**3GPP TSG-RAN WG2 Meeting #126 *R2-240xxxx***

**Fukuoka, Japan May 22nd – 26th, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.321** | **CR** | **1820** | **rev** | **2** | **Current version:** | **17.8.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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| ***Title:*** | Correction on multicast DRX to support NTN | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | LG eletronics Inc., Samsung, Xiaomi, Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NTN\_enh-Core, NR\_MBS\_enh-Core | | | | |  | ***Date:*** | | | 2024-05-03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
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| ***Reason for change:*** | | According to the current specification, there is no restriction on that the MBS can be served by NTN. It means that the MBS traffic can be transmitted via NTN.  In DRX for NTN, since the duration of the HARQ-RTT-TimerDL cannot cover the large propagation delay in NTN, the UE sets the HARQ-RTT-TimerDL-NTN equal to drx-HARQ-RTT-TimerDL plus the latest available UE-gNB RTT value. Then, the UE starts the HARQ-RTT-TimerDL-NTN.  However, for multicast DRX, the duration of the drx-HARQ-RTT-TimerDL is not considered for the large propagation delay in NTN. For this reason, if the multicast MBS traffic is transmitted via NTN, the UE starts the drx-RetransmissionTimerDL before escaping the RTT because the HARQ-RTT-TimerDL-PTM and HARQ-RTT-TimerDL are shorter than the RTT. Therefore, the UE in NTN cannot receive the retransmission of the MAC PDU for MBS. | | | | | | | | |
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| ***Summary of change:*** | | Introduce a new state variable, i.e., HARQ-RTT-TimerDL-PTM-NTN, to extend the RTT timer for drx-HARQ-RTT-TimerDL-PTM.  Add the procedure text to extend the HARQ-RTT-TimerDL-NTN and HARQ-RTT-TimerDL-PTM-NTN in clause 5.7b.  **Impact analysis**  Impacted functionality:  MBS  Inter-operability:   1. If the network is implemented according to the CR and the UE is not, the desynchronization of the UE’s ActiveTime happens. 2. If the UE is implemented according to the CR and the network is not, the desynchronization of the UE’s ActiveTime happens. | | | | | | | | |
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| ***Consequences if not approved:*** | | The UE cannot receive the MAC PDU for retransmission while running the drx-RetransmissionTimerDL. | | | | | | | | |
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| ***Clauses affected:*** | | 5.7, 5.7b | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... TBU | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... TBU | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

START OF CHANGES

## 5.7 Discontinuous Reception (DRX)

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, AI-RNTI, SL-RNTI, SLCS-RNTI and SL Semi-Persistent Scheduling V-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: Void

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;

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

- *drx-HARQ-RTT-TimerSL* (per SL HARQ process): the minimum duration before an SL 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;

- *downlinkHARQ-FeedbackDisabled* (optional): the configuration to enable HARQ feedback per DL HARQ process;

- *uplinkHARQ-Mode* (optional): the configuration to set *HARQmodeA* or *HARQmodeB* per UL HARQ process.

Serving Cells of a MAC entity may be configured by RRC in two DRX groups with separate DRX parameters. When RRC does not configure a secondary DRX group, there is only one DRX group and all Serving Cells belong to that one DRX group. When two DRX groups are configured, each Serving Cell is uniquely assigned to either of the two groups. The DRX parameters that are separately configured for each DRX group are: *drx-onDurationTimer*, *drx-InactivityTimer*. The DRX parameters that are common to the DRX groups are: *drx-SlotOffset*, *drx-RetransmissionTimerDL*, *drx-RetransmissionTimerUL*, *drx-LongCycleStartOffset*, *drx-ShortCycle* (optional), *drx-ShortCycleTimer* (optional), *drx-HARQ-RTT-TimerDL*, *drx-HARQ-RTT-TimerUL*, *downlinkHARQ-FeedbackDisabled* (optional) and *uplinkHARQ-Mode* (optional).

