of any SDAP header, as described in Figure 6.2.2.1-1.



Figure 6.2.2.1-1: SDAP Data PDU format without SDAP header

[TS 37.324 clause 6.2.2.2]

Figure 6.2.2.2 – 1 shows the format of SDAP Data PDU of DL with SDAP header being configured.



Figure 6.2.2.2-1: DL SDAP Data PDU format with SDAP header

[TS 37.324 clause 6.2.2.3]

Figure 6.2.2.3 – 1 shows the format of SDAP Data PDU of UL with SDAP header being configured.



Figure 6.2.2.3-1: UL SDAP Data PDU format with SDAP header

[TS 37.324 clause 6.2.3]

Figure 6.2.3 – 1 shows the format of End-Marker Control PDU.



Figure 6.2.2.3-1: UL SDAP Data PDU format with SDAP header

[TS 37.324 clause 6.3.4]

Length: 6 bits

The QFI field indicates the ID of the QoS flow (3GPP TS 23.501 [4]) to which the SDAP PDU belongs.

[TS 24.501 clause 6.2.5.1.3]

For PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, upon receiving an UL user data packet from the upper layers for transmission via a PDU session, the UE shall attempt to associate the UL user data packet with:

a) the QFI of a signalled QoS rule associated with the PDU session which has a set of packet filters containing a packet filter for UL direction matching the UL user data packet or containing a packet filter for both UL and DL directions matching the UL user data packet; or

b) the QFI of a derived QoS rule associated with the PDU session which has the packet filter for UL direction matching the UL user data packet;

by evaluating the QoS rules in increasing order of their precedence values until the UL user data packet is associated with a QFI or all QoS rules are evaluated.

For PDU session of unstructured PDU session type, upon receiving an UL user data packet from the upper layers for transmission via a PDU session, the UE shall associate the UL user data packet with the QFI of the default QoS rule associated with the PDU session.

If the UL user data packet is associated with a QFI, the UE shall pass the QFI along the UL user data packet to the lower layers for transmission.

NOTE: Marking of the UL user data packet with the QFI is performed by the lower layers.

If all QoS rules are evaluated and the UL user data packet is not associated with a QFI, the UE shall discard the UL user data packet.

7.1.4.1.3 Test description

7.1.4.1.3.1 Pre-test conditions

System Simulator:

- NR Cell 1

UE:

- None.

Preamble:

- The UE is in 5GS state 3N-A with one PDU session active according to TS 38.508-1 [4], clause 4.4A.3, Table 4.4A.3-1 and using the message condition UE TEST LOOP MODE B active with IP PDU delay = 1 second, to return one SDAP SDU per DL SDAP SDU. 2 DRBs are configured where DRB j is defined as default DRB. The NAS QoS rules for the QoS flows with QFI=1, QFI=2, QFI=5 and QFI=6 are configured. QoS flows with QFI=5 and QFI=6 are mapped to DRB j, QoS flows with QFI=1 and QFI=2 are mapped to DRB k.

