**3GPP TSG-RAN WG2 Meeting #123bis** **R2-230xxxx**

**Xiamen, P.R. China, 9th-13th October, 2023**

**Agenda item: 7.3.1**

**Source: InterDigital (Rapporteur)**

**Title: [Post123][314][NES] 38.321 Running CR (InterDigital)**

**Document for: Discussion and Decision**

# Introduction

This document collects the comments received during the following email discussion on the draft MAC CR for NES.

* [POST123][314][NES] Running CR 38.321 (InterDigital)

Scope : Review running CR

Outcome: CR to be submitted to next meeting

Deadline: long

## Contact information:

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| --- | --- | --- |
| Company | Delegate Name | Email |
| Samsung | Sangkyu Baek | sangkyu.baek@samsung.com |
| LGE | Seong Kim | sj117.kim@lge.com |
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# Discussions

Companies can provide comments and suggestions to the uploaded running CR here:

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| --- | --- | --- |
| Company + Issue Number (e.g., ID001) | Issue | Comments and proposed changes |
| S001 | 5.3.1  Removal of Cell DTX configuration | Suggestion:  if the PDSCH duration of the configured downlink assignment does not overlap with the cell DTX Non-Active Period (as described in clause 5.x) ~~or CellDTX-Config is not configured~~ for the associated Serving Cell:  Reason:  If CellDTX-Config is not configured, the Non-Active Time never exists. The additional condition on configuration is not necessary. |
| S002 | 5.4.1  Removal of Cell DRX configuration | Suggestion:  if the PUSCH duration of the configured uplink grant does not overlap with the cell DRX Non-Active Period (as described in clause 5.x) ~~or CellDRX-Config is not configured~~ for the associated Serving Cell:  Reason:  If CellDRX-Config is not configured, the Non-Active Time never exists. The additional condition on configuration is not necessary. |
| S003 | 5.4.1 Duplicated condition of overlap | The following condition appears twice for different places:  2> if the PUSCH duration of the configured uplink grant does not overlap with the cell DRX Non-Active Period (as described in clause 5.x) or CellDRX-Config is not configured for the associated Serving Cell; and  We may have alternative option like:  “and” is removed  lower levels of all remaining texts below   * The second condition for the case that CGRT is configured and not running can be removed: “the PUSCH duration of the configured uplink grant does not overlap with the cell DRX Non-Active Period (as described in clause 5.x) or *CellDRX-Config* is not configured for the associated Serving Cell; and” |
| S004 | 5.4.2.1  4> if *CellDRX-Config* is not configured for the associated Serving Cell; or  4> if this uplink grant is not a configured grant; or  4> if this uplink grant is a configured grant and the PUSCH duration does not overlap with the cell DRX Non-Active Period (as described in clause 5.x): | This change is not needed.  As changed in 5.4.1, if the CG overlaps with Non-Active Period, the configured uplink grant will not be delivered to the HARQ entity. Thus, 5.4.2.1 does not apply. |
| S005 | 5.4.2.1  Partial CG bundle overlap with Non-Active Time  3> if the uplink grant is part of a bundle of the configured uplink grant, and the PUSCH duration of the uplink grant overlaps with the cell DRX Non-Active Period (as described in clause 5.x) and *CellDRX-Config* is configured for the associated Serving Cell: | This should be FFS. Suggest to remove for now.  RAN2 did not discuss how to handle partial overlap: Whether to allow CG bundle transmission for the case that only a part of a bundle overlaps with Active Time.  Even in legacy, CG bundle transmission from the second resource may not be possible. RAN2 should discuss this and make an agreement. |
| S006 | 5.4.4  Removal of Cell DRX configuration | Suggestion:  if the SR transmission occasion does not overlap with the cell DRX Non-Active Period (as described in clause 5.x) ~~or CellDRX-Config is not configured~~ for the associated Serving Cell; and  Reason:  If CellDRX-Config is not configured, the Non-Active Time never exists. The additional condition on configuration is not necessary |
| S007 | 5.7  C-DRX Active Time definition  *drx-onDurationTimer* or *drx-InactivityTimer* configured for the DRX group is running and at least one Serving Cell in the DRX group is not configured with *CellDTX-Config* or is in the cell DTX Active Period (as described in clause 5.x); or | This change is incorrect and unnecessary.  - Lets say there are three cells Cell 1, Cell 2 and Cell 3 in DRX group. CellDTX-Config is not configured for cell 1. As per above text, in this case MAC entity will be in active time for the DRX group. As a result, UE will monitor PDCCH in cell 2 and cell 3 even during cell DTX inactive period.  Moreover, RAN2 did not agree that the definition of Active Time changes.  Considering observations above, it would be much better to define cell DTX/DRX Active Time independent of UE C-DRX Active Time and corresponding UE behaviour in 5.x. |
| S008 | 5.x  Separate sections for DTX and DRX, respectively | It would be better to have separate subclauses for DTX and DRX? E.g:  5.x Cell-Level Energy Saving  5.x.1 Cell Discontinuous Transmission  5.x.2 Cell Discontinuous Reception  The current running CR captures DTX part and DRX part separately. Section split will make reader understand the feature easier. |
| S009 | 5.x  RRC per Serving Cell ? | “Each Serving Cell may be configured by RRC” would be better than “RRC per Serving Cell” which misleads RRC signalling is per Serving Cell. |
| S010 | 5.x  Terminology: Active Period vs Active Time | Prefer to use aligned terminology with C-DRX, i.e. “Active Period” -> “Active Time” |
| S011 | 5.x  DTX Activation Condition  1> if cell DTX activation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]; or  1> if cell DTX deactivation indication has not been received from lower layers for this Serving cell, as specified in TS 38.213 [x]: | Those two 1> conditions can be merged and simplified as follows:  1> if cell DTX is activated for this Serving Cell:  Moreover, RRC-based activation should be considered. We cannot consider only L1 signaling. |
| S012 | 5.x  DRX Activation Condition  1> if cell DRX activation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]; or  1> if cell DRX deactivation indication has not been received from lower layers for this Serving cell, as specified in TS 38.213 [x]: | Similar to DTX, those two 1> conditions can be merged and simplified as follows:  1> if cell DRX is activated for this Serving Cell:  Moreover, RRC-based activation should be considered. We cannot consider only L1 signaling. |
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# Alternative modelling