When DRX 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*, *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerSL* 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 5.22.1.5). If this Serving Cell is part of a non-terrestrial network, the Active Time is started after the Scheduling Request transmission that is performed when the *SR\_COUNTER* is 0 for all the SR configurations with pending SR(s) plus the UE-gNB RTT; 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).

The following MAC timers are used for DRX operation in a non-terrestrial network:

- *HARQ-RTT-TimerDL-NTN* (per DL HARQ process configured with HARQ feedback enabled or per DL HARQ process for MBS multicast): the minimum duration before a DL assignment for HARQ retransmission is expected by the MAC entity;

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

NEXT CHANGES

## 5.7b Discontinuous Reception (DRX) for MBS Multicast

For MBS multicast, the MAC entity may be configured by RRC with a DRX functionality per G-RNTI or per G-CS-RNTI that controls the UE's PDCCH monitoring activity for the MAC entity's G-RNTI(s) and G-CS-RNTI(s) as specified in TS 38.331 [5]. When in RRC\_CONNECTED, if multicast DRX is configured for a G-RNTI or G-CS-RNTI, the MAC entity is allowed to monitor the PDCCH for this G-RNTI or G-CS-RNTI discontinuously using the multicast DRX operation specified in this clause; otherwise the MAC entity monitors the PDCCH for this G-RNTI or G-CS-RNTI as specified in TS 38.213 [6]. The multicast DRX operation specified in this clause is performed independently for each G-RNTI or G-CS-RNTI and independently from the DRX operation specified in clauses 5.7 and 5.7a.

RRC controls multicast DRX operation per G-RNTI or per G-CS-RNTI by configuring the following parameters:

- *drx-onDurationTimerPTM*: the duration at the beginning of a DRX cycle;

- *drx-SlotOffsetPTM*: the delay before starting the *drx-onDurationTimerPTM*;

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

- *drx-LongCycleStartOffsetPTM*: the long DRX cycle *drx-LongCycle-PTM* and *drx-StartOffset-PTM* which defines the subframe where the long DRX cycle starts;

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

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

The following MAC timer is used for DRX operation in a non-terrestrial network:

- *HARQ-RTT-TimerDL-PTM-NTN* (per DL HARQ process for MBS multicast): the minimum duration before a DL multicast assignment for HARQ retransmission is expected by the MAC entity.

When multicast DRX is configured for a G-RNTI or G-CS-RNTI, the Active Time includes the time while:

- *drx-onDurationTimerPTM* or *drx-InactivityTimerPTM* or *drx-RetransmissionTimerDL-PTM* for this G-RNTI or G-CS-RNTI is running.

When multicast DRX is not configured for a G-RNTI or G-CS-RNTI, and the *cfr-ConfigMulticast* is configured for at least one of the active BWP(s) of the Serving Cell(s), and unicast DRX is configured, the MAC entity shall for this G-RNTI or G-CS-RNTI:

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

1> if the PDCCH indicates a DL multicast transmission; or

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

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

1> if the PDCCH addressed to G-RNTI indicates a DL multicast transmission; or

1> if the PDCCH addressed to G-CS-RNTI indicates a DL multicast transmission and CS-RNTI is configured; or

1> if a MAC PDU is received in a configured downlink multicast assignment and CS-RNTI is configured:

2> if the first HARQ-ACK reporting mode (i.e. ack-nack) is used as specified in TS 38.213 [6]; and

2> if HARQ feedback for MBS multicast is enabled:

3> if the MAC PDU is received on a non-terrestrial network:

4> set *HARQ-RTT-TimerDL-NTN* for the corresponding HARQ process equal to *drx-HARQ-RTT-TimerDL* plus the latest available UE-gNB RTT value;

4> start the *HARQ-RTT-TimerDL-NTN* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback.

3> else:

4> 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.

