**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

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# Discussions

Companies can provide comments and suggestions to the uploaded running CR here (including all subsequent versions):

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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.  [OPPO] Tend to agree  [Apple] Agree that 2nd sentence is duplicated. In addition, Cell DTX may be configured but not activated. In this case, overlapping case is not applicable here.  Thus, as modification, we suggest add "if configured and activated" at the end of 1st sentence.  [vivo] Agree with Apple to add "if configured and activated" at the end of 1st sentence.  [Rapporteur]: “or CellDTX-Config is not configured” can be redundant as explained by Samsung. I will let others continue to comment if they think it’s needed, but it can be removed.  Regarding “if configured and activated”, the definition of the Active Period already includes the case where it is activated (as the On duration timer is running). It also includes the case where it is configured and deactivated, as the UE behaviour is the same as in when the On duration time is running.  [QC]: Fine with Apple suggestion, seems like the most concise way. Did not understand the rapporteur’s comment very well, the behaviour only changes if cell DTX is configured and activated.  [Nokia] agree with Apple to add “if CellDTX is activated”. See also comment in the definition part S011, if we refer to the activate time only when DTX is activated, then no need to cover the case when it is deactivated in the active time definition part either.  [Rapporteur]: This is not applicable to the self- contained version, on which v1 is based on. We can come back to this if we go with the distributed modelling.  Apple suggestion on “configured and activated” is adopted in v1, per suggestion O001. |
| 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.  [OPPO] Tend to agree  [Apple] Agree that 2nd sentence is duplicated. In addition, Cell DRX may be configured but not activated. In this case, overlapping case is not applicable here.  Thus, as modification, we suggest add "if configured and activated" at the end of 1st sentence.  [vivo] Agree with Apple to add "if configured and activated" at the end of 1st sentence.  [Rapporteur]: Same comment for S001.  [Rapporteur]: This is not applicable to the self- contained version, on which v1 is based on. We can come back to this if we go with the distributed modelling.  Apple suggestion on “configured and activated” is adopted in v1, per suggestion O001. |
| 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”   [OPPO] Prefer the alternative option provided by Samsung to simplify the spec. BTW, there is a minor mistake, i.e. “if” is missing from the second change.  [Apple] Agree Samsung's suggestion. Although the current way can also work, the duplicated conditions may increase burden for future maintenance.  [Rapporteur]: That is fine as well. It would be a lot of text that will “change level”. I will let others continue to comment, but it can be done.  [QC]: Seems that current text has “if condition” then “else if same condition” so this is an error. I think we just need one condition, and we lower level of CGT and CGRT conditions.  [Nokia] fine with Samsung’s suggestion.  [Rapporteur]: This is not applicable to the self-contained version, on which v1 is based on. We can come back to this if we go with the distributed modelling. |
| 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.  [OPPO] Agree with Samsung. If we have changed 5.4.1, there is no need to change this part in 5.4.2.1 for CG.  [Rapporteur]: clarification: Isn’t there a case where the configured grant is delivered to the HARQ entity before cell DRX activation is received? Then this text address that case. If companies think this case is not possible, indeed this text can be removed.  [Apple] Support Rapporteur. We don't think it is a corner case: "the configured grant is delivered to the HARQ entity before cell DRX activation is received", because there may be a long duration between DRX configured and L1 signaling received.  [vivo] Agree with Rapporteur’s observation.  [QC]: Agree with Samsung & OPPO. Depending on how RAN1 designs DCI we think this may be a non-issue, e.g., if activation DCI is similar to WUS, the activation would come before the UE C-DRX ON duration, at which case UE delivers to HARQ entity with perfect knowledge about activation state. In any case, we don’t prefer doing things on a very short-time scale like that unless we explicitly agree there is a need so we prefer to hold off on this change or remove it altogether until we answer the question “what is the minimum time between activation and CG occasion”. Shouldn’t be that small to allow for the case mentioned by rapporteur.  [Nokia] agree with Samsung. In the UL grant section, the condition says “if the PUSCH duration of the configured uplink grant does not overlap with the cell DRX Non-Active” so it already considered the timing of PUSCH transmission.  [Rapporteur]: The corresponding clause in the self-contained version has been removed in v1. I added an editor's note instead, given the different opinions.  Editor’s note: whether a configured grant can be delivered to the HARQ entity before cell DRX activation is received and any associated impacts. |