During RAN2#123, it was commented by two companies that they prefer an alternative modelling to capture the agreements for TS 38.321, whereby all UE behaviours in the non-active period is captured in a self-contained section without making any changes to other parts of the MAC specification. Such alternate modelling is provided by the rapporteur in Annex A.

Rapporteur thinks that such modelling could work, but may result in conflicting specifications, more changes, duplication of existing text (e.g. the C-DRX section), and potentially missed conflicts. From the rapporteur’s perspective, the following notes and issues are observed with a self-contained modelling in Annex A:

* This modelling is issuing conflicting behaviours to the UE in different sections, e.g. to transmit SR or to obtain a PDU for transmission in one section, even though no TB/SR can be transmitted in the non-active period, then to be told in a later section (5.x) that the UE shall not transmit SR or on CG.
* The existing SR sections specifies that the UE increments the counter and starts the prohibit timer, even though no SR transmission is made in the non-active period. This would be avoided if we added this condition on SR transmission in the SR section. With the modelling in Annex A, the UE is specified in one section (5.4.4) to increment the SR counter and start the SR prohibit timer, then is specified later in section (5.x) not to do those actions.
* Some text from the DRX section (5.7) needs to be duplicated to ensure the agreed cases where the UE shall monitor PDCCH during the non-active period is captured. A general statement that the UE doesn’t monitor PDCCH during the cell DTX non-active period is thus not sufficient. For example, it was agreed not to change the UE behaviour and that the UE monitors PDCCH when C-DRX retransmission timers are running, when an SR was transmitted and is pending, or when RA timers are running. Such behaviours are captured in detail already in section 5.7, and thus need to be duplicated if we don’t touch specification text in other sections outside of the new 5.x section. Note that in R2#123, it was agreed that the “We focus on the case where DTX in RRC can only be configured when C-DRX is configured. We will not optimize for the case where C-DRX is not configured” and thus there is no need to specify text already captured in the C-DRX section.
* Section 5.4.2.1 specifies delivering a PDU to the HARQ process upon obtaining the TB and generating new transmission for this HARQ process and starting the *configuredGrantTimer* and *cg-RetransmissionTimer*, even though no CG transmission can be made during the cell DRX non-active period. Therefore, the modelling in section 5.x needs to specify the UE not to obtain the PDU for an already delivered configured grant and not to start the *configuredGrantTimer* and *cg-RetransmissionTimer*, thus negating what’s already specified in 5.4.2.1.
* While it’s tidy to have all agreed NES behaviours in one section, it can cause potentially missed conflicts or more corrections down the line.