When multicast DRX is configured for a G-RNTI or G-CS-RNTI, and the *cfr-ConfigMulticast* is configured for at least one of the active BWP(s) of the Serving Cell(s), the MAC entity shall for this G-RNTI or G-CS-RNTI:

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

2> if HARQ feedback for MBS multicast is enabled:

3> if the MAC PDU is received on a non-terrestrial network:

4> set *HARQ-RTT-TimerDL-PTM-NTN* for the corresponding HARQ process equal to *drx-HARQ-RTT-TimerDL-PTM* plus the latest available UE-gNB RTT value;

4> start the *HARQ-RTT-TimerDL-PTM-NTN* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback.

3> else

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

3> if the first HARQ-ACK reporting mode (i.e. ack-nack) is used as specified in TS 38.213 [6]; and

3> if CS-RNTI is configured:

4> if the MAC PDU is received on a non-terrestrial network:

5> set *HARQ-RTT-TimerDL-NTN* for the corresponding HARQ process equal to *drx-HARQ-RTT-TimerDL* plus the latest available UE-gNB RTT value;

5> start the *HARQ-RTT-TimerDL-NTN* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback.

4> else:

5> 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-PTM* for the corresponding HARQ process;

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

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

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

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

1> if a *HARQ-RTT-TimerDL-PTM-NTN* expires:

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

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

1> if a DRX Command MAC CE indicated by PDCCH addressed to a G-RNTI or G-CS-RNTI, or by a configured downlink multicast assignment is received:

2> stop *drx-onDurationTimerPTM* of the DRX for this G-RNTI or G-CS-RNTI, or the corresponding G-CS-RNTI;

2> stop *drx-InactivityTimerPTM* of the DRX for this G-RNTI or G-CS-RNTI, or the corresponding G-CS-RNTI.

1> if [(SFN × 10) + subframe number] modulo (*drx-LongCycle-PTM*) = *drx-StartOffset-PTM*:

2> start *drx-onDurationTimerPTM* after *drx-SlotOffsetPTM* from the beginning of the subframe.

1> if the MAC entity is in Active Time for this G-RNTI or G-CS-RNTI:

2> monitor the PDCCH for this G-RNTI or G-CS-RNTI as specified in TS 38.213 [6];

2> if the PDCCH indicates a DL multicast transmission:

3> if HARQ feedback for MBS multicast is enabled:

4> if the PDCCH is indicated on a non-terrestrial network:

5> set *HARQ-RTT-TimerDL-PTM-NTN* for the corresponding HARQ process equal to *drx-HARQ-RTT-TimerDL-PTM* plus the latest available UE-gNB RTT value;

5> start the *HARQ-RTT-TimerDL-PTM-NTN* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback.

4> else:

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

4> if the first HARQ-ACK reporting mode (i.e. ack-nack) is used as specified in TS 38.213 [6]:

5> if the PDCCH addressed to G-RNTI indicates a DL multicast transmission; or

5> if the PDCCH addressed to G-CS-RNTI indicates a DL multicast transmission and CS-RNTI is configured:

6> if the PDCCH is indicated on a non-terrestrial network:

7> set *HARQ-RTT-TimerDL-NTN* for the corresponding HARQ process equal to *drx-HARQ-RTT-TimerDL* plus the latest available UE-gNB RTT value;

7> start the *HARQ-RTT-TimerDL-NTN* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback.

6> else:

7> 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-PTM* for the corresponding HARQ process;

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

2> if the PDCCH indicates a new multicast transmission for this G-RNTI or G-CS-RNTI:

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

NOTE 1: A PDCCH indicating activation of multicast SPS is considered to indicate a new transmission.

NOTE 2: The UE may start the *drx-HARQ-RTT-TimerDL* or *HARQ-RTT-TimerDL-NTN* after receiving a PTM transmission only if *ptp-Retx-Multicast* or *ptp-Retx-SPS-Multicast* was included in the *UECapabilityInformation* message to network.

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

END OF CHANGES