| 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.  [Apple] Agree CG bundle transmission is FFS. However, this is a RAN1 issue (i.e. if RV0 is not sent), and RAN1 have identified this issue before. We think this issue can be left to RAN1.  [Rapporteur]: The agreement on not transmitting on CG during non-active period was general for all transmissions and did not differentiate between repetitions and non-repetitions. However, an editor’s note can be added instead of this for now if it is not clear, but companies are welcome to continue to provide their views.  [Nokia] ok to leave it FFS.  [Rapporteur]: an editor’s note is added in v1.  Editor’s note: FFS whether to allow configured grant bundle transmission for the case that only a part of a bundle overlaps with cell DRX Active Period. |
| 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  [OPPO] Tend to agree  [Apple] Agree that 2nd sentence is duplicated. In addition, Cell DRX may be configured but not activated. In this case, overlapping case is not applicable here.  Thus, as modification, we suggest add "if configured and activated" at the end of 1st sentence.  [vivo] Agree with Apple to add "if configured and activated" at the end of 1st sentence.  [Rapporteur]: Same comment per S001.  [Rapporteur]: This is not applicable to the self- contained version, on which v1 is based on. We can come back to this if we go with the distributed modelling.  Apple suggestion on “configured and activated” is adopted in v1, per suggestion O002. |
| 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.  [OPPO] As the activation of cell DTX/DRX is per cell, it would be the case that cell DTX/DRX of some cell is activated, but others associated with the same MAC entity are not. It is reasonable that UE stops monitoring PDCCH during cell DTX/DRX non-active of the cell whose cell DTX/DRX is activated, but the UE keeps monitoring PDCCH on other cells whose cell DTX/DRX is not activated. Thus, the current description is inaccurate. As Samsung suggested, it would be better to have a separate description.  [Rapporteur]: clarification: per the agreement “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”, my understanding is we don’t need to redefine a new way for PDCCH monitoring at carrier-level granularity and instead we rely on C-DRX mechanism. Indeed C-DRX defines monitoring per C-DRX group in the MAC entity, but likely the NW configures similar patterns across cells in the same C-DRX group and deactivate SCells at low load.  [Apple] Because RAN2 has agreed that activation of Cell DTX is per serving cell, this change doesn't fully reflect the agreement as Samsung and OPPO mentioned. In our understanding, the agreement quoted by Rapporteur just means Cell DTX has to be configured with UE CDRX (as clarified online).  We tend to agree this way can simplify UE PDCCH monitoring behaviour and spec change. So, we are OK with this change. But since this was not discussed before in RAN2, it is better to ensure each company in same page.  [vivo] Agree with Samsung that RAN2 did not agree to touch C-DRX active time. It would be clean and neat to independently define the behaviors in 5.x.  [QC]: Both rapporteur and Samsung are correct, we will not be changing C-DRX to carrier level granularity, nor is that in the WID, but also, we followed RAN1 agreement on activation per cell. In this case, we tend to agree with Samsung & vivo to leave ON duration definition untouched, since this is a stable part of the spec. and there is a n inclination by companies to capture Cell DTX/DRX in a self-contained way anyway.  [Nokia] agree with Samsung we do not need to touch UE active time definition. Only need to capture the behaviour during active time that if the Cell is not in Cell DTX active time, then the UE does not need to monitor PDCCH for that serving cell (except for the case when retx timer is running).  Conditions related to Cell DTX active time to be added here for the PDCCH monitoring bullet:  2> if Cell DTX is not activated for the serving cell or the serving cell is in Cell DTX active period; or  2> if *drx-RetransmissionTimerDL, or drx-RetransmissionTimerUL* is running for the serving cell;  3> monitor the PDCCH on the Serving Cells in this DRX group as specified in TS 38.213 [6];  [Rapporteur]: Suggestion adopted in v1. Version 1 is based on the self-contained version in Annex A, and thus does not make any changes to the C-DRX section. Also added Nokia/Qualcomm suggestion to specify when the UE monitors PDCCH rather than the opposite (not monitor). |
| 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.  [Rapporteur]: I will let others continue to comment, but it should be fine to separate it into two sections.  [Nokia] No strong view. Ok with separate sections.  [Rapporteur]: Suggestion adopted in v1. |
| 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.  [Rapporteur]: I will let others continue to comment; I can clarify it per the suggestion in the next version.  [Nokia] Agree with Samsung’s suggestion.  [Rapporteur]: Suggestion adopted in v1. |