7.1.4.1.3.2 Test procedure sequence

Table 7.1.4.1.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The SS sends the SDAP Data PDU with SDAP header on DRB k and the following content to the UE: RDI=0. RQI=0, QFI=2. | <-- | SDAP DL Data PDU | - | - |
| 2 | Check: Does the UE re-transmit SDAP Data PDU on DRB k with SDAP header as per the stored DRB mapping flow with QFI=2? | --> | SDAP UL Data PDU | 1,2 | P |
| 2A | The SS transmits an OPEN UE TEST LOOP message. | <-- | OPEN UE TEST LOOP | - | - |
| 2B | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | OPEN UE TEST LOOP COMPLETE | - | - |
| 2C | The SS transmits a CLOSE UE TEST LOOP Message with IP PDU delay = 1 second. | <-- | CLOSE UE TEST LOOP | - | - |
| 2D | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | CLOSE UE TEST LOOP COMPLETE | - | - |
| 3 | The SS sends the SDAP Data PDU with SDAP header on DRB k and the following content to the UE: RDI=1, RQI=0, QFI=5. | <-- | SDAP DL Data PDU | - | - |
| - | EXCEPTION: In parallel to the event described in step 4 the events specified in Table 7.1.4.1.3.2-2 shall take place. | - | - | - | - |
| 4 | Check: Does the UE re-transmit SDAP Data PDU on DRB k with SDAP header as per the stored DRB mapping Flow with QFI=5? | --> | SDAP UL Data PDU | 3 | P |
| 4A | The SS transmits an OPEN UE TEST LOOP message. | <-- | OPEN UE TEST LOOP | - | - |
| 4B | The UE transmits an OPEN UE TEST LOOP COMPLETE message. | --> | OPEN UE TEST LOOP COMPLETE | - | - |
| 4C | The SS transmits a CLOSE UE TEST LOOP Message with IP PDU delay = 1 second. | <-- | CLOSE UE TEST LOOP | - | - |
| 4D | The UE transmits a CLOSE UE TEST LOOP COMPLETE message. | --> | CLOSE UE TEST LOOP COMPLETE | - | - |
| 5 | The SS transmits an RRCReconfiguration message including a PDU SESSION MODIFICATION COMMAND | <-- | *RRCReconfiguration*  *(*PDU SESSION MODIFICATION COMMAND) | - | - |
| - | EXCEPTION: In parallel to the event described in step 6 the events specified in Tables 7.1.4.1.3.2-3 and 7.1.4.1.3.2-4 shall take place. | - | - | - | - |
| 6 | The UE transmits an RRCReconfigurationComplete message. | --> | *RRCReconfigurationComplete* | - | - |
| 7 | The SS sends the SDAP Data PDU with SDAP header on DRB k and the following content to the UE: RDI=0. RQI=0, QFI=4. | <-- | SDAP DL Data PDU | - | - |
| 8 | Check: Does the UE re-transmit SDAP Data PDU on DRB k with SDAP header as per the stored DRB mapping Flow with QFI=4? | --> | SDAP UL Data PDU | 5 | P |

Table 7.1.4.1.3.2-2: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE transmit End-Marker Control PDU on DRB j for QFI=5? | --> | SDAP UL Control PDU | 4 | P |

Table 7.1.4.1.3.2-3: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | Check: Does the UE transmit End-Marker Control PDU on DRB j for QFI=4? | --> | SDAP UL Control PDU | 5 | P |

Table 7.1.4.1.3.2-4: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| St | Procedure | Message Sequence | | TP | Verdict |
|  |  | U - S | Message |  |  |
| 1 | The UE Transmits PDU SESSION MODIFICATION COMPLETE | --> | *ULInformationTransfer*  (PDU SESSION MODIFICATION COMPLETE) | - | - |

7.1.4.1.3.3 Specific message contents

Table 7.1.4.1.3.3-1: RadioBearerConfig-DRB(Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.6.3-132 and condition NR | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 2 entries |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | present |  |  |
| sdap-HeaderUL | present |  |  |
| defaultDRB | false |  |  |
| mappedQoS-FlowsToAdd SEQUENCE { |  |  |  |
| QFI | 1 |  |  |
| QFI | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | k | k is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| DRB-ToAddMod[2] SEQUENCE { |  | entry 2 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | present |  |  |
| sdap-HeaderUL | present |  |  |
| defaultDRB | true |  |  |
| mappedQoS-FlowsToAdd SEQUENCE { |  |  |  |
| QFI | 5 |  |  |
| QFI | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | j | j is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.4.1.3.3-2: RadioBearerConfig-DRB(step 5, Table 7.1.4.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.6.3-132 and condition NR | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { | - | - |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry | BID is the total number of established DRBs in the UE, before applying the contents of this IE |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | present |  |  |
| sdap-HeaderUL | present |  |  |
| defaultDRB | false |  |  |
| mappedQoS-FlowsToAdd SEQUENCE { |  |  |  |
| QFI | 4 |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | k | k is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.4.1.3.3-3: PDU SESSION MODIFICATION COMMAND (step 5, Table 7.1.4.1.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.7.2-9 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| PDU session ID | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| Authorized QoS rules | 1 entry |  |  |
| QoS rule [1] | Reference QoS rule #4a as defined in TS 38.508-1 [4], Table 4.8.2.1-4a. | QFI=4 |  |
| Authorized QoS flow descriptions | 1 entry |  |  |
| QoS flow [1] | Reference QoS flow #2a as defined in TS 38.508-1 [4], Table 4.8.2.3-2a. | QFI=4 |  |