Companies can provide their view below on whether they prefer the modelling of section 5.x in Annex A instead of the TS 38.321 running draft CR uploaded version to this email discussion.

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| --- | --- | --- |
| Company | Preferred modelling   (uploaded version or Annex A version) | Comments and proposed changes. |
| Samsung | Annex A | 1) The additional texts in Annex looks much simpler than the running CR draft. Also, it is much easier to understand the new feature, although some conditions were copied and pasted from the relevant sections.  2) It’s working and we do not see any critical conflict with other sections.  3) From the TS rapporteur company perspectives, the current form of the MAC spec is that one existing feature has mixed and lengthy conditions considering many WI features (e.g. NR-U, SDT, IIOT/URLLC/2RACH in 5.3.1/5.4.1/5.4.4) but only one or two are actually used in commercial system. The problem is that the readability of our spec is getting worse and worse. So, we would like to avoid this situation if possible. |
| LGE | Annex B | We prefer capturing all UE behaviours during non-active cell DTX/DRX period in a self-contained section without making any changes to other parts of the MAC specification. Also, we think that UE behaviours related to reception and transmission can be captured in a simple manner by referring to the existing sections as shown in Annex B (we added Annex B section to clearly show the TP.).  We have two points here.  1) During the cell DTX non-active period, there is no need to explicitly prohibit UE actions related to reception. For comparison, in case of UE C-DRX, UE “shall” monitor PDCCH during Active time. But, UE behaviour during not being Active time is not explicitly specified in the spec. The principal needs to be followed for cell DTX. We suggest to use “may not” instead of “shall not” for specifying UE behaviours related to reception during cell DTX non-active period.  2) In the alternative modelling, we think that there is no need to enumerate all the UE behaviours related to UE reception and transmission because they are already specified in section 5.3/5.7 and 5.4, respectively. We can simply refer to the sections as below (TP is suggested in Annex B).  - For each Serving Cell configured with *CellDTX-Config*, if the Serving Cell is not in the cell DTX Active Period, the MAC entity may not perform the procedures specified in clause 5.3 and 5.7.  - For each Serving Cell configured with *CellDRX-Config*, if the Serving Cell is not in the cell DRX Active Period, the MAC entity shall not perform the procedures specified in clause 5.4 except for UL grant associated with random access procedure. |

# Conclusion

TBD

# References

1. RP-223540, “New WID: Network energy savings for NR”, Huawei
2. R2-2308393, “Running CR to 38.321 for Network energy savings”, InterDigital

# Annex A: Alternate modelling in a self-contained section

=====================================NEXT CHANGE===================================

* 5.x Cell Discontinuous Transmission and Reception

The MAC entity may be configured by RRC per Serving Cell with a periodic cell DTX and/or cell DRX pattern (i.e., Active and Non-Active Periods). The cell DTX functionality controls UE’s monitoring activity of PDCCH and configured downlink assignments in RRC\_CONNECTED. For all activated Serving Cells configured with cell DTX, the MAC entity may monitor PDCCH and configured downlink assignments using the cell DTX operation specified in this clause. The cell DRX functionality controls Scheduling Request and configured uplink grant transmission activity in RRC\_CONNECTED. For all activated Serving Cells configured with cell DRX, the MAC entity may transmit configured uplink grant transmissions and Scheduling Request using the cell DRX operation specified in this clause.