| S010 | 5.x  Terminology: Active Period vs Active Time | Prefer to use aligned terminology with C-DRX, i.e. “Active Period” -> “Active Time”  [OPPO] Support.  [Rapporteur]: I used the term from the agreement. Stage 2 uses “active period” or “active duration”. I’m indifferent; will use what majority prefers.  [QC]: support to keep in line with 38.300. |
| 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.  [OPPO] Agree, RRC-based activation case is missing. We should also capture this case here.  [Rapporteur]: clarification: implicit activation after receiving RRC configuration is captured by this text for implicit reception of RRC configuration:  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.  [Apple] We are confused by Rapporteur's explanation why highlighted text can cover implicit activation by RRC. If we understand correctly, "not receiving L1 deactivation indication" means RRC based activation, right? It seems not correct because it requires the UE to differentiate below 2 cases of "not receiving L1 deactivation indication":   * Case a): gNB intends to activate cell DTX by RRC. * Case b): gNB intends to activated cell DTX by L1 signaling but it has not send L1 activation indication yet (e.g. due to loading consideration, gNB decides to activate Cell DTX in a later time).   To achieve it, RAN1 may need to specify a max time gap (i.e. if the gap is larger than the value, the UE may regard it is RRC activation). We think it is not necessary and not flexible. The simplest way is to add explicit indication in RRC whether it is L1 based activation or RRC based activation (as current CG type 1 vs CG type 2).  [Rapporteur]: Re Apple’s comment, I implemented the agreement “Cell DTX/DRX is activated/deactivated implicitly by RRC signalling, i.e. activated immediately once configured by RRC”, which is implicit based and immediate. Please refer to my comment on issue A002 for more detail.  [QC]: Current phrasing by rapporteur is actually correct understanding in our view. The current agreement is  ” 4. As a baseline Cell DTX/DRX is activated/deactivated implicitly by RRC signalling, i.e. activated immediately once configured by RRC and deactivated once the RRC configuration is released.”. Now L1 is added to activation/deactivation but the initial state seems to be “activated” by this agreement. We understand “case b” by Apple above may have some utility, but we don’t think there are agreements to support it yet, thus, within the current framework rapporteurs phrasing is correct.  [Nokia] Agree with Samsung. See comment also to S001. “while” for the second bullet for reception of deactivation indication is not correct anyway.  [Rapporteur]: Deactivation case removed from Active Period definition in v1, as it does not apply to the self-contained modelling. |
| 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.  [OPPO] Agree, RRC-based activation case is missing. We should also capture this case here.  [Rapporteur]: clarification: same comment as the previous line for cell DTX. |
| O001 | 5.x  Action on using cell DTX  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 and other clauses of this specification. | Is it more accurate to say “For each activated Serving Cell~~s~~ configured and activated with cell DTX”?  [Rapporteur]: clarification: wording of “cell DTX activated or deactivated” is generally avoided, as it would require defining the meaning of activation, including which signals and channels that are expected when we usually specify “activated/deactivated”.  [Apple] We agree with OPPO to clearly specify "configured" and/or "activated". On Rapporteur's explanation, we are confused why it can be avoided: the UE behavior are different between when Cell DTX is configured but not activated and when Cell DTX is configured and activated, right?  [Nokia] agree to add activated.  [Rapporteur]: Suggestion adopted in v1. |
| O002 | 5.x  Action on using cell DRX  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 and other clauses of this specification. | Similar comments as O001  [Rapporteur]: Suggestion adopted in v1. |
| O003 | 5.x  stop celldtx-onDurationTimer  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. | The question is if we stop celldtx-onDurationTimer due to L1 deactivation signalling, need we stop such timer due to RRC-based de-configuration? If so, the RRC-based case should be reflected here.  [Rapporteur]: This clause was added for completeness, but it can be removed. Nothing behaviourally changes if removed.  [QC]: Won’t that mean the whole configuration is released? i.e., there is no celldtx-onDurationTimer to stop.  [Rapporteur]: This clause is removed in v1. Indeed, like QC suggests, if the configuration is removed then there is no timer. |
| O004 | 5.x  stop celldrx-onDurationTimer  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. | 1, stop *celldtx-onDurationTimer*, if running. => stop *celldrx-onDurationTimer*, if running.  2. Similar comments to DTX, in O003  [Rapporteur]: Similar comment to O0003 [Rapporteur]: This clause is removed in v1. |