Table 7.1.4.1.3.3-4: PDU SESSION ESTABLISHMENT ACCEPT (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.7.2-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDU session ID | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| Authorized QoS rules | 4 entries |  |  |
| QoS rule [1] | Reference QoS rule #1 as defined in TS 38.508-1 [4], Table 4.8.2.1-1 | QFI=1 |  |
| QoS rule [2] | Reference QoS rule #4 as defined in Table 7.1.4.1.3.3-7 | QFI=2 |  |
| QoS rule [3] | Reference QoS rule #5 as defined in TS 38.508-1 [4], Table 4.8.2.1-5 | QFI=5 |  |
| QoS rule [4] | Reference QoS rule #6 as defined in TS 38.508-1 [4], Table 4.8.2.1-6 | QFI=6 |  |
| Mapped EPS Bearer contexts | Not Present |  |  |
| Authorized QoS flow descriptions | 4 entries |  |  |
| QoS flow [1] | Reference QoS flow #1 as defined in Table 7.1.4.1.3.3-5 | QFI=1 |  |
| QoS flow [2] | Reference QoS flow #2 as defined in Table 7.1.4.1.3.3-6 | QFI=2 |  |
| QoS flow [3] | Reference QoS flow #3 as defined in TS 38.508-1 [4], Table 4.8.2.3-3 | QFI=5 |  |
| QoS flow [4] | Reference QoS flow #4 as defined in TS 38.508-1 [4], Table 4.8.2.3-4 | QFI=6 |  |

Table 7.1.4.1.3.3-5: Reference QoS flow #1 (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.8.2.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| QoS flow descriptions |  |  |  |
| QoS flow description | 1 entry |  |  |
| QFI | ‘00 0001’B | QFI 1 |  |
| Operation code | ‘001’B | Create new QoS flow description |  |
| E bit | ‘1’B | Parameters list is included |  |
| Number of parameters | ’00 0001’B | 1 parameter |  |
| 5QI | ‘0000 1001’B | 5QI 9 |  |

Table 7.1.4.1.3.3-6: Reference QoS flow #2 (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.8.2.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| QoS flow descriptions |  |  |  |
| QoS flow description | 1 entry |  |  |
| QFI | ‘00 0010’B | QFI 2 |  |
| Operation code | ‘001’B | Create new QoS flow description |  |
| E bit | ‘1’B | Parameters list is included |  |
| Number of parameters | ’00 0001’B | 1 parameter |  |
| 5QI | ‘0000 0101’B | 5QI 5 |  |

Table 7.1.4.1.3.3-7: Reference QoS rule #4

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[4], table 4.8.2.1-4 | | | |
| Information Element | Value/remark | Comment | Condition |
| QoS rules |  |  |  |
| QoS rule |  |  |  |
| DQR bit | ‘0’B |  |  |

#### 7.1.4.2 SDAP Data Transfer handling without Header UL/DL

7.1.4.2.1 Test Purpose (TP)

(1)

**with** { UE in RRC\_CONNECTED state with multiple DRB's established. SDAP configured without header and no stored QoS flow mapping }

**ensure** **that** {

**when** { UE receives a SDAP SDU from upper layers }

**then** { UE SDAP entity transmits the SDAP PDU with header on default DRB }

}

(2)

**with** { UE in RRC\_CONNECTED state with multiple DRB's established. SDAP configured without header and no stored QoS flow mapping }