Editor’s note: FFS whether to support multiple cell DTX/DRX pattern configurations.

RRC controls cell DTX operation by configuring the following parameters in *CellDTX-Config*:

- *celldtx-onDurationTimer*: the active duration at the beginning of a cell DTX cycle;

- *celldtx-StartOffset*: defines the subframe where the cell DTX cycle starts;

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

- *celldtx-Cycle*: the cell DTX cycle period.

RRC controls cell DRX operation by configuring the following parameters in *CellDRX-Config*:

- *celldrx-onDurationTimer*: the active duration at the beginning of a cell DRX cycle;

- *celldrx-StartOffset*: defines the subframe where the cell DRX cycle starts;

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

- *celldrx-Cycle*: the cell DRX cycle period.

Editor’s note: TBC whether cell DTX/DRX is configured per serving cell. Instances of “for the Serving Cell” and “for each Serving Cell” will be removed if it is configured per MAC entity.

Editor’s note: TBC whether cell DTX/DRX parameters can be configured with different values per serving cell.

For each Serving Cell configured with *CellDTX-Config*, the MAC entity shall:

1> if cell DTX activation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]; or

1> if cell DTX deactivation indication has not been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> if [(SFN × 10) + subframe number] modulo (*celldtx-Cycle*) = (*celldtx-StartOffset*):

3> start *celldtx-onDurationTimer* for this serving cell after *celldtx-SlotOffset* from the beginning of the subframe.

1> if cell DTX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> stop *celldtx-onDurationTimer*, if running.

For each Serving Cell configured with *CellDRX-Config*, the MAC entity shall:

1> if cell DRX activation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]; or

1> if cell DRX deactivation indication has not been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> if [(SFN × 10) + subframe number] modulo (*celldrx-Cycle*) = (*celldrx-StartOffset*):

3> start *celldrx-onDurationTimer* for this serving cell after *celldrx-SlotOffset* from the beginning of the subframe.

1> if cell DRX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> stop celldtx-onDurationTimer, if running.

When *CellDTX-Config* is configured for a Serving Cell, the cell DTX Active Period includes the time while:

- *celldtx-onDurationTimer* is running for the associated Serving Cell; or

- cell DTX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x].

When *CellDRX-Config* is configured for a Serving Cell, the cell DRX Active Period includes the time while:

- *celldrx-onDurationTimer* is running for the associated Serving Cell; or

- cell DRX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x].

For each Serving Cell configured with *CellDTX-Config*, the MAC entity shall:

1> if the Serving Cell is not in the cell DTX Active Period:

2> not instruct the physical layer to receive transport block on the DL-SCH according to the configured downlink assignment;

2> not indicate the presence of any configured downlink assignment and deliver the stored HARQ information to the HARQ entity;

2> if drx-RetransmissionTimerDL, drx-RetransmissionTimerUL or drx-RetransmissionTimerSL (as described in clause 5.7) is not running on any Serving Cell in the DRX group; and

2> if ra-ContentionResolutionTimer (as described in clause 5.1.5) or msgB-ResponseWindow (as described in clause 5.1.4a) is not running; and

2> if a Scheduling Request is not sent on PUCCH and is not pending (as described in clause 5.4.4 or 5.22.1.5); and

2> if a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has 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):

3> not monitor PDCCH 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.

For each Serving Cell configured with *CellDRX-Config*, the MAC entity shall:

1> if the Serving Cell is not in the cell DRX Active Period:

2> not instruct the physical layer to signal the SR on a PUCCH resource for SR;

2> not increment the SR counter for a pending SR;

2> not start the *sr-ProhibitTimer* for a pending SR;

2> not deliver any configured uplink grant and the associated HARQ information to the HARQ entity;

2> not obtain the MAC PDU to transmit from the Multiplexing and assembly entity for a configured uplink grant;

2> not instruct a HARQ process associated with a configured uplink grant to trigger a new transmission or a retransmission;

2> not start or restart the *configuredGrantTimer*, if configured;

2> not start or restart the *cg-RetransmissionTimer*, if configured.