| A001 | 5.x  The below agreed exceptional behaviours seem to miss to be captured:  1 UE monitors PDCCH for RAR during Cell DTX non-active time. The ra-ResponseWindow could be started as legacy.  2 UE monitors PDCCH for msg4 during Cell DTX non-active time. The ra-ContentionResolutionTimer could be started as legacy. | In UE CDRX section (5.7), it is modelled that the exceptional monitoring behaviours (including RAR and ContentionResolution window) are active time of the DRX group. So, we are not sure whether the similar modelling can be reused in Cell DTX, i.e. the active time of Cell DTX include:  - *ra-ContentionResolutionTimer* (as described in clause 5.1.5) or *msgB-ResponseWindow* (as described in clause 5.1.4a) is running; 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).  [Nokia] we do not think those need to be added into Cell DTX active time. The behaviour is covered as the UE monitors PDCCH for RACH regardless of Cell DTX active time.  [Rapporteur]: Monitoring PDCCH while these timers are running is added in v1, given v1 is based on the self-contained version with exceptional cases where PDCCH is monitored are listed. |
| A002 | 5.x  For both Cell DRX and Cell DTX, deactivation via RRC is missed. Please note that RAN1 agreed that new group comment DCI (DCI 2-9) is a separate UE capability. So, we think it needs to explicitly capture RRC based activation / deactivation. | Please note below RAN1#114 agreement:  **Agreement**   * An information block field of DCI format 2\_X is variable size either 1 or 2 bits.   + Higher layer signaling configures whether the activation/deactivation of cell DTX and/or cell DRX is indicated in DCI format 2\_X for a serving cell.     - If both cell DTX and cell DRX are configured for a serving cell,       * 1st bit corresponds to activation/deactivation of cell DTX configuration, and       * 2nd bit corresponds to activation/deactivation of cell DRX configuration,     - otherwise, the 1 bit corresponds to the configured cell DTX or cell DRX configuration.   + Note: this does not imply there may be separate higher layer signaling to enable L1 signaling based activation/deactivation for a cell DTX and/or cell DRX configuration. Signaling design is up to RAN2.   So, we suggest to add:   * explicit indication in RRC whether it is L1 based activation or RRC based activation (as current CG type 1 vs CG type 2). * Explicit UE behavior of RRC based activation / deactivation.   [Rapporteur]: Added the Note part which was missing from the copied R1 agreement.  Regarding the first suggestion bullet, per the Note in the R1 agreement, it’s up to R2 to decide whether to add separate higher layer signaling to enable L1 signaling based activation/deactivation for a cell DTX and/or cell DRX configuration; the configuration quoted in the agreement is not about this. As commented by vivo below, we can come back to this if an additional bit is introduced within the cell DTX configuration to indicated whether cell DTX can be deactivated by L1 signalling when configured.  Regarding the second suggestion bullet, I implemented the agreement “Cell DTX/DRX is activated/deactivated implicitly by RRC signalling, i.e. activated immediately once configured by RRC”, which is implicit based and also says “immediately”. Companies are welcome to continue to comment on this.  [QC]: Similar to comment above, currently there is only RRC configuration and immediate activation and (de)configuration (whole configuration is released). Our understanding that RRC (de)activation is not yet agreed by RAN2. Other companies may share views on understanding of agreements as well.  [Rapporteur]: This issue will be added to the list of open issues for TS 38.321 tdoc. |
| Q0001 | 5.x Cell Discontinuous Transmission and Reception The cell DTX functionality affects UE’s monitoring activity of PDCCH and configured downlink assignments in RRC\_CONNECTED. | Due to the many exceptions of cell DTX PDCCH monitoring (RACH, dynamic assignment, HARQ feedback, SR, retx), we think that Cell DTX only affects this monitoring behaviour.  [Rapporteur]: Suggestion adopted in v1. |
| N001 | 5.x “the MAC entity may monitor PDCCH and configured downlink assignments using the cell DTX operation specified in this clause and other clauses of this specification. ” | PDCCH monitoring is not specified anywhere in this section. It is only about the definition of active perid and non-active period. Some conditions to be added to 5.7 on PDCCH monitoring, see comment to S007  [Rapporteur]: Nokia’s suggestion in S007 is adopted in v1 in section 5.x.1, as it is based on the self-contained version. |
| H001 | The following editor’s note: “TBC whether cell DTX/DRX parameters can be configured with different values per serving cell.” is no longer valid. | The note needs to be updated based on the agreement that ”On-duration and Cycle parameters are common between cell DTX and DRX, when both are configured.”  This agreement should be also captured in the CR, e.g. in the *CellDRX-Config* parameters part.  [Rapporteur]: The editor’s note is removed. The agreement is also added under the cell DRX parameters part. |
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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. LG: In case of supporting Annex A, UE actions related to reception and transmission can be simply expressed by referring to the corresponding sections (clause 5.3, 5.4 and 5.7) as shown in Annex B instead of enumerating UE actions.