**ensure** **that** {

**when** { UE SDAP recieves from RRC new Qos Flow mapping }

**then** { UE SDAP entity transmits an end-marker control PDU for the QoS flow on default DRB }

}

(3)

**with** { UE in RRC\_CONNECTED state with multiple DRB's established. SDAP configured without header and stored QoS flow mapping configured by RRC }

**ensure** **that** {

**when** { UE receives a SDAP SDU from upper layers }

**then** { UE SDAP entity transmits the SDAP PDU without header on non default DRB as per configured QoS flow mapping }

}

7.1.4.2.2 Conformance requirements

References: The conformance requirements covered in the present test case are specified in: TS 37.324, clauses 5.2.1, 5.2.2, 5.3.1, 6.2.2.1 and 6.2.3, TS 24.501 clause 6.2.5.1.3. Unless otherwise stated these are Rel-15 requirements.

[TS 37.324 clause 5.2.1]

At the reception of an SDAP SDU from upper layer for a QoS flow, the transmitting SDAP entity shall:

- if there is no stored QoS flow to DRB mapping rule for the QoS flow as specified in the subclause 5.3:

- map the SDAP SDU to the default DRB;

- else:

- map the SDAP SDU to the DRB according to the stored QoS flow to DRB mapping rule;

- if the DRB to which the SDAP SDU is mapped is configured by RRC (3GPP TS 38.331 [3]) with the presence of SDAP header,

- construct the UL SDAP data PDU as specified in the subclause 6.2.2.3;

- else:

- construct the UL SDAP data PDU as specified in the subclause 6.2.2.1;

- submit the constructed UL SDAP data PDU to the lower layers.

NOTE 1: UE behaviour is not defined if there is neither a default DRB nor a stored QoS flow to DRB mapping rule for the QoS flow.

NOTE 2: Default DRB is always configured with UL SDAP header (3GPP TS 38.331 [3]).

[TS 37.324 clause 5.2.2]

At the reception of an SDAP data PDU from lower layers for a QoS flow, the receiving SDAP entity shall:

- if the DRB from which this SDAP data PDU is received is configured by RRC (3GPP TS 38.331 [3]) with the presence of SDAP header:

- perform reflective QoS flow to DRB mapping as specified in the subclause 5.3.2;

- perform RQI handling as specified in the subclause 5.4;

- retrieve the SDAP SDU from the DL SDAP data PDU as specified in the subclause 6.2.2.2.

- else:

- retrieve the SDAP SDU from the DL SDAP data PDU as specified in the subclause 6.2.2.1;

- deliver the retrieved SDAP SDU to the upper layer.

[TS 37.324 clause 5.3.1]

When RRC (3GPP TS 38.331 [3]) configures an UL QoS flow to DRB mapping rule for a QoS flow, the SDAP entity shall:

- if the SDAP entity has already been established and there is no stored QoS flow to DRB mapping rule for the QoS flow and a default DRB is configured:

- construct an end-marker control PDU, as specified in the subclause 6.2.3, for the QoS flow;

- map the end-marker control PDU to the default DRB;

- submit the end-marker control PDU to the lower layers.

- if the stored UL QoS flow to DRB mapping rule is different from the configured QoS flow to DRB mapping rule for the QoS flow and the DRB according to the stored QoS flow to DRB mapping rule is configured by RRC (3GPP TS 38.331 [3]) with the presence of UL SDAP header:

- construct an end-marker control PDU, as specified in the subclause 6.2.3, for the QoS flow;

- map the end-marker control PDU to the DRB according to the stored QoS flow to DRB mapping rule;

- submit the end-marker control PDU to the lower layers.

- store the configured UL QoS flow to DRB mapping rule for the QoS flow.

When RRC (3GPP TS 38.331 [3]) releases an UL QoS flow to DRB mapping rule for a QoS flow, the SDAP entity shall:

- remove the UL QoS flow to DRB mapping rule for the QoS flow.

[TS 37.324 clause 6.2.2.1]

An SDAP PDU consists only of a data field and does not consist of any SDAP header, as described in Figure 6.2.2.1-1.