===============================CHANGE ENDS=========================================

# Annex B: Alternate modelling in a self-contained section

=====================================NEXT CHANGE===================================

* 5.x Cell Discontinuous Transmission and Reception

The MAC entity may be configured by RRC per Serving Cell with a periodic cell DTX and/or cell DRX pattern (i.e., Active and Non-Active Periods). The cell DTX functionality controls UE’s monitoring activity of PDCCH and configured downlink assignments in RRC\_CONNECTED. For all activated Serving Cells configured with cell DTX, the MAC entity may monitor PDCCH and configured downlink assignments using the cell DTX operation specified in this clause. The cell DRX functionality controls Scheduling Request and configured uplink grant transmission activity in RRC\_CONNECTED. For all activated Serving Cells configured with cell DRX, the MAC entity may transmit configured uplink grant transmissions and Scheduling Request using the cell DRX operation specified in this clause.

Editor’s note: FFS whether to support multiple cell DTX/DRX pattern configurations.

RRC controls cell DTX operation by configuring the following parameters in *CellDTX-Config*:

- *celldtx-onDurationTimer*: the active duration at the beginning of a cell DTX cycle;

- *celldtx-StartOffset*: defines the subframe where the cell DTX cycle starts;

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

- *celldtx-Cycle*: the cell DTX cycle period.

RRC controls cell DRX operation by configuring the following parameters in *CellDRX-Config*:

- *celldrx-onDurationTimer*: the active duration at the beginning of a cell DRX cycle;

- *celldrx-StartOffset*: defines the subframe where the cell DRX cycle starts;

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

- *celldrx-Cycle*: the cell DRX cycle period.

Editor’s note: TBC whether cell DTX/DRX is configured per serving cell. Instances of “for the Serving Cell” and “for each Serving Cell” will be removed if it is configured per MAC entity.

Editor’s note: TBC whether cell DTX/DRX parameters can be configured with different values per serving cell.

For each Serving Cell configured with *CellDTX-Config*, the MAC entity shall:

1> if cell DTX activation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]; or

1> if cell DTX deactivation indication has not been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> if [(SFN × 10) + subframe number] modulo (*celldtx-Cycle*) = (*celldtx-StartOffset*):

3> start *celldtx-onDurationTimer* for this serving cell after *celldtx-SlotOffset* from the beginning of the subframe.

1> if cell DTX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> stop *celldtx-onDurationTimer*, if running.

For each Serving Cell configured with *CellDRX-Config*, the MAC entity shall:

1> if cell DRX activation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]; or

1> if cell DRX deactivation indication has not been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> if [(SFN × 10) + subframe number] modulo (*celldrx-Cycle*) = (*celldrx-StartOffset*):

3> start *celldrx-onDurationTimer* for this serving cell after *celldrx-SlotOffset* from the beginning of the subframe.

1> if cell DRX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x]:

2> stop celldtx-onDurationTimer, if running.

When *CellDTX-Config* is configured for a Serving Cell, the cell DTX Active Period includes the time while:

- *celldtx-onDurationTimer* is running for the associated Serving Cell; or

- cell DTX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x].

When *CellDRX-Config* is configured for a Serving Cell, the cell DRX Active Period includes the time while:

- *celldrx-onDurationTimer* is running for the associated Serving Cell; or

- cell DRX deactivation indication has been received from lower layers for this Serving cell, as specified in TS 38.213 [x].

For each Serving Cell configured with *CellDTX-Config*, if the Serving Cell is not in the cell DTX Active Period, the MAC entity may not perform the procedures specified in clause 5.3 and 5.7.

For each Serving Cell configured with *CellDRX-Config*, if the Serving Cell is not in the cell DRX Active Period, the MAC entity shall not perform the procedures specified in clause 5.4 except for UL grant associated with random access procedure.===============================CHANGE ENDS=========================================