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| --- | --- | --- |
| Company | Preferred modelling   (uploaded version or Annex A version or Annex B 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. |
| OPPO | Slightly prefer Annex A | Using Annex A, we do not see any critical conflict with other sections, and it can minimize the impact on the legacy text. But we have no strong view, can follow the majority. |
| Apple | Prefer Annex A | Agree the modelling of Annex A is more simple and more readable. In addition, TS rapporteur (Samsung) prefer this way. |
| Xiaomi | Annex A | Annex A seem simple from spec impact perspective.  We should try to decouple the cell DTX/DRX and other section, e.g., UE C-DRX operation. SPS, CG etc.  But the wording in Annex A should be improved. Please check the below comments in Annex A from xiaomi side. |
| vivo | Annex A | Considering there are some exceptional handling cases, e.g. the UE still monitors PDCCH when C-DRX retransmissionTimer is running even in cell DTX non-active period, Annex A provides a more readable version and thus is preferred. |
| Qualcomm | Can follow majority between current text and Annex A | We have sympathy to Samsung’s pov, it can be fine as long as we properly characterize the prioritization between legacy MAC behaviour and cell DTX config in a separate section. For instance:   * Cell DTX active time overrides UE C-DRX inactivity timer * SR timer, Retransmission timer, Dynamic grant, All RACH procedures, UL HARQ all override cell DTX active time, i.e., UE ignores Cell DTX configuration/activation and monitors PDCCH.   In current text, it may be easier to insert the behaviour within its proper level within the MAC behaviour and the insertions are not that cumbersome so far but features add up to complicate readability. Annex A would need a lengthy rewrite of MAC spec to place the behaviour in the proper level and characterize all exceptions but would be easier to develop and maintain.  Annex B we don’t think captures all those exceptions so it wouldn’t be reflective of agreements. |
| Nokia | Slightly prefer the uploaded version | Too many exceptions in Annex A and can easily miss something.  “may not perform” in Annex B is not correct either since it shall not instruct PHY to receive PDSCH during non-active period as otherwise it will send feedback for it. |
| Huawei | Annex A | Considering that the structure of Annex A is similar to C-DRX, we are fine to adapt the Annex A version as a baseline. Some wording improvement might be needed e.g. for SPS behaviour but it is a good starting point. |
| ZTE | Annex | minimize the impact on the legacy text as much as possible |
| Rapporteur |  | Given a majority of companies prefer the self-contained version, I have uploaded draft version 1 of the running CR based on the self-contained version in Annex A, and also considering suggestions so far. Companies can provide any further comments on it using the table in section 2. For ease of readability and tracking, please refrain from providing any further comments or suggestions directly to the CR or to Annex A.  Companies can still provide suggestions and comments on whether they prefer a self-contained version or the distributed version (v0). |

# 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

Draft version 1 of the running CR based on the self-contained version in this Annex, considering suggestions so far. For ease of readability and tracking, **please refrain from providing any further comments or suggestions directly to the CR or to Annex A.** Any further comments on it can be provided using the table in section 2.

=====================================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=========================================