Figure 6.2.2.1-1: SDAP Data PDU format without SDAP header

[TS 37.324 clause 6.2.3]

Figure 6.2.3 – 1 shows the format of End-Marker Control PDU.



Figure 6.2.3-1: End-Marker Control PDU

[TS 24.501 clause 6.2.5.1.3]

For PDU session of IPv4, IPv6, IPv4v6 or Ethernet PDU session type, upon receiving an UL user data packet from the upper layers for transmission via a PDU session, the UE shall attempt to associate the UL user data packet with:

a) the QFI of a signalled QoS rule associated with the PDU session which has a set of packet filters containing a packet filter for UL direction matching the UL user data packet or containing a packet filter for both UL and DL directions matching the UL user data packet; or

b) the QFI of a derived QoS rule associated with the PDU session which has the packet filter for UL direction matching the UL user data packet;

by evaluating the QoS rules in increasing order of their precedence values until the UL user data packet is associated with a QFI or all QoS rules are evaluated.

For PDU session of unstructured PDU session type, upon receiving an UL user data packet from the upper layers for transmission via a PDU session, the UE shall associate the UL user data packet with the QFI of the default QoS rule associated with the PDU session.

If the UL user data packet is associated with a QFI, the UE shall pass the QFI along the UL user data packet to the lower layers for transmission.

NOTE: Marking of the UL user data packet with the QFI is performed by the lower layers.

If all QoS rules are evaluated and the UL user data packet is not associated with a QFI, the UE shall discard the UL user data packet.

7.1.4.2.3 Test description

7.1.4.2.3.1 Pre-test conditions

System Simulator:

- NR Cell 1

UE:

- None.

Preamble:

- The UE is in 5GS state 3N-A with one PDU session active according to TS 38.508-1 [4], clause 4.4A.3, Table 4.4A.3-1 and using the message condition UE TEST LOOP MODE B active to return one UL SDAP SDU per DL SDAP SDU. 2 DRBs are configured where DRBj is defined as default DRB. The NAS QoS rules for QoS flows QFI = 5 and QFI = 2 are configured. The 'mappedQoS-Flows' is empty for both DRB's for SDAP layer.

7.1.4.2.3.2 Test procedure sequence

Table 7.1.4.2.3.2-1: Main behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | The SS sends the SDAP Data PDU without SDAP header on DRB k for QFI =2. | <-- | SDAP DL Data PDU | - | - |
| 2 | Check: Does the UE transmit SDAP Data PDU on DRB j, which is default DRB, with SDAP header including QFI=2? | --> | SDAP UL Data PDU | 1 | P |
| 3 | The SS sends the SDAP Data PDU without SDAP header on DRB j for QFI 5. | <-- | SDAP DL Data PDU | - | - |
| 4 | Check: Does the UE transmit SDAP Data PDU on DRB j, which is default DRB, with SDAP header including QFI=5? | --> | SDAP UL Data PDU | 1 | P |
| 5 | The SS transmits an NR RRCReconfiguration message to configure QoS Flow rules | <-- | *(RRCReconfiguration)* | - | - |
| - | EXCEPTION: In parallel to the event described in step 6 the events specified in Table 7.1.4.2.3.2-2 shall take place. | - | *-* | - | - |
| 6 | The UE transmit an NR *RRCReconfigurationComplete* message. | --> | *(RRCReconfigurationComplete)* | - | - |
| 7 | The SS sends the SDAP Data PDU without SDAP header on DRB k for QFI =2. | <-- | SDAP DL Data PDU | - | - |
| 8 | Check: Does the UE transmit SDAP Data PDU on DRB k? | --> | SDAP UL Data PDU | 3 | P |
| 9 | The SS sends the SDAP Data PDU without SDAP header on DRB j for QFI 5. | <-- | SDAP DL Data PDU | - | - |
| 10 | Check: Does the UE transmit SDAP Data PDU on DRB j, with SDAP header including QFI=5? | --> | SDAP UL Data PDU | 3 | P |

Table 7.1.4.2.3.2-2: Parallel behaviour

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **St** | **Procedure** | **Message Sequence** | | **TP** | **Verdict** |
|  |  | **U - S** | **Message** |  |  |
| 1 | Check: Does the UE transmit End-Marker Control PDU on DRBj for QFI=2? | --> | SDAP UL Control PDU | 2 | P |

Table 7.1.4.2.3.2-3: Void

7.1.4.2.3.3 Specific message contents

Table 7.1.4.2.3.3-1: RadioBearerConfig-DRB(Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.6.3-132 and condition NR | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 2 entries |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | absent |  |  |
| sdap-HeaderUL | absent |  |  |
| defaultDRB | false |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | k | k is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| DRB-ToAddMod[2] SEQUENCE { |  | entry 2 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | absent |  |  |
| sdap-HeaderUL | present |  |  |
| defaultDRB | true |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | j | j is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.4.2.3.3-2: RadioBearerConfig-DRB(step 5, Table 7.1.4.2.3.2-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.6.3-132 and condition NR | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 2 entries |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | absent |  |  |
| sdap-HeaderUL | absent |  |  |
| defaultDRB | false |  |  |
| mappedQoS-FlowsToAdd SEQUENCE { |  |  |  |
| QFI | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | k | k is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| DRB-ToAddMod[2] SEQUENCE { |  | entry 2 |  |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config SEQUENCE { |  |  |  |
| pdu-Session | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| sdap-HeaderDL | absent |  |  |
| sdap-HeaderUL | present |  |  |
| defaultDRB | true |  |  |
| mappedQoS-FlowsToAdd | Not present | The 'mappedQoS-Flows' is empty for the DRB. |  |
| } |  |  |  |
| } |  |  |  |
| drb-Identity | j | j is allocated according to internal TTCN mapping |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.1.4.2.3.3-3: PDU SESSION ESTABLISHMENT ACCEPT (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.7.2-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDU session ID | The same as the PDU session ID in PDU SESSION ESTABLISHMENT REQUEST |  |  |
| Authorized QoS rules | 3 entries |  |  |
| QoS rule [1] | Reference QoS rule #1 as defined in Table 4.8.2.1-1 | QFI=1 |  |
| QoS rule [2] | Reference QoS rule #4 as defined in Table 4.8.2.1-4 except DQR bit set to ‘0’ | QFI=2 |  |
| QoS rule [3] | Reference QoS rule #5 as defined in Table 4.8.2.1-5 | QFI=5 |  |
| Mapped EPS bearer contexts | Not Present |  |  |
| Authorized QoS flow descriptions | 3 entries |  |  |
| QoS flow [1] | Reference QoS flow #1 as defined in Table 7.1.4.2.3.3-4 | QFI=1 |  |
| QoS flow [2] | Reference QoS flow #2 as defined in Table 7.1.4.2.3.3-5 | QFI=2 |  |
| QoS flow [3] | Reference QoS flow #3 as defined in Table 4.8.2.3-3 | QFI=5 |  |

Table 7.1.4.2.3.3-4: Reference QoS flow #1 (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.8.2.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| QoS flow descriptions |  |  |  |
| QoS flow description | 1 entry |  |  |
| QFI | ‘00 0001’B | QFI 1 |  |
| Operation code | ‘001’B | Create new QoS flow description |  |
| E bit | ‘1’B | Parameters list is included |  |
| Number of parameters | ’00 0001’B | 1 parameter |  |
| 5QI | ‘0000 1001’B | 5QI 9 |  |

Table 7.1.4.2.3.3-5: Reference QoS flow #2 (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], table 4.8.2.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| QoS flow descriptions |  |  |  |
| QoS flow description | 1 entry |  |  |
| QFI | ‘00 0010’B | QFI 2 |  |
| Operation code | ‘001’B | Create new QoS flow description |  |
| E bit | ‘1’B | Parameters list is included |  |
| Number of parameters | ’00 0001’B | 1 parameter |  |
| 5QI | ‘0000 0101’B | 5QI 5 